

# Caudal anesthesia for anoplasty in a toddler with uncorrected tetralogy of Fallot: a case report

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## Abstract

**Background:** Non-cardiac surgery is prevalent among individuals with a history of cyanotic congenital heart disease (CHD), including tetralogy of Fallot (ToF). Surgical and anesthetic procedures in such patients may lead to multiple complications. In the selected patient group, neuraxial block, a specific type of caudal anesthesia, can be a viable alternative for anesthetic management.

**Objective:** The study aimed to assess the efficacy of caudal anesthesia as postoperative analgesia for an infant with uncorrected ToF who underwent anoplasty.

**Methods:** The case was a 17-month-old female toddler with uncorrected ToF who underwent anoplasty to treat anorectal malformation. For the anoplasty performance, the patient received caudal anesthesia with sedation using bupivacaine. In addition, sedation was carried out using low-dose ketamine and midazolam combination following fluid rehydration. The entire surgical procedure was performed in the prone position and lasted approximately 60 minutes.

**Results:** Based on intraoperative monitoring records, patient exhibited stable hemodynamics with no intraoperative or postoperative complications. Intraoperative systolic blood pressure ranged from 70 to 80 mmHg, diastolic blood pressure from 35 to 40 mmHg, and heart rate from 120 to 140 beats per minute, respectively.

**Conclusion:** This study showed that caudal analgesia is an effective analgesic technique associated with few adverse effects and positive outcomes in pediatric patients with ToF.

**Keywords:** anesthesia; anoplasty; hemodynamics; regional anesthesia; tetralogy of Fallot

## Background

Tetralogy of Fallot (ToF) is among the most prevalent cyanotic congenital heart diseases (CHDs), representing 3–5 % of all congenital cardiac anomalies, with an incidence of roughly 3 per 10,000 live births [1]. It provides a challenge for anesthesiologists during non-cardiac procedures due to an increased likelihood of adverse effects compared to healthy children, particularly hypercyanotic episode, pulmonary hypertension, and postoperative apneic episode.

Regarding anesthetic issue in ToF patients, caudal anesthesia may be selected to enhance hemodynamic

results during surgery and reduce potential complications, including hypoventilation or apnea [2; 3]. This case report demonstrates the utility of caudal anesthesia as a postoperative analgesia for a toddler with uncorrected ToF who underwent anoplasty.

## Case Description

A 17-month-old female toddler (weight: 8 kg, length: 78 cm) with a history of ToF was scheduled for an anoplasty surgery due to anorectal malformation. During the primary survey, she was fully alert with no additional breath sounds. Her vital signs were as follows: respiratory



**Fig. 1.** Prone positioning

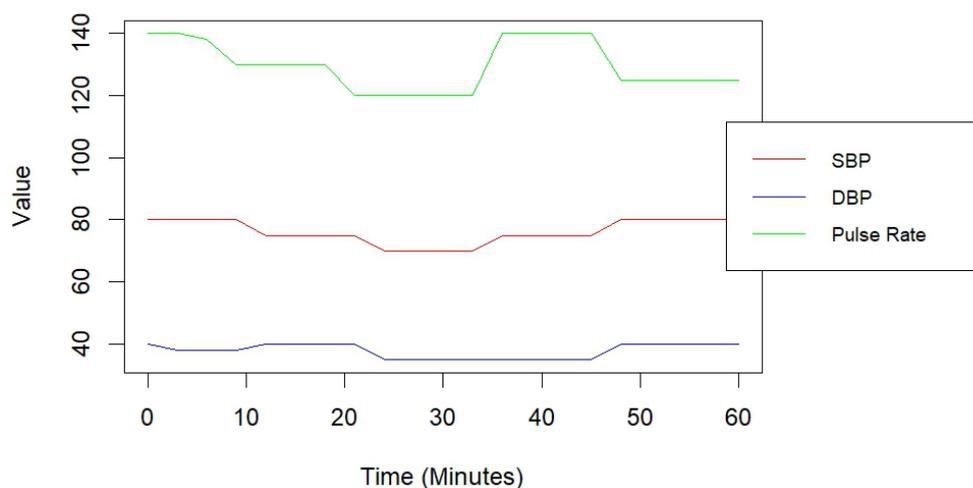
rate, 28–30 breaths per minute; oxygen saturation, 66–68 % on ambient air; blood pressure, 115/70 mmHg; heart rate, 132 beats per minute; and temperature, 37 °C. The secondary survey revealed cyanosis on crying, finger clubbing, and a boot-shaped heart appearance on chest X-ray. Furthermore, an echocardiographic assessment revealed pulmonary atresia and a complete atrioventricular septal defect.

Anesthesia management began with classifying the patient's physical condition as American Society of Anesthesiologists (ASA) physical status III, signifying severe systemic disease due to her congenital defects. The anesthetic plan was a caudal block with sedation. Upon arrival in the operating room, a preoperative assessment was performed. The patient's airway was clear, her

breathing rate was 30–32 breaths per minute, and oxygen saturation was 72 % with a nasal cannula at 2 L/min. On cardiac auscultation, murmur and gallop were noted, and her pulse rate was 134 beats per minute. All other physical examination findings were unremarkable. Due to the patient's ToF, several standard interventions are available to manage sudden cyanotic spells, including oxygen, phenylephrine, epinephrine, and milrinone. A ventilator is available should intraoperative invasive ventilation be necessary. Additionally, preparations have been made for the patient's postoperative transfer to the pediatric intensive care unit as needed.

The patient was taken to the operating room for anoplasty. Rehydration was initiated with 10 ml/kg of crystalloid fluid. Subsequently, sedation was induced with a combination of low-dose ketamine 1 mg/kg and midazolam 0.05 mg/kg, administered as a continuous intravenous (IV) infusion. In addition, atropine sulfate 0.01 mg/kg was also given as an adjunct to IV sedation procedure. After obtaining a Ramsay sedation scale of 6 (patient exhibited no response), and hemodynamic stability was established, caudal anesthesia was performed using 0.25 % bupivacaine (0.5 ml/kg) with epinephrine (5 mcg/kg). After 10 minutes of monitoring to ensure hemodynamic stability, the patient was placed in the prone position (Fig. 1). The procedure then commenced under continued sedation with supplemental oxygen delivered via a nasal cannula at 2 L/min. The patient was monitored using standard measures, including electrocardiography, non-invasive blood pressure (NIBP), and oxygen saturation. During surgery, the patient's physical condition remained stable (Fig. 2). The procedure was successful, and she was transferred to the post-anesthesia care unit (PACU) without complications.

### Hemodynamic Monitoring



**Fig. 2.** Intraoperative hemodynamic monitoring

## Discussion

Patients with ToF often experience hemodynamic instability resulting from multiple cardiac abnormalities. For anesthetic management in these patients, caudal block anesthesia (or spinal anesthesia) with sedation is a viable option. This approach lowers the need for general anesthesia, thereby mitigating the risk of respiratory depression and cardiovascular compromise while providing analgesia in the surgical region, essential for postoperative patient comfort [3].

Young children can tolerate high levels of neuraxial blockade with minimal hemodynamic alteration. Caudal anesthesia can serve as an alternative anesthetic method for major infraumbilical procedures in neonates, infants, and toddlers with cyanotic CHD [2, 3]. Caudal block diminishes hemodynamic stress and enhances perioperative analgesia, which is crucial for mitigating the stress response and catabolic hormonal changes associated with surgery.

In young children with CHD undergoing non-cardiac surgery, blood flow distribution depends on the balance between systemic vascular resistance (SVR) and pulmonary vascular resistance (PVR). Episodes of abrupt oxygen desaturation, or “cyanotic spells,” are typically triggered by infundibular muscle spasm, often during periods of distress. These spells are caused by physiological changes that increase the right-to-left shunting of deoxygenated blood. Over time, this leads to secondary right ventricular hypertrophy and diastolic dysfunction, characterized by impaired ventricular relaxation and filling (lusitropy). Consequently, any increase in heart rate (tachycardia) reduces diastolic filling time, decreases stroke volume and simultaneously increases myocardial oxygen demand [2].

In the present case of a patient with uncorrected ToF who underwent anoplasty, we opted for a combination of ketamine and midazolam for sedation [4]. Ketamine

was chosen for its analgesic and amnestic effects, as well as its ability to maintain stable cardiovascular conditions. Meanwhile, midazolam, a benzodiazepine, was administered to provide additional sedation and anxiolysis. The synergistic action of these two agents offers the advantages of hemodynamic stability and effective pain management, superior to the midazolam-propofol combination. This combination provides a reduction in possible respiratory side effects while improving the SVR and cardiac index due to the positive inotropic and chronotropic effects of ketamine [5]. Moreover, sedation allows the patient to maintain spontaneous respiration and protective airway reflexes and reduces the risk of respiratory depression associated with general anesthetics.

The procedure was performed with the patient in the prone position. In ToF patients, this position can markedly influence hemodynamics by improving venous return and cardiac output [2]. This position may also help prevent cyanotic spells by reducing the obstruction to pulmonary blood flow. However, it is important to acknowledge that prone positioning poses certain challenges. In spontaneously breathing patients, this position is associated with risks such as skin damage, abdominal distention, pressure injuries, vomiting, and nerve compression [6].

## Conclusion

Caudal anesthesia provides an effective alternative for non-cardiac surgery in toddlers with ToF. This approach offers efficient analgesia in the operative region, diminishing the necessity for general anesthetic and systemic opioids. Furthermore, caudal anesthesia promotes hemodynamic stability by mitigating the stress response and ensuring airway patency.

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