Brain Abscess Drainage in a Case of Tetralogy of Fallot with Pulmonary Atresia with Major Aortopulmonary Collateral Arteries Under Scalp Block

Surya K. Maddala[1] Krishna P. Yadavilli[1] Prasanta K. Das[1] Vipin Chandran C.[2]

[1] Department of Anesthesiology and Critical Care, All India Institute of Medical Sciences, Bhubaneswar, Orissa, India
[2] Department of Neurosurgery, All India Institute of Medical Sciences, Bhubaneswar, Orissa, India

Address for correspondence Prasanta K. Das, MD, DM, Department of Anesthesiology and Critical Care, All India Institute of Medical Sciences, Bhubaneswar 751019, Orissa, India (e-mail: docdas.aiims@gmail.com).

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Abstract

Tetralogy of Fallot (TOF) is the most common cyanotic congenital heart disease. There are a few reports of uncorrected TOF patients surviving into adulthood requiring noncardiac surgery. They are commonly susceptible to developing brain abscesses due to paradoxical embolism and lack of pulmonary phagocytic clearance. A 32-year-old man, a known patient of TOF with pulmonary atresia and major aortopulmonary collateral arteries, presented with left side weakness and seizures. He was drowsy with a Glasgow Coma Scale (GCS) of 13/15, heart rate of 72/min, oxygen saturation of 78% with 6 L/min oxygen via face mask, and blood pressure of 90/60 mm Hg with noradrenaline at 0.5 mcg/kg/min. He had central cyanosis, clubbing, and icterus. The left upper and lower limb power was 2/5, whereas it was 5/5 for the right. Cardiovascular examination revealed a grade 3/6 continuous murmur at the base of the heart. No pulmonary abnormality was noted on auscultation. Echocardiography showed large subaortic ventricular septal defect (VSD) with overriding of the aorta, pulmonary atresia, right-sided aortic arch, and ejection fraction of 62%. Magnetic resonance imaging (MRI) of the brain revealed features suggestive of brain abscess. Brain abscess drainage was performed under scalp block with sedation to avoid major hemodynamic fluctuations. The procedure was uneventful, and the patient's power on the left side improved postprocedure. Scalp block with sedation is a suitable alternative to general anesthesia for drainage of brain abscess in TOF patients.

Keywords
- brain abscess
- congenital heart disease
- pulmonary atresia
- scalp block
- tetralogy of Fallot

Introduction

Tetralogy of Fallot (TOF) is the most common cyanotic congenital heart disease characterized by aortic overriding, right ventricular hypertrophy, pulmonary stenosis, and ventricular septal defect. The extreme end of the TOF spectrum is associated with pulmonary atresia (PA), with no antegrade pulmonary arterial flow. In the most severe case, the sole source of pulmonary blood is via the major aortopulmonary collateral arteries (MAPCAs).[1] Only 20% of TOF cases have PA, and between 30 and 65% of these have MAPCAs. An uncorrected TOF has a low likelihood of survival into adulthood.[2] Due to paradoxical embolism and a lack of pulmonary phagocytic clearance of germs, they are susceptible to

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developing brain abscess. Here we report the anesthetic management of a young adult with uncorrected TOF/PA/MAPCAs posted for brain abscess drainage.

Case Report

A 32-year-old man, a known patient of TOF with PA and MAPCA, presented with left-sided weakness and seizures. His Glasgow Coma Scale (GCS) score was 13/15, heart rate (HR) of 72/min, blood pressure (BP) of 90/60 mm Hg with supports of noradrenaline 0.5 mcg/kg/min, and oxygen saturation of 78% with 6 L/min oxygen. Examination revealed central cyanosis, clubbing, and icterus. Neurological examination revealed a power of 2/5 on the left upper and lower limbs, and it was 5/5 on the right side. Cardiovascular examination revealed a right parasternal heave, normal S1 and S2, and a grade 3/6 continuous murmur at the base of the heart. No pulmonary abnormality was noted on auscultation. Laboratory investigations were performed, which showed the following: hemoglobin 18.9 m/dL, packed cell volume 74.3%, white blood cell count 13.6×10^3 cells/mm^3, platelet count 138×10^3 cells/mm^3, urea 20 mg/dL, serum creatinine 1.14 mg/dL, sodium 132 mEq/L, potassium 4.28 mEq/L, total bilirubin 7.7 mg/dL, direct bilirubin 1.6 mg/dL, indirect bilirubin 6.1 mg/dL, aspartate transaminase 23 U/L, alanine transaminase 13.2 U/L, alkaline phosphatase 79 U/L, albumin 5.9 g/dL, prothrombin time (PT) 13.5 seconds, and international normalized ratio (INR) 1.1. Chest X-ray showed a characteristic boot-shaped heart. Electrocardiogram (ECG) showed sinus rhythm with right ventricular hypertrophy. Echocardiography showed large subaortic VSD with overriding of the aorta, PA, right-sided aortic arch, and an ejection fraction of 62%. No abnormality was noted in computed tomography (CT) of the brain. Magnetic resonance imaging (MRI) of the brain revealed a well-defined peripherally enhancing T2-weighted (T2W)/fluid-attenuated inversion recovery (FLAIR) hyperintense lesion measuring $3.2 \times 3.2 \times 3.8$ cm in the right parietal lobe. Mass effect in the form of effacement of adjacent sulcal spaces and midline shift of 3 mm were seen. Diffuse leptomeningeal enhancement was seen in the adjacent right cerebral hemisphere. This was suggestive of a brain abscess (►**Fig. 1**).

