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CASE REPORT PEDIATRIC ANESTHESIA

Anesthetic management for drainage of cerebral abscess in a child with uncorrected Tetralogy of Fallot

Kiran Ayesha

Fellow of Anesthesia, Department of Anesthesiology, Pakistan Institute of Medical Sciences, G–8/3, Islamabad, Pakistan.

Correspondence: Dr. Kiran Ayesha; E–mail: kiranayesha594@gmail.com

Abstract

Tetralogy of Fallot is the most common cause of cyanotic congenital heart disease that consists of four defects. Children with uncorrected tetralogy of fallot can present for non-cardiac surgeries. Such patients are prone to develop cerebral abscess because of right to left shunting of blood and absence of pulmonary clearance of microorganisms. These cases are a significant challenge for anesthesiologists. General anesthesia is a riskier anesthetic technique. I present a case of six years male child with uncorrected tetralogy of fallot who underwent drainage of brain abscess under scalp block with sedation and had uneventful recovery.

Key words: Tetralogy of Fallot; Cyanotic heart disease; cerebral abscess; Scalp block

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1. Introduction

Most common etiology of cyanotic congenital heart disease (CHD) is Tetralogy of Fallot (TOF) that accounts for 10% of all CHD. [1] Patients with uncorrected TOF have a life expectancy of about 12 years. [2] TOF comprises of four defects: ventricular septal defect (VSD), aorta that overrides VSD, right ventricular outflow tract obstruction and right ventricular hypertrophy. Right ventricular outflow tract obstruction can be because of defect in pulmonary valve or infundibulum or defect in both. [3] In TOF there is right to left shunting of blood that leads to chronic hypoxemia and cyanosis. [4] Patients with uncorrected TOF can develop neurologic complications and TOF accounts for 13 to 70% of all cerebral abscess. [1] Due to right to left shunt and chronic hypoxemia patients who present for drainage of brain abscess are prone to develop intraoperative complications, hence such cases are a real challenge for anesthetist. [5] I present a case of drainage of cerebral abscess in a child with uncorrected TOF which was proceeded under scalp block and sedation.

2. Case Report

6 years male child weighing 20 kg presented to emergency operating room for drainage of brain abscess. Patient was a diagnosed case of TOF since 3 months of age. Patient's general condition was poor, had reduced exercise tolerance. He had history of dyspnea on mild exertion and fatigue. He was taking tablet propranolol 10 mg three times daily. Patient had history of weakness of right side of body associated with fever and vomiting for one week. On examination patient had clubbing and cyanosis, his GCS was 15/15, had reduced muscle tone and power 2/5 on right upper and lower limb, had up going plantars on right side. Auscultation of precordium showed normal 1st and 2nd heart sounds along with harsh ejection systolic murmur heard at left upper sternal border. Rest of the examination was unremarkable. Patient had hematocrit 54.7%, raised TLC count and deranged coagulation profile. Child's serum electrolytes liver function and renal function tests were within normal limits. ECG shows sinus rhythm with heart rate of 100/min. his 2D echocardiography showed large perimembranous VSD with overriding of aorta, right to left shunting, severe infundibular stenosis and right ventricular outflow tract obstruction with a mean gradient of 52 mmHg (Figure 1). Chest x ray and arterial blood gas analysis were not done. CT brain revealed left parietotemporal multiple brain abscesses (Figure 2).

