



EMERGENCY CRANIOTOMY FOR CEREBRAL ABSCESS IN A PATIENT WITH DOUBLE OUTLET RIGHT VENTRICLE: ANAESTHETIC CONSIDERATIONS AND CHALLENGES

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ABSTRACT: Introduction: Double Outlet Right Ventricle (DORV) is a cyanotic congenital heart defect characterized by both the aorta and pulmonary artery arising from the morphologic right ventricle, typically accompanied by a ventricular septal defect (VSD). Children with uncorrected DORV may present for non-cardiac surgical procedures and are predisposed to cerebral abscesses due to right-to-left intracardiac shunting and the absence of pulmonary microbial filtration. These patients pose significant anaesthetic challenges due to their complex cardiovascular physiology. **Case Summary:** We report the case of a six-year-old male child with uncorrected DORV who presented with a cerebral abscess. The child exhibited central cyanosis and had a peripheral oxygen saturation of 79% on room air. Neurological examination revealed a drowsy state with signs of raised intracranial pressure (ICP) and a Glasgow Coma Scale (GCS) score of E4V4M5. The patient underwent surgical drainage of the brain abscess under general anaesthesia with controlled mechanical ventilation and invasive hemodynamic monitoring. Anaesthetic management focused on maintaining hemodynamic stability, preventing increases in ICP and pulmonary vascular resistance (PVR), and optimizing oxygenation. The postoperative course was uneventful, and the child recovered without complications. **Conclusion:** Anaesthetic management in children with uncorrected cyanotic congenital heart disease such as DORV centers on maintaining systemic vascular resistance (SVR) greater than pulmonary vascular resistance (PVR) to promote adequate pulmonary blood flow and systemic oxygenation. Reduction in PVR can be achieved through the use of high inspired oxygen concentrations, correction of acidosis via controlled ventilation, and the avoidance of hypothermia, hypercarbia, and acidosis. A meticulous and individualized anaesthetic approach is essential for optimal outcomes in such high-risk cases.

Keywords: Brain abscess, congenital heart disease, double outlet right ventricle, cyanotic heart disease, paediatric anaesthesia

INTRODUCTION

Double Outlet Right Ventricle (DORV) is a heterogeneous congenital cardiac anomaly in which both great arteries—the aorta and the pulmonary artery—arise entirely or predominantly from the morphologic right ventricle, accompanied by a ventricular septal defect (VSD). It accounts for approximately 0.9% of all congenital heart diseases¹. The most widely accepted classification of DORV is by Neufeld, which categorizes the anomaly based on the spatial relationship between the VSD, the muscular septum, and the great arteries, as well as the presence or absence of pulmonic stenosis. According to this classification, DORV is divided into four types: (i) subpulmonic, (ii) subaortic, (iii) doubly committed, and (iv) noncommitted.²

This case report describes the perioperative management of a six-year-old boy with uncorrected DORV who presented with a cerebral abscess requiring emergency surgical drainage.

CASE PRESENTATION

A six-year-old boy was brought to the emergency pre-anaesthetic evaluation room of Government Medical College, Kozhikode, with complaints of high-grade fever for one week, associated with projectile vomiting and headache. There was no history of trauma, seizures, or ear discharge. The child had a documented history of recurrent upper respiratory tract infections in the neonatal period and was diagnosed with Double Outlet Right Ventricle (DORV) at 40 days of life. No medical or surgical intervention had been pursued since diagnosis.

On examination, he appeared appropriate for age, pale, febrile, and anicteric, with central cyanosis. Peripheral oxygen saturation on room air was 79%. Central nervous system evaluation revealed a lethargic child with a Glasgow Coma Scale (GCS) score of E4V4M5. His heart rate was 134 beats/min (low volume, regular), blood pressure 86/62 mmHg, and respiratory rate 30/min without added sounds. Cardiac auscultation revealed a loud second heart sound and a grade 4 pansystolic murmur.

Electrocardiography showed sinus tachycardia. Two-dimensional echocardiography revealed atrioventricular and ventriculoarterial concordance, a large subaortic ventricular septal defect (VSD) with >50% override of a posteriorly located aorta, a large ostium secundum atrial septal defect (ASD) with left-to-right shunt, dilated right atrium and right ventricle, and moderate pulmonary artery hypertension — consistent with DORV. Chest X-ray revealed a boot-shaped heart. Contrast-enhanced computed tomography (CECT) of the brain showed a heterogeneously hypodense lesion with peripheral rim enhancement in the right frontal lobe cortex with surrounding edema, mass effect, and midline shift — suggestive of a brain abscess.

The child was started on intravenous antibiotics: meropenem 455 mg every 8 hours, vancomycin 230 mg every 6 hours, antiepileptic levetiracetam 230 mg every 12 hours, and 3% hypertonic saline infusion at 5.7 mL/hour. The patient was classified as ASA physical status Grade III, and informed high-risk consent was obtained from the parents following detailed counselling.

In the operating theatre, standard monitors were applied. A 22G intravenous cannula was secured in the right foot. Baseline vitals were: heart rate 126 beats/min, blood pressure 84/59 mmHg, and oxygen saturation 78% on room air.

