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Case Report

# Anesthetic Management of Exploratory Laparotomy for Strangulated Umbilical Hernia in a Neonate with Mixed-Type TAPVC: A Case Report

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**ABSTRACT**

Mixed-type total anomalous pulmonary venous connection (TAPVC) in a neonate requiring emergency surgical intervention for a strangulated umbilical hernia presents unique anesthetic challenges. We report successful perioperative management of a 24-day-old male infant (3.2 kg) with mixed TAPVC posted for exploratory laparotomy. Key management strategies included careful modulation of pulmonary and systemic vascular resistance, strategic use of inotropic support, and meticulous monitoring of oxygen delivery in the context of right-to-left shunting. The patient remained hemodynamically stable throughout surgery and was successfully managed postoperatively with graduated ventilatory support. This case highlights the critical importance of coordinated anesthetic and surgical planning in neonates with complex congenital heart disease undergoing non-cardiac emergency procedures.

## Introduction

Neonatal anesthesia in the presence of complex congenital heart disease presents profound challenges, particularly for emergency procedures outside standard cardiac repair [1]. Mixed-type total anomalous pulmonary venous connection (TAPVC) is a rare (7-9 per 100,000 live births) but critical anomaly where pulmonary venous drainage is partially to the systemic venous circulation, resulting in obligatory right-to-left shunting and cyanosis [2]. We report the perioperative anesthetic management of a 24-day-old male infant with mixed TAPVC posted for emergency exploratory laparotomy due to a strangulated umbilical hernia with loss of bowel vascularity.

## Case Report

A 24-day-old, full-term male neonate (3.2 kg at presentation) presented with acute abdominal distension and clinical signs of a strangulated umbilical hernia. The hernial defect measured 12 mm with bowel and omentum herniating; intraoperative findings confirmed loss of vascularity requiring resection. Obstetric history was unremarkable—normal vaginal delivery, immediate cry, and birth weight of 3.1 kg. The infant had spent 7 days in the neonatal intensive care unit (NICU) before presentation in view of cyanosis, initially maintained on continuous positive airway pressure (CPAP) at 40% inspired oxygen.

Transthoracic echocardiography performed during NICU admission revealed mixed TAPVC with three pulmonary veins draining into the coronary sinus (which drains into the right atrium), the left pulmonary vein draining into the innominate vein, a small patent foramen

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ovale (PFO) with right-to-left shunt, mild tricuspid regurgitation (gradient 30 mmHg), confluent and dilated branch pulmonary arteries, an intact interventricular septum, and good biventricular function. Cardiac surgery had been planned for early TAPVC repair; however, the acute development of a strangulated hernia necessitated urgent surgical intervention.

Physical examination at the time of presentation revealed clinical evidence of compensated cardiac status: S1 loud, S2 widely split, and a Grade 3/6 ejection systolic murmur at the left upper sternal border. Femoral pulses were palpable and equal bilaterally with an O2 saturation of 84%; no dysmorphic features were noted. Preoperative investigations, Complete blood count: hemoglobin 15.1 g/dL, total leukocyte count 15,950/mm³, platelet count 336,000/mm³. In other labs serum creatinine was 0.48 mg/dL, serum electrolytes were sodium being 137 mEq/L, potassium 4.54 mEq/L and chloride 106 mEq/L. The patient had a total bilirubin of 7.1 mg/dL (conjugated 0.48 mg/dL, unconjugated 6.62 mg/dL), SGOT/PT was 26/11 U/L, ALP 324 U/L. Arterial blood gas analysis showed pH 7.42, $pCO_2$ 32 mmHg, $pO_2$ 48 mmHg, $HCO_3^-$ 20.8 mEq/L, and base excess −3.7. Coombs' test was negative. Blood group: O negative. Preoperative medications included IV Amikacin 15 mg/kg every 24 hours, Metronidazole 7.5 mg/kg 8-hourly, and Meropenem 20 mg/kg daily as part of antimicrobial coverage. The patient received cefotaxime 150 mg intravenously for surgical prophylaxis.

Following preoxygenation with 100% oxygen for 3 minutes, anesthetic induction was accomplished with: Fentanyl 6.4 mcg (2 mcg/kg), ketamine 6 mg (approximately 2 mg/kg), and vecuronium 0.3 mg (approximately 0.1 mg/kg) for neuromuscular blockade. The patient was intubated orally with a 3.5 mm uncuffed endotracheal tube (Cormack-Lehane Grade 1 view obtained at first laryngoscopy). Bilateral air entry was confirmed by auscultation. A nasogastric tube (8 French) was inserted. Volume controlled Ventilation started with Tidal volume of 6-8 mL/kg with frequency of 30-35 breaths per minute. Post-intubation, a 4 French right subclavian central venous line was set-up. Standard monitoring consisted of electrocardiography, blood pressure (noninvasive), SpO2, end-tidal carbon dioxide, temperature, and lastly the central venous pressure monitoring. Inj. Hydrocortisone 2 mg/kg, Inj. Dexamethasone 0.1 mg/kg, and Inj. Paracetamol 7.5 mg/kg were administered intravenously. Special attention was paid to ventilatory parameters to minimize factors that worsen pulmonary hypertension and increase right-to-left shunting:

1. Target $SpO_2$: 85–95%, not >95% to avoid excessive pulmonary vasodilation. (Figure 1)
2. Target $EtCO_2$: 30–35 mmHg (mild hypercarbia avoided; mild hypocarbia acceptable).
3. $FiO_2$: Titrated to achieve target $SpO_2$ without excessive oxygen
4. Ventilatory rate: 30–35 breaths/minute, appropriate for age