Patient was initially managed with intravenous (IV) fluids, IV ceftriaxone and prophylactic antiepileptic was also given intravenously. Neurosurgeons decided to

Segmental Sequential Analysis:

- Levocardia
- Situs solitus
- Normal venous connection
- Atrioventricular concordance
- Ventriculoarterial concordance
- Intact interatrial septum
- Large Perimembranous VSD with overriding of aorta, shunting R to L
- Good size LV
- Severe infundibular pulmonary stenosis
- Good size pulmonary vasculature
- Descending aorta 10.5mm, MPA 6.8mm, RPA 5.8mm, LPA 7.8mm
- No PDA
- Left aortic arch

Conclusion:

- Tetrology of fallot
- Good size LV
- Good size pulmonary vasculature

Figure 1: Echocardiography

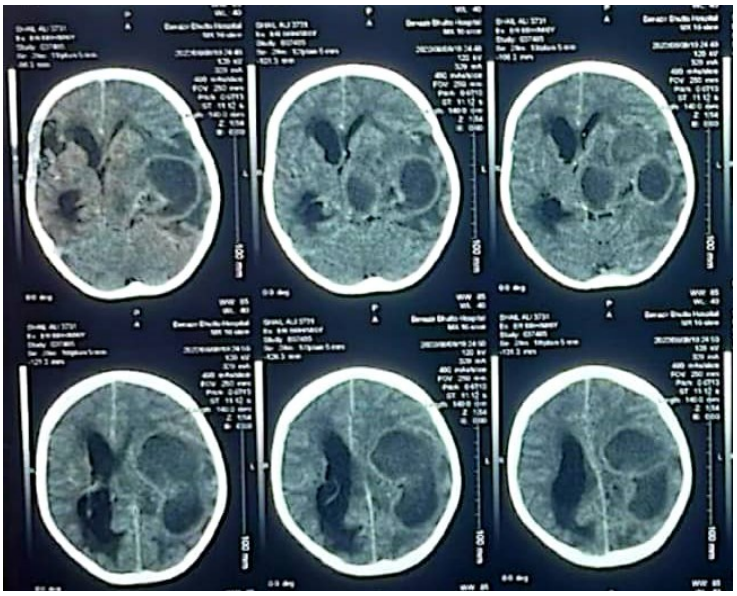

Figure 2: CT Brain showing left parietotemporal multiple brain abscesses

proceed for emergency drainage of cerebral abscess. Patient belonged to American Society of Anesthesiologists (ASA) class IVE. Informed high risk consent taken and parents were counselled regarding increased risk of anesthetic complications

2.1. Anesthetic management

In the operating room, standard ASA monitoring was started. Preoperatively patient had a blood pressure of 110/60 mean arterial pressure (MAP) 76.6 mmHg heart rate was around 69/min sinus rhythm and oxygen saturation was around 60% on room air. Oxygen saturation improved to 80 to 85% when oxygen was given via facemask. 24G intravenous (IV) line was already in place. 22G IV cannula was inserted and both lines were de aired. Vasopressor (phenylephrine), beta blocker, defibrillator and airway equipment were kept ready. Foley's catheter was inserted for monitoring of urine output.

Injection midazolam 1 mg and dexamethasone 4 mg was given intravenously. IV fluid started. Child was placed in supine position and head towards right side. Scalp block was performed using 6 ml of 0.5% bupivacaine under aseptic measures. Left zygomaticotemporal, auriculotemporal, lesser and greater occipital nerve were blocked. Block was supplemented with injection nalbuphine 2 mg, ketamine 20 mg and paracetamol 300 mg. Surgeon also infiltrated 3 ml of 2% lidocaine at the site of burr hole. Injection transamine 200 mg and levetiracetam 200 mg was given slow intravenously. 10 mg ketamine was repeated at the time of burr hole. Throughout the procedure child was spontaneously breathing and oxygen was given via face mask.

Intraoperatively patient's oxygen saturation remained around 80 to 85%, heart rate 60 to 70 beats/ min and blood pressure around 100/60 MAP around 73.3 mmHg .(Figure 3) Intraoperative blood loss was 60 ml and urine output was 50 ml. Surgeons drained 33 ml of pus which was sent for culture and sensitivity. 350 ml of infusion ringer's lactate was given. Procedure lasted for 45 minutes. Intraoperative course was uneventful.

Postoperatively patient was shifted to neurosurgery intensive care unit with following vitals: Blood pressure 96/70 mmHg (MAP 78.6 mmHg) heart rate 60/min, oxygen saturation 80% with oxygen. Postoperative orders were advised.

