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**Scalp block for brain abscess drainage in patient with uncorrected tetralogy of Fallot**

Sethi S *et al.* Scalp block for brain abscess drainage

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**Abstract**

We report a case of a 11 years old boy with diagnosed but uncorrected tetralogy of Fallot presented to us for brain abcess drainage. The child was managed successfully with scalp block with sedation.

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**Key words:** Tetralogy of Fallot; Brain abcess; Ketamine; Scalp block; Conginital heart disease

**Core tip:** We present a case report describing the use of scalp block combined with the sedation for brain abscess drainage in a child with un-corrected tetralogy of Fallot. The goal should be to maintain the hemodynamic stability and avoid any increase of right to left shunt. Therefore, we decided to perform scalp block combined with sedation in this child. We used O2 inhalation, analgesia and sedation with fentanyl midazolam and ketamine to alleviate anxiety and also to increase SVR, pulmonary perfusion and oxygenation.

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**INTRODUCTION**

Tetralogy of Fallot (TOF), with an incidence of 10% of all congenital heart diseases[1] , is the commonest cyanotic congenital heart disease[1] and has a dilated aorta which overrides the large ventricular septal defect along with right ventricular outflow tract (RVOT) obstruction and hypertrophy of right ventricle. RVOT can be valvular, infundibular or both[2]. There has been several case reports of successful management of TOF presenting for brain abscess drainage, caesarean section and major abdomial surgeries[3-5]. We present a case report describing the use of scalp block combined with the sedation for brain abscess drainage in a child with un-corrected TOF.

**CASE REPORT**

An 11 years old male child weighing 44 kg presented to us in the emergency with history of fever upto 102 ºF, headache and vomiting since 10 d. The child was a known case of TOF but had not undergone any surgical repair. His effort tolerance was poor. History of cyanotic spells since childhood was present but was not on any kind of medication. On examination the child was conscious though irritable and crying. The child did not show any signs of raised ICP. Central cyanosis and clubbing was present. He had a pulse rate of 76 per minute with a blood pressure of 110/60 mmHg. On examination of the cardiovascular system the apex beat was found in the left 5th intercostal space in the mid clavicular line and was associated with left parasternal heave. 1st and 2nd heart sounds, along with a loud pulmonary component of 2nd heart sound were audible along with a pansystolic murmur (Grade 4/6) at the left lower sternal border. No focal deficit was found on neurological examination. Respiratory system and gastrointestinal system were normal on examination.

Chest X-ray (Figure 1) showed an enlarged cardiac shadow with left ventricular hypertrophy and dilated pulmonary arteries. ECG revealed sinus rhythm with right ventricular hypertrophy. ECHO showed a large VSD of 13 mm, 60% overriding of aorta, right ventricular hypertrophy and right ventricular tract outflow obstruction and ejection fraction of 0.6. Cardiac catheterization was not done. CECT (Figure 2) showed a left temporoparietal abcess with no uncal herniation along with midline shift of 2 mm. His hematocrit was 58% with a platelet count of 105 × 109/L. The child’s serum electrolytes, coagulation studies and renal function tests were within normal limits. The baseline ABG revealed pH 7.419, Po2 35.5 mmHg, Pco2 31.8 mmHg, HCO3 20.1 mEq/L, SPO2 68.7%, BE-3.3. The child received infective endocraditis prophylaxis prior to the surgery and was allowed oral intake of fluids upto 2 h prior to surgery and normal saline was used as the maintenance fluid thereafter in the ward. In the operation theatre, standard monitoring was done with non invasive blood pressure, pulse oximetry, ECG, temperature. NeoStarTM triple lumen central venous catheter was in situ as it was inserted when the child presented to us in the emergency department. A 20 G arterial cannula (Becton Dickinson Critical Care Systems, Singapore) was inserted into the radial artery under local anesthesia. The baseline heart rate was 70 beats per min with an invasive blood pressure of 116/68 mmHg and a CVP of 10 cm of H2O.Child had 64% Spo2 with 50% O2 on venturi face mask. Normal saline was used maintenance fluid in the dose of 4 mL/kg per hour.

The scalp block was given with 20 mL of 0.75% ropivacaine without adrenaline (3-4 mL for each nerve) to block supra trochlear, supra-orbital, zygomaticotemporal, auriculotemporal, greater and lesser occipital nerve. The block was supplemented with Fentanyl 20 µg I.V, followed by Ketamine 20 mg I.V and Midazolam 0.2mg I.V. at the time of burr hole. The child was kept on spontaneous respiration throughout the procedure with 50% oxygen and air mixture.At the time of dural opening, Ketamine 20 mg intravenouswas repeated. Normal saline was administered to keep CVP in range of 14-16 cm of H2O.The procedure lasted for 30 min and the intraoperative course was uneventful with maintenance of hemodynamic parameters, and acid base status within normal limits with a SPO2 69.5%.

**DISCUSSION**

For the anesthetic management of these patients one should be careful about the drugs and events that may increase the R-L shunt[6]. The severity of the disease directly correlates with the size of VSD, severity of pulmonary stenosis and functional status of the right ventricle[7]. Complications of right to left shunts include chronic hypoxia leading to pulmonary vasoconstriction, altered acid base status, polycythemia, coagulopathy, infective endocarditis and cerebral abscess due to increased risk of paradoxical emboli. The reported incidence of brain abscess in patients with cyanotic heart disease is between 5% and 18.7%[8].

Anaesthetic management of these patients is always a challange for the anesthesists because of the cardiopulmonary and coagulation abnormalities, dehydration and electrolyte imbalance along with abscess-induced complications of seizures, meningitis and raised intracranial pressure[4].

General anesthesia with controlled ventilation has the advantage of better oxygenation but can be associated with the risk of hemodynamic instability along with compression of pulmonary vessels, impaired gas exchange and academia[9].

Most of the agents used for induction and maintenance of general anaesthesia may also lead to myocardial depression along with reduction of SVR.

The goal should be to maintain the hemodynamic stability and avoid the changes that would increase right to left shunt. Therefore, we decided to perform scalp block combined with sedation in this child.

Factors such as thorough pre-operative examination, ECHO, treatment of any chest infections, cardiologist consultation, and documentation of pre-operative cardiac and neurological status, correction of any coagulopathy were necessary and were taken care of in our child.

Prolonged fasting is better avoided in these patients, and intake of clear fluids up to two hours prior to the surgery should be allowed. We followed the same guidelines in our patient as well along with normal saline as a maintenance fluid in the ward. Prevention of dehydration is also important as these patients have increased hematocrit .The patients who have hematocrit ≥ 60% are susceptible for developing coagulopathy and preoperative phlebotomy is beneficial in such cases. Our child had hematocrit of 58% and preoperative phlebotomy was not performed as it was an emergency procedure but adequate precaution to prevent dehydration and liberal fluid administration was done to keep the CVP in range of 14-16 cm of H2O. Fluid boluses of 20 mL/kg may be required to increase the blood pressure and RV preload[10].

Air bubbles are also a preventable cause of peri-operative morbidity in patients with shunting, as air or particulate matter may be shunted directly into the arterial bed[11,12] and we took measures to prevent it.

We used O2 inhalation, analgesia and sedation with fentanyl midazolam and ketamine to alleviate anxiety and also to increase SVR, pulmonary perfusion and oxygenation. Though O2 inhalation, fentanyl and midazolam cannot increase SVR, but avoid increasing PVR. Ketamine may increase SVR in some level, or, more important, can prevent lowering of SVR and has helped in our patient by decreasing left to right shunt.

Ketamine has also been shown to be better in children who had pulmonary hypertension[13,14] though this is not the cause of the cyanosis in these patients, rather it is the fall in SVR leading to left-right shunt which causes hypoxia. In one study of 18 neonates who had complex cardiac defects, ketamine was used most commonly when intubation was not required for surgery[15]. Anesthetic agents like sevoflurane , isoflurane and fentanyl/midazolam infusions have no effect on shunt fraction of children having shunts[16-18].

Scalp block is a well established technique for craniotomy being increasingly used for epilepsy surgery, temporal lobectomy where the excision encroaches on eloquent cortex areas[19].

Scalp block may be given pre-operatively to reduce the hemodynamic response to pin holder application, and post-operatively before the emergence to decrease the severity of post-operative pain. They also decrease intra and postoperative opioid requirement[20,21].

We used 0.75% ropivacaine without adrenaline for administering scalp block as addition of adrenaline may cause tachycardia that is very dangerous in patients with uncorrected TOF, because it may cause infundibular spasm and cyanotic spell.

Scalp block along with sedation is being used successfully in our institute for patients with chronic SDH. Since the patient we encountered had to go an emergency procedure, with no time for cardiac catheterization and medical optimization of the patient, we decided to proceed with regional anaesthesia with sedation and invasive monitoring in the patient.

The avoidance of general anesthesia due to medical reasons in selected patients and with the thorough anatomical knowledge of nerve blocks, this underestimated regional technique of scalp block with sedation may be considered as an alternative technique in selective patients with un-repaired TOF and has proved to be extremely rewarding procedure for the neuroanaesthetist, whilst offering the best possible outcome for the patient.

**COMMENTS**

***Case characteristics***

An 11 years old male, a known case of tetralogy of Fallot (TOF), presented withfever (upto 102 ºF), headache and vomiting for the past 10 d.

***Clinical diagnosis***

On examination the child had central cyanosis, clubbing, loud P2, grade IV pansystolic murmur but there were no signs of raised intracranial pressure and no neurological focal deficit.

***Differential diagnosis***

It is a known case of TOF but had not undergone any surgical repair and has presented with brain abscess.

***Laboratory diagnosis***

The patient had high hematocrit with normal coagulation profile. The baseline ABG revealed pH 7.419, Po2 35.5 mmHg, Pco2 31.8 mmHg, HCO3 20.1 mEq/L, SPO2 68.7%, BE -3.3.

***Imaging diagnosis***

ECHO revealed a large VSD of 13 mm, 60% overriding of aorta, right ventricular tract outflow obstruction and ejection fraction of 0.6 while CECT (Figure 2) showed a left temporoparietal abcess with no uncal herniation and a midline shift of 2 mm.

***Pathological diagnosis***

Patient was diagnosed brain abscess with uncorrected TOF

***Treatment***

Child was not on any kind of medication and presented to us in emergency. The child had received infective endocarditis prophylaxis prior to the surgery.

***Experiences and lessons***

Uncorrected TOF presents as a challenge to the anaesthetists and a thorough knowledge about the physiological and pathological changes occurring with the disease is essential for the safe management of the patient in the peri-opertive period.

Regional anaesthesia should be considered as an alternative to the general anesthesia when feasible.

***Peer review***

A good paper that can be accepted.

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**Figure 1 Chest X-ray of the patient showing enlarged cardiac silhouette.**



**Figure 2 CECT of the patient showing left temporoparietal abcess .**