CASE REPORT

Stereotactic Aspiration of Multiple Brain Abscesses in a Child with a Single Ventricle

Vaishali P Chaskar1, Rajshree Deopujari2

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ABSTRACT

One of the most frequent complications of congenital heart disease (CHD) is multiple brain abscesses. Prior to the palliative repair of CHD, these abscesses must be aspirated. The least invasive and least complicated method is stereotactic aspiration. The anesthesiologist should focus on patient-related and surgical-related issues when performing a case with complicated CHD for neurosurgery. Successful anesthetic management for the stereotactic aspiration of numerous abscesses in a 2-year-old child with a single ventricle is highlighted in this article.

Keywords: Case report, Complex congenital heart disease with single ventricle, Neurocardiac anesthesia, Stereotactic frame.

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INTRODUCTION

A new procedure called stereotactic brain surgery uses pictures of the brain to direct the surgeon to specific areas of the brain. The method makes use of a head-mounted external frame to use computed tomography (CT) imaging to position the surgical approach. Brain abscesses may require 1–2 hours to aspirate. It entails positioning a large stereotactic frame around the head, imaging in a CT or magnetic resonance imaging (MRI) room, and transportation to at least three different locations in our hospital. Additionally, the frame’s severely constrained airway access causes issues with maintaining conscious sedation and an open airway.

CASE DESCRIPTION

A 2-year-old 10 kg patient was brought into our hospital with the main complaints of vomiting and fever. According to the mother’s history, the infant had a known case of complicated single-ventricle congenital heart disease (CHD). The child had no symptoms at all and was developing normally. He was being monitored by a cardiologist on a regular basis. He was not receiving treatment for heart failure or cyanotic episodes.

On examination, medium build, with no clubbing or cyanosis. Respiratory rate was 22/minute, room air saturation of peripheral oxygen (SpO2) was 84–86%, and heart rate was 140 beats per minute. A cardiovascular examination revealed a systolic murmur and tachycardia. Rest systems were absolutely normal.

All blood tests revealed normal results, with the exception of hemoglobin (Hb)—10 gm%. Common atrium and a single ventricle were visible on two-dimensional echo. There was a significant pulmonary stenosis and massive vascular transposition. Peak systemic gradient in the pulmonary outflow tract was reduced considerably from 113 to 68. MRI of the brain had three different-sized brain abscesses in the parietal and occipital regions. Child had 100 mL of whole blood transfusion during preoperative optimization to raise Hb.

The child was not premeditated and was fasted in accordance with the rules for fasting. Before wheeling the patient into the operating room (OR), the OR temperature was raised to avoid shivering and hypothermia. Since the intravenous (IV) cannula was already in place, we began Ringer’s lactate according to the Holliday-Segar formula. Cefuroxime 400 mg, an antibiotic, was administered. Following preoxygenation with the Jackson-Rees circuit, induction was carried out using injections of glycopyrrrolate (0.04 mg), ketamine (12 mg), fentanyl (5 mcg), and atracurium...
(5 mg). With 4.5 uncuffed endotracheal tube (ETT), intubation was performed. An arterial catheter was placed under aseptic conditions into the left posterior tibial artery because we could not cannulate radial arteries. The following perioperative monitoring tools were used: five lead electrocardiogram (ECG), SpO2, end-tidal carbon dioxide (CO2), temperature, arterial blood gas, and arterial blood pressure in the OR and during transport; SpO2 and ECG in the CT room; and non-invasive blood pressure (NIBP).

Important consideration was given to ETT position, Continuous oxygen delivery, vital parameters during frame fixation, transport of the kid from the OR to the CT and back to the OR, and aspiration of abscesses. Around 15 mL of pus in total were aspirated intracranially by a stereotactic approach. After the entire aspiration was finished, the youngster was sent for a CT scan to confirm it. After confirming, we immediately transferred the child to the pediatric intensive care unit (PICU) and extubated him once he had sufficient respiratory efforts, muscle tone, and consciousness. The child was observed for 24 hours in the PICU before being discharged on the 7th day.

**DISCUSSION**

Children with complicated CHD with a single ventricle are more susceptible to developing such brain abscesses, due to the bypass of such blood from the pulmonary area. Systemic blood flow is dependent on patent ductus arteriosus in such a scenario. Additionally, a healthy balance between pulmonary and systemic vascular resistance (SVR) is necessary for survival.1

Anesthesia is quite risky in neurosurgery. The stereotactic technique is associated with low invasiveness, fewer morbidity, and early ambulation when compared to craniotomy.2 According to a case report, a 5-year-old kid with tetralogy of Fallot who had a brain stem abscess that was resistant to conservative medical treatment was cured after just one CT-guided stereotactic aspiration and the proper antibiotic therapy.3 For the anesthesiologist, neurosurgeon, and radiologist, providing safe and effective anesthesia for stereotactic operations in young children presents distinct complications. The patient should be quiet and properly sedated during these treatments. Patient must easily be moved between several hospital complex locations. The trachea is typically intubated before the stereotactic frame is put in place for a number of reasons. In addition to having a cerebral illness, these patients may be especially vulnerable to hypoxia and severe hypercapnia as a result of airway obstruction. Second, it could be challenging to stabilize the neck and head in order to maintain a patent airway when the stereotactic device is already in place. The preliminary series suggests that incorporating positron emission tomography and MRI into the planning of stereotactic brain biopsy (SBB) in children improves the diagnostic yield of SBB in infiltrative, ill-defined brain lesions, enables the reduction of sampling in high-risk/functional areas, and enhances the quality of therapeutic management of pediatric brain tumors.4

The degree of pulmonary stenosis and the balance between SVR and pulmonary vascular resistance (PVR) also play a role in complex CHD with single ventricle survival.5 The solitary ventricle serves as a pump to move the oxygenated blood throughout the body and create physiological circulation. Increased intrathoracic pressure, acidosis, hyperthermia, hypercapnia, and hypoxia all contribute to a rise in PVR. Thus, an anesthesiologist must be familiar with the pathophysiology involved. Rapid CO₂ or partial pressure of oxygen measurement, close monitoring for volume status and systemic cardiac output are all made possible by arterial lines.5

The most important thing to remember is that kids with cyanotic CHD are more likely to need both major and minor noncardiac surgical operations. Depending on the patient’s age, an IV line prior to induction is regarded as a luxury. Therefore we installed an IV line in the ward. Positive outcome of the first stereotactic aspiration brain abscess.5

There is no “best anesthetic” in terms of anesthesia management for this population. Sevoflurane can be safely used for an inhalational induction, but it’s important to prevent stimulation while the infant is still “light stage of anesthesia” because this can result in an increase in PVR and a subsequent decline in oxygen saturation. Ketamine is the only induction agent of choice for children with CHD in order to keep SVR and PVR in balance. As a result, we chose to induce this child using ketamine, fentanyl, and atracurium. The decision to use narcotics was completely dependent on the child’s functional status prior to surgery.2,8 The possibility of postoperative respiratory depression makes high doses undesirable.

Prior to the procedure, questions about frame fixation were also reviewed in addition to the anesthesia management. The introduction of stereotactic frames intended specifically for functional neurosurgery and MRI-compatible. None of the stereotactic frames for children is available at that time. Crepe bandage was carefully put around the child’s skull after induction and ETT fixation. Over the crepe roller bandage, a plaster of Paris sheet that had been soaked in water was put circumferentially around the head. This method made it possible to create a head circumference as same as that of an adult head and that was symmetrical, smooth, and even before applying the stereotactic pins (Fig. 1).

Transporting an anesthetized youngster to three distinct locations is essential for stereotactic surgery. During transportation, the child was monitored with pulse oximetry, an ECG, and NIBP in addition to having all resuscitative measures at the ready.

Extubation is dependent on the length of the procedure and hemodynamic stability. Extubation was carried out after 1½ hours in the pediatric ICU. Even if they are extubated at the end of the surgery, all children with single ventricle physiology should be observed at least overnight in an intensive care facility.5,10

In our case, successful management was achieved after foreseeing all issues. The child was discharged after 7 days.
CONCLUSION

Elective intubation before frame installation aids in retaining total control of the airway in juvenile patients and individuals with problems opening their airways. Consideration must be given to all safety measures for neuro anesthesia, including smooth perioperative intracranial pressure, and hemodynamic management.

The fundamental objective of anesthetic management in children with complicated CHD and a single ventricle is to maintain a balance between SVR and PVR. For such a case, collaboration between the surgeons, the cardiologists, the anesthesiologists, and the intensivists is crucial to its success.9

ORCID

Vaishali P Chaskar o https://orcid.org/0000-0002-3479-7359

REFERENCES