After an uneventful postoperative course, patient was discharged on 4th day on oral antibiotics and antiepileptic. Follow up in cardiology department was advised.

3. Discussion

Tetralogy of Fallot is the most common congenital heart disease that causes right to left shunting of blood. Patients with uncorrected TOF have delayed milestones, chronic hypoxia and can develop cerebral abscess.[6] With

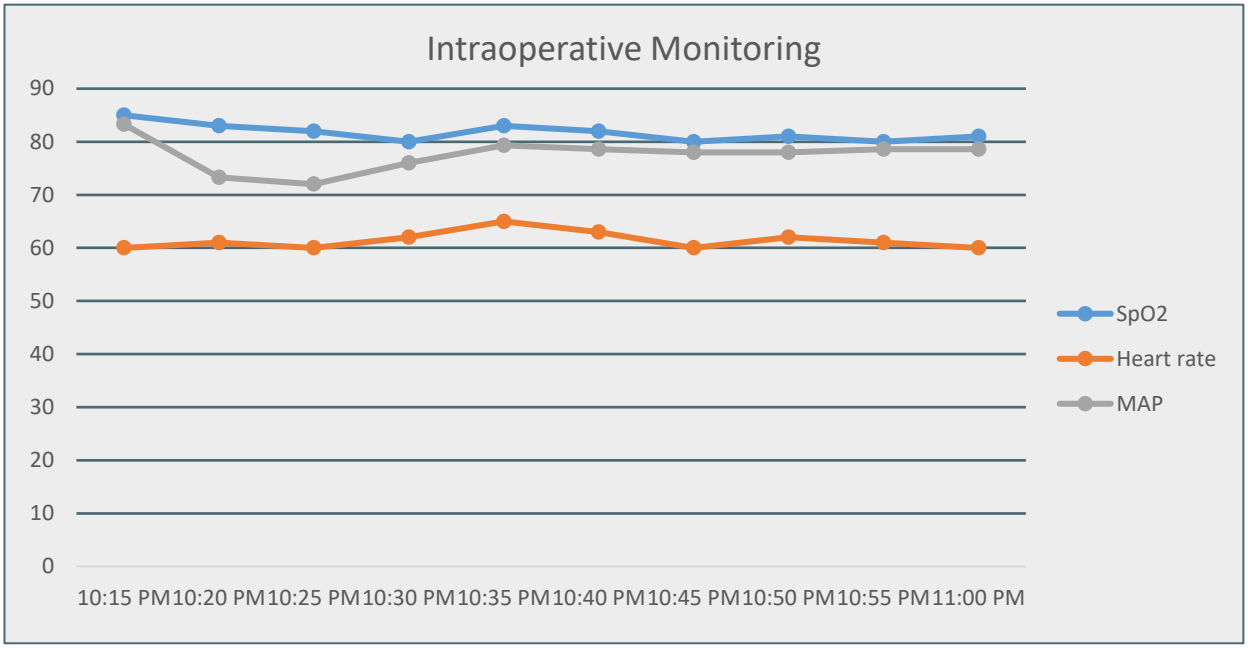

Figure 3: Intraoperative hemodynamic parameters

right to left shunting of blood, microorganisms bypass pulmonary circulation and are taken to cerebral circulation. Chronic hypoxemia in TOF patient leads to hyperviscosity and polycythemia which leads to formation of foci of ischemia in cerebral circulation. These ischemic areas get colonized with microorganisms. [2] Most common bacteria causing cerebral abscess is non hemolytic streptococci. [4]

Patients with uncorrected cyanotic congenital heart disease presenting for drainage of cerebral abscess are a challenge for anesthetist and such cases have many anesthetic concerns. Major anesthetic considerations include intraoperative hemodynamic instability, Tet spell, heart failure and paradoxical air embolism. Dehydration can increase right ventricular outflow tract obstruction. [7] Hypotension, tachycardia and increased myocardial contractility can lead to perioperative cyanotic spell. [6]