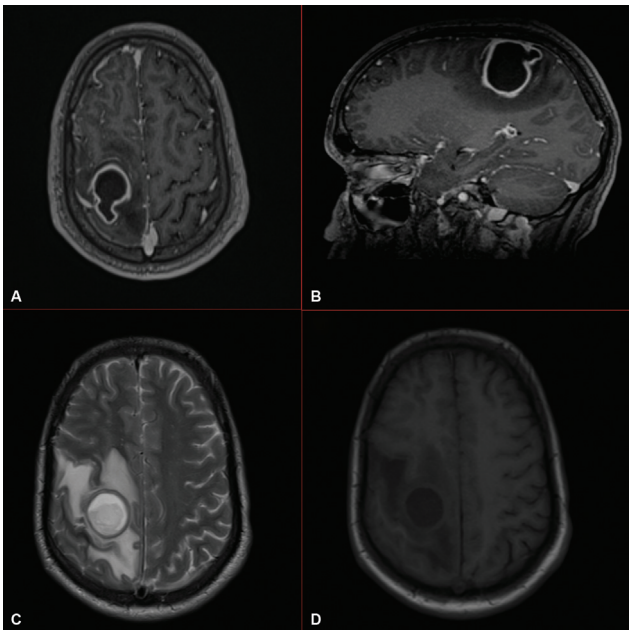

Fig. 1 (**A**, **B**) Contrast axial and sagittal images. A well-defined ring-enhancing lesion with an area of nonenhancement in the center located anterior to the central sulcus in the right side. (**C**) T2-weighted (T2W) image. A hyperintense lesion with an area of hypointensity in the periphery anterior to the central sulcus in the right side with surrounding edema. (**D**) T1W image. A well-defined hypointense lesion with peripheral isointensity anterior to the central sulcus with a surrounding edema.

The patient was scheduled for brain abscess drainage. The patient was previously on warfarin 1 mg once daily, which was changed to enoxaparin 40 mg twice daily. Enoxaparin was withheld 24 hours prior to surgery. The patient was on levetiracetam 500 mg intravenous (IV) twice daily, which was continued. In complex congenital heart disease such as this patient, general anesthesia may be associated with hemodynamic disturbances, occurrence of cyanotic spells, and increase in perioperative morbidity. So, we preferred to give a scalp block with sedation.

The patient was shifted to the operating theater, and all American Society of Anesthesiologists (ASA) standard monitors were attached, and a defibrillator and an airway cart were kept ready. Due to logistic issues, depth of anesthesia monitoring could not be done. Oxygen was administered with a nonrebreathing mask at 10 L/min, which improved oxygen saturation to 90%. Two wide-bore IV cannulas, right internal jugular vein canulation, and radial arterial canulation were all done under local anesthesia. Injection midazolam 1 mg IV, injection fentanyl 25 mcg IV, and injection ketamine 20 mg IV were given. Scalp block was performed bilaterally with 20 mL 0.5% bupivacaine, and 30 mcg dexmedetomidine was added for prolongation of block. Head clamp was not applied, and surgery was started after 10 minutes of block after confirming adequate analgesia. During the incision of the dura mater, 25 mcg fentanyl was repeated. Three percent NaCl was given at 5 mL/kg intraoperatively. Injection levetiracetam 500 mg stat was given.

Intraoperative hemodynamics were stable, and the patient's HR throughout the procedure was 75 to 80 beats/min. There were no episodes of hypotension and cyanotic spells intraoperatively. Surgery was completed in 30 minutes. Postprocedure, the patient was shifted to the intensive care unit (ICU) for monitoring. Motor power of the left limbs improved to 4/5 2 days after the procedure, and the patient was shifted to the ward for follow-up by the cardiology department.

Discussion

In patients with TOF, chronic hypoxemia and cyanosis ensue due to right to left shunt and inadequate pulmonary perfusion. Compensatory mechanisms include polycythemia, vasodilation, hyperventilation, and chronic respiratory

alkalosis.[3] Perioperative hemodynamic instability, cyanosis, coagulation abnormalities due to polycythemia, paradoxical air emboli, fluid and acid–base imbalance, and congestive heart failure are the primary concerns during anesthesia. The prevention of infective endocarditis is advised in cases of uncorrected TOF. Increased blood viscosity and thromboembolism are decreased by adequate hydration. If the patient has infundibular stenosis, hypovolemia can make the right ventricular outflow tract obstruction worse.

Anesthetic management in patients with uncorrected TOF for noncardiac surgery is focused on avoiding a further increase in right-to-left shunt, decreasing consumption of oxygen, arrhythmia prevention, and hypovolemia prevention.[4] Right-to-left shunting is minimized by maintaining higher systemic vascular resistance (SVR) compared with pulmonary vascular resistance (PVR). Acidosis, hypercarbia, and hypoxia may significantly increase PVR. Without positive end-expiratory pressure (PEEP), hyperventilation reduces PVR. Better oxygenation can be achieved by using general anesthesia, but there is a risk of hemodynamic instability, pulmonary vascular compression, poor exchange, and acidemia.[5]

With thorough anatomical knowledge, regional technique of scalp block with sedation may be an alternative in patients with uncorrected TOF offering the best outcome for the patient.[6] A well-monitored anesthesia regimen combined with local burr hole infiltration and scalp block, with or without supraglottic airway devices, is believed to provide ideal conditions for brain abscess drainage while preserving hemodynamics, intracranial pressure, preventing postoperative nausea and vomiting, and maintaining peripheral oxygen saturation.[7]

Conclusion

Scalp block combined with sedation is a suitable alternative in patients with uncorrected TOF with PA and MAPCA for brain abscess drainage. This is associated with fewer hemodynamic complications associated with general anesthesia.

Conflict of Interest
None declared.

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