Case Report

Ventriculoperitonial Shunt Surgery in a Neonate with Atrial Septal Defect, Ventricular Septal Defect, Patent Ductus Arteriosus, MILD PS, and Bicuspid Aortic Valve

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Abstract

The combination of congenital hydrocephalus and congenital heart disease in children is infrequent. It poses considerable challenge to the anesthetist during emergency ventriculoperitoneal shunt surgery. This case report highlights the challenges encountered and successful management in acyanotic congenital heart disease with bicuspid aortic valve neonate.

Key words: Congenital heart disease, anesthesia, bicuspid aortic valve, ventriculoperitoneal shunt surgery

Introduction

The patient with acyanotic heart disease or hydrocephalus are encountered commonly during clinical anaesthesia practice, however there is paucity of reports in literature regarding anaesthetic management of patients having both the conditions. It may present considerable dilemmas in anaesthetic management. We report anaesthetic management of a neonate with multiple acyanotic cardiac lesions who presented for emergency ventriculoperitoneal shunt surgery.

Case Report

A 28-day-old male baby weighing 3 kg was admitted to our hospital with a history of vomiting and increased head size since birth. There was no history of seizure or focal neurological deficit. On examination, the heart rate was 160 beats/min, respiratory rate was 29 breaths/min, head circumference was 47 cm, interior fontanelle was full and bulging, and the sunset sign was present. Cardiovascular examination revealed pan systolic murmur of grade 4. X-ray of the chest was within normal limits. The electrocardiogram (ECG) showed sinus tachycardia. ECG revealed complex acyanotic congenital heart disease with a small atrial septal defect (ASD), ventricular septal defect (VSD), a perimembranous, 4-mm patent ductus arteriosus (PDA), mild pulmonary stenosis (PS) with a gradient of 46 mmHg, and bicuspid aortic valve and normal biventricular function. Noncontrast computed tomography scan of the head showed evidence of hydrocephalous with markedly dilated lateral ventricles. Magnetic resonance imaging of the brain showed markedly dilated lateral ventricles and supratentorial brain parenchyma partially visualized in the anterior frontal and temporal lobes with nonvisualized posterior frontoperitonial brain parenchyma.

The baby was taken up for emergency ventriculoperitoneal shunt surgery in view of raised intracranial tension and deterioration of his neurological condition. In the operation room (OR) after securing all the necessary informed consents, mandatory preoperative checks, and international OR guidelines, we attached an all-standard monitor 24G intravenous cannula that was secured. In view of the anticipated difficult intubation, the whole body of the patient except for the head was elevated

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by placing over a mattress so that the body of the patient lay at a similar level to that of the enlarged head. Preoxygenation was done for 3 min. After giving midazolam 0.05 mg/kg and fentanyl 2 mcg/kg intravenously (IV), the left radial artery was cannulated under local anesthesia and invasive blood pressure was monitored. Tracheal intubation was facilitated easily using thiopentone 6 mg/kg, vecuronium (0.1 mg/kg), oxygen and nitrous oxide (50:50), and isoflurane. Anesthesia was maintained with isoflurane in oxygen and nitrous oxide (50:50) with intermittent positive pressure ventilation and vecuronium. The end-tidal CO_2 was kept between 30 mmHg and 35 mmHg. Intraoperatively, the heart rate and blood pressure were targeted to be maintained within 10% of the baseline values. The temperature of odds ratio (OR) was maintained at 27ºC and the patient's skin temperature remained between 36ºC and 37.5ºC. The oxygen saturation was maintained between 97% and 100%. Intraoperatively, the lactated ringer solution (RL) was used for correction of preoperative fluid deficit and 1% dextrose in normal saline as maintenance fluid. The patient had 2 h of fasting, which was replaced by 24 mL of lactated ringer solution over 3 h and 12 mL of 1% dextrose in NS was given every hour as maintenance fluid. The blood loss was estimated to be approximately 20 mL, which was replaced by 60 mL of RL solution. The duration of the surgery was 75 min. For postoperative analgesia, paracetamol suppository 120 mg (loading dose 40 mg/kg) was inserted rectally at the conclusion of the surgery. Residual neuromuscular blockade was reversed with 0.15 mg of neostigmine and 0.03 mg of glycopyrrolate. When respiration of the patient become regular and of adequate tidal volume and there was active movements of all the four limbs, tracheal extubation was done uneventfully. The baby was monitored in the intensive care unit for 24 h. The paracetamol suppositories were repeated every 8 h in a dosage of 60 mg rectally for the maintenance of analgesia during the first 24 h. He was discharged uneventfully from the hospital on the fourth day.

Discussion

The association of congenital hydrocephalus and congenital heart disease in children is infrequent but may present considerable dilemmas in anesthetic management. Crawford *et al*., reported the occurrence of symptomatic hydrocephalus and heart disease in the perinatal period resulted in mortality or neurodevelopmental disability in 9/11 children.[1] Patients with acyanotic heart disease or hydrocephalus are encountered commonly during clinical anesthesia practice; however, there is a paucity of reports in the literature regarding anesthetic management of patients having both the conditions. There is single case report of anesthetic management of a patient of congenital hydrocephalus with ASD and PDA with double aortic arch.[2]

Emergency ventriculoperitoneal shunt surgery in a patient with complex congenital heart disease poses a great challenge to the anesthesiologist. The goals of anesthetic management in patients with raised intracranial pressure (ICP) and in patients with left-to-right cardiac shunt are contradictory to each other. Hyperventilation to decrease cerebral blood flow and at the same time keep adequate PaO_2 is a prerequisite to reduce intracranial pressure; meanwhile, this particular strategy can be detrimental in left-to-right cardiac shunt as it can lead to pulmonary congestion.[3] So in cases having left-to-right shunt associated with hydrocephalus, the main goal during anesthesia is to decrease the shunt flow to avoid both pulmonary vasodilatation and cerebral hyperaemia.

Premedication may help to prevent perioperative tachycardia. Short acting opioids may be helpful. Monitoring includes standard noninvasive modalities. Usually, the arterial line is placed in the preoperative period. Invasive monitoring of CVP is considered if surgical procedures involve the potential for blood loss and volume shifts. To treat possible arrhythmias, external cardioversion pads should be considered.

We preferred intravenous induction using fentanyl, midazolam, and thiopentone as induction is smoother and they cause greater reduction in ICP compared to inhalational agents. The incremental doses of intravenous induction agents should be used in left-to-right shunt cases to avoid a precipitous fall in systemic venous resistance. For maintenance of anesthesia, we used oxygen- nitrous oxide mixture in isoflurane with minimum alveolar concentration (MAC) <1. Although nitrous oxide is cited to cause pulmonary vasoconstriction and increase ICP, we used it for the maintenance of anesthesia as evidence for the safety of total intravenous anesthesia in children of less than 3 years is lacking and we did not have a supply of medical air in the OR.[4] The addition of nitrous oxide to volatile anesthetic has been found to increase cerebral blood flow modestly and in the presence of normal pulmonary arterial pressure, it has negligible vasoconstricting effect.[5,6] Intraoperatively, we ensured normocarbia, normoxia, normothermia, and the vital parameters remained within 10% of the baseline.

Taking into consideration all the factors, we successfully managed a case of hydrocephalus with ASD, VSD, PDA, PS, and bicuspid aortic valve for ventriculoperitoneal shunt surgery. A thorough understanding of the pathophysiology of the disease, vigilant monitoring, and balanced anesthesia are mandatory for managing such complex cases perioperatively.

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Conflicts of interest

There are no conflicts of interest.

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