Aims of anesthetic management are: to increase systemic vascular resistance, avoid factors that increase pulmonary vascular resistance, avoid dehydration and hypoxemia and avoid increase in myocardial oxygen demand. Neurosurgical goal is to maintain cerebral perfusion pressure by maintaining adequate mean arterial pressure (at least 64 mmHg for a six years child) and avoid increase in intracranial pressure. [6] Preoperatively, prolonged fasting hours must be avoided. [5] Perioperative cyanotic spell is managed with IV fluids, alpha agonist phenylephrine, beta blockers and by maintaining adequate analgesia. [1]

Delay in diagnosis of cerebral abscess in patients with tetralogy of fallot can complicate the disease and increase the perioperative risk as well thus increasing morbidity and mortality. Paediatric patients with congenital cyanotic heart disease who present for drainage of brain abscess are considered high risk for general anesthesia. So drainage of abscess is preferred to be done under local or regional anesthesia with sedation as these patients might require repeated aspirations. [5] There is no doubt that general anesthesia will provide better oxygenation but it can cause hemodynamic instability, raised pulmonary vascular resistance, hypoxemia and acidosis. Mechanical ventilation increases pulmonary vascular resistance thus worsens right to left shunt. [3] Other factors that increase pulmonary vascular resistance include hypoxia, hypercarbia, acidosis, hypothermia and hypovolemia. [5] Most of the drugs used for general anesthesia cause myocardial depression and by reducing systemic vascular resistance they can increase right to left shunting of blood. If case has to be proceeded under general anesthesia all drugs must be carefully titrated and early Extubation must be planned. [3]

In order to avoid risks associated with general anesthesia, our plan was to proceed under scalp block with sedation keeping goals in mind. Awake craniotomy can be successfully performed under scalp block.

Pediatric patients need sedation as well. Scalp block maintains stable hemodynamics by providing adequate analgesia, reduces stress response to surgery, reduces the requirement of opioids intraoperatively and keeps patient pain free postoperatively. [3] Adequate analgesia is a major anesthetic concern as pain can trigger cyanotic spell. [1]

In such cases ketamine is considered to be an ideal drug as it increases systemic vascular resistance, prevents right to left shunting thus improves oxygenation. Ketamine can be used along with fentanyl, midazolam or dexmedetomidine. Midazolam maintains systemic vascular resistance. Dexmedetomidine alpha 2 agonist in titrated dose can be used for sedation along with ketamine. It provides conscious sedation, analgesia and reduces sympathetic outflow but it must be carefully titrated in order to avoid hypotension and bradycardia. Ketamine and dexmedetomidine reduces the requirement of opioid for pain management. [1] Dexmedetomidine prevents Tet spell too. [7]

It's very important to maintain preload and prevent hypothermia. Warm IV fluid bolus 20 ml/kg can be given in order to treat dehydration. [3] Prevent air entry into veins through IV lines as it can lead to paradoxical air embolism in patient with cyanotic congenital heart disease. [5]

Postoperative management includes oxygenation, strict monitoring, adequate pain management, fluid balance, seizures prophylaxis, antibiotic prophylaxis and cardiology review. [7]

In our setup we did not have facility of invasive monitoring for paediatric patients, our patient had to undergo emergency surgery and there was no time for optimization, so we decided to proceed under regional anesthesia with sedation.

4. Conclusion

Carefully administered anesthesia with goals of management can make good outcome in patients with uncorrected tetralogy of fallot undergoing drainage of cerebral abscess. For such high risk patients, scalp block with sedation can be used successfully as an alternative technique.

5. Conflict of Interest

None to declare

6. Consent to publish

Written consent to publish this report for academic purposes was obtained from the father of the child

7. Acknowledgement

Dedicated to my parents and my teacher

8. Author Contribution

Ayesha Kiran is the sole author of this case report

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