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Anesthetic Management of a Pediatric Patient with Partial Atrioventricular Septal Defect for an Emergency Drainage of Brain Abscess

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Abstract
Congenital heart diseases, such as atrioventricular septal defect, increase the perioperative risk of children presenting for surgery. We report a case of a pediatric patient with partial atrioventricular septal defect who presented for emergency evacuation of brain abscess. The preoperative findings, pathophysiology of the cardiac condition, and effects of anesthesia were correlated to safely administer general anesthesia for an emergency noncardiac surgery. More reports and studies can further establish the anesthetic considerations that can point toward safe perioperative management of future similar cases.

Keywords: Atrioventricular septal defect, brain abscess, general anesthesia

Introduction

Congenital heart diseases (CHD) in children increases risk of perioperative mortality in major and minor surgeries. The anesthetic management of such patient for noncardiac surgery depends on the patient's age, complexity of the cardiac condition, urgency of the surgery, and other comorbidities.[1]Atrioventricular septal defect (AVSD), also known as atrioventricular canal defect, is an acyanotic congenital heart disease with inadequate development of the septum along the atrioventricular (AV) valves as well as the valves themsleves.[2] Its incidence was estimated at 0.24 to 0.31 in 1000 live births, with significant association with Down's syndrome.[3] We describe a case of brain abscess in a pediatric patient with an acyanotic CHD, atrioventricular septal defect, and the anesthetic management during his emergency drainage of brain abscess.

Case History

A 5-year-old boy weighing 15 kg initially presented with an 11-day history of squeezing frontotemporal headache with no associated changes in vision and gait. On the day of consult to the emergency department, there was note of increased sleeping time and an episode of generalized tonic-clonic seizure. Review of systems was unremarkable. On examination, he had increased blood pressure, episodes of bradycardia, and desaturation at 91% oxygen saturation. He also had weakness of the left extremities, shallow left nasolabial fold, and supple neck.

Initial chest x-ray showed cardiomegaly and his ECG revealed extreme left axis deviation. Echocardiography confirmed a partial AVSD, large primum atrial septal defect (ASD), right atrial and

ventricular enlargement, severe right atrioventricular valvar regurgitation, and mild pulmonary regurgitation. Cranial MRI showed a large intraparenchymal mass in the right fronto-parieto-temporal lobes (Figure 1). The patient was then referred to Neurosurgery service for emergency drainage of cerebral abscess.

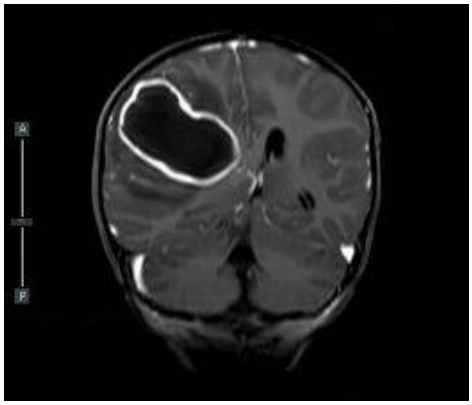

Figure 1. Cranial MRI with gadolinium contrast showing cerebral abscess

He arrived at the operating room hypertensive for his age with blood pressure of 134/103 and bradycardic with heart rate of 53 beats per minute. He was induced intravenously using 1.5 mg of Midazolam, 45 mcg of Fentanyl, and 15 mg of Ketamine. Neuromuscular paralysis was done with 15 mg of rocuronium prior to intubation using a videolaryngoscope (Karl-Storz C-MAC, Mac 2 blade) and a cuffed endotracheal tube with internal diameter of 5.0 mm. Anesthesia was maintained with sevoflurane 1.5-2.5% volume and Dexmedetomidine 0.4-0.5 mcg/kg/hour. Intraoperative monitoring was done with noninvasive blood pressure, pulse oximetry, five-lead electrocardiogram, and precordial stethoscope. A central venous triple-lumen catheter was inserted in his right femoral vein for the procedure. Intraoperative hypotension was augmented with dobutamine at 3 mcg/kg/min and Norepinephrine 0.1-0.15 mcg/kg/min, which was maintained until the post-operative period. When the blood loss from the procedure accumulated to 100 ml, the anesthesiologists started a transfusion of 150 ml of packed red blood cell intraoperatively. The neurosurgical team found and drained greenish-yellow abscess with thick capsule in the patient's subarachnoid space. At the end of the procedure, his neurological status was assessed for improvement. He was extubated in the operating room.

Post-operatively, he underwent close monitoring and management by the pediatric intensive care unit. Norepinephrine infusion was slowly tapered off while maintaining adequate perfusion peripherally and centrally. Episodes of desaturations at 89-93% were noted, which were addressed with oxygen support of 15 liters per minute given by a nonrebreather face mask. His lateralizing neurologic signs resolved. Medical decompression for increased intracranial pressure was discontinued. Inotropic and oxygen supports were eventually reduced and discontinuation was tolerated by the patient with no cardiovascular or respiratory instability. Otorhinolaryngological evaluation revealed acute otitis media. On his 38th hospital day, he underwent oral rehabilitation for dental caries under general anesthesia, which was unremarkable. After finishing his course of intravenous antibiotics, the patient was discharged well.

Discussion

Brain abscess, a focal infection affecting the cerebral parenchyma, is a serious health concern affecting the pediatric population, especially in developing countries.[4] The most common cause of brain abscess

in children is cardiogenic, majority arising from cyanotic CHD.[5] Other causes include spread from otologic or dental infection. [4] The exact cause of the patient's brain abscess remains unclear, especially when brain abscesses from acyanotic CHD have also been reported.[6]

The perioperative anesthetic management AVSD cases is comparable to patients with ASD and left AV valve regurgitation. One of the main anesthetic considerations for patients with left-to-right shunt is the presence of increased pulmonary vascular resistance (PVR) and pulmonary artery hypertension, due to oxygenated blood returning to pulmonary blood flow via the septal defect.[7] Recommended preoperative evaluation include investigation for presence of congestive heart failure and pulmonary artery hypertension. In partial AVSD, pulmonary vascular resistance is oftentimes not significantly increased.[8]

In ASD, systemic vascular resistance and pulmonary vascular resistance, which are affected by the administration of anesthesia, should be intricately balanced. When SVR is low compared to PVR, such as in cases of deep anesthesia with hypovolemia, right-to-left-shunt may increase, leading to hypoxic shunt phenomenon. Similarly, airway obstruction (such as bronchospasm and laryngospasm), hypoventilation, and hypoxemia which increase PVR. On the other hand, increased SVR relative to PVR increases left-to-right shunting. In this manner, factors that decrease PVR should also be avoided. [7, 9]

Across an ASD, bubbles from intravenous access may cross from the right side of the heart to the left and cause paradoxical emboli. [9] In this index case, the intravenous lines were carefully guarded against bubbles and other debris.

Cardiomegaly is also a concern in patients with left-to-right cardiac shunts. Angiotensin-converting enzyme inhibitors (ACEi) help decrease cardiac remodeling. .[7] Captopril was started preoperatively in this case

Other complications that may result from the pathophysiological changes in patients with left-to-right cardiac shunts include dysrhythmias and myocardial ischemia, which were not observed in the patient perioperatively.[7]

Patients with partial AVSD usually tolerate anesthesia well owing from good cardiac reserve and normal PVR.[8] More studies can further establish the points to be considered perioperatively to be able to administer anesthesia safely in patients with partial AVSD.

Conclusion

Safe administration of anesthesia in a patient with partial AVSD for noncardiac surgery includes thorough preoperative assessment of cardiac function, consideration of the pathophysiology of the patient's heart condition, careful selection of appropriate anesthetics to be given, and close monitoring until post-operative period. More reports and studies are encouraged in order to guide anesthetic management in future similar cases.

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