Premedication was given with intravenous midazolam (0.1 mg/kg) and fentanyl (2 mcg/kg). Preoxygenation was done with 100% oxygen for 3 minutes. Induction was carried out with graded doses of intravenous propofol (up to 2 mg/kg) to prevent a fall in blood pressure, followed by intravenous atracurium (0.5 mg/kg) to facilitate endotracheal intubation. The trachea was intubated using a cuffed endotracheal tube (ID 5.0 mm), fixed at 14 cm after confirming bilateral air entry.

Following intubation, the left radial artery was cannulated with a 22G arterial catheter, and invasive blood pressure monitoring was initiated. The right femoral vein was cannulated with a 5Fr triple-lumen central venous catheter, and central venous pressure (CVP) was measured at 8 cm H₂O.

Anaesthesia was maintained with isoflurane in an oxygen–air mixture and intermittent doses of atracurium. Inspired oxygen concentration (FiO₂) was titrated to maintain oxygen saturation above 85%. Normothermia, normocapnia, and hemodynamic stability were ensured to prevent any increase in pulmonary vascular resistance. A right frontal craniotomy was performed, and approximately 20 mL of purulent material was drained. The procedure lasted 90 minutes, with an estimated blood loss of 100 mL. Intravenous Ringer lactate was administered to maintain hydration. Noradrenaline infusion was used to maintain a mean arterial pressure above 60 mmHg.

At the conclusion of the surgery, neuromuscular blockade was reversed with intravenous neostigmine (0.05 mg/kg) and glycopyrrolate (0.01 mg/kg). The child was extubated successfully and maintained a peripheral oxygen saturation of 78% on room air. He was shifted to the paediatric intensive care unit for postoperative monitoring and care. Postoperative management included multimodal analgesia, continuation of antibiotics and antiepileptics, and careful monitoring of fluid balance and neurological status. The child was discharged on postoperative day 4.

DISCUSSION

A brain abscess is a localized collection of purulent material within the brain parenchyma, typically resulting from contiguous spread or hematogenous seeding. Common predisposing factors include cyanotic congenital heart disease, chronic otitis media, sinusitis, mastoiditis, and infections involving the facial, scalp, or dental regions.³ In cyanotic congenital heart disease, systemic venous blood is diverted into the systemic circulation through a right-to-left shunt, bypassing the pulmonary capillary filter. This leads to chronic arterial desaturation and cyanosis, which triggers compensatory polycythemia and increases blood viscosity.⁴ The combination of unfiltered microbial entry into the cerebral circulation and microvascular stasis predisposes to the development of ischemic foci that can become infected, resulting in a brain abscess.

Anaesthetic management in such patients is particularly challenging due to the risks of hypoxia, hemodynamic instability, Eisenmenger physiology, and raised intracranial pressure (ICP). In this case, ketamine was avoided owing to its potential to elevate ICP. Intraoperative goals focused on the prevention of factors that increase pulmonary vascular resistance (PVR), such as acidosis, hypothermia, and hypercapnia. Dehydration and hypoxemia were carefully avoided, as the former can exacerbate right ventricular outflow tract obstruction.⁵ Furthermore, hypotension, tachycardia, and heightened myocardial contractility were managed vigilantly to avoid triggering perioperative cyanotic spells due to increased myocardial oxygen consumption.⁶

A central aspect of anaesthetic management in patients with uncorrected double outlet right ventricle (DORV) is to preserve effective hemodynamic function. This is achieved by maintaining adequate myocardial contractility, stable heart rate, and sufficient preload to ensure optimal cardiac output. Equally important is maintaining systemic vascular resistance (SVR) at a level higher than PVR. A fall in SVR can reduce pulmonary perfusion, worsening systemic hypoxemia. Therefore, minimizing PVR is essential and can be accomplished by administering high concentrations of inspired oxygen, maintaining normothermia, avoiding hypercarbia, and correcting acidosis through controlled ventilation. Chronic hypoxemia-driven polycythemia further elevates blood viscosity, which can increase both SVR and PVR, necessitating careful intraoperative and postoperative fluid and perfusion management.⁴

Postoperative care should include continued oxygen supplementation, close hemodynamic and neurological monitoring, adequate pain control, fluid balance maintenance, seizure prophylaxis, antibiotic therapy, and timely cardiology consultation. These measures are crucial to ensure recovery and prevent further neurological or cardiovascular complications.

CONCLUSION

Anaesthetic management of a child with uncorrected double outlet right ventricle (DORV) and shunt reversal presents substantial perioperative challenges that demand precise physiological regulation and a multidisciplinary approach. Successful outcomes hinge on maintaining hemodynamic stability, optimizing oxygenation, preventing elevations in pulmonary vascular resistance and intracranial pressure, and ensuring vigilant perioperative monitoring and supportive care.

Informed Consent:

Written informed consent was obtained from all the participants.

Ethics Committee Approval :

According ethics consent.

Conflict of Interest:

No potential conflict of interest relevant to this article was reported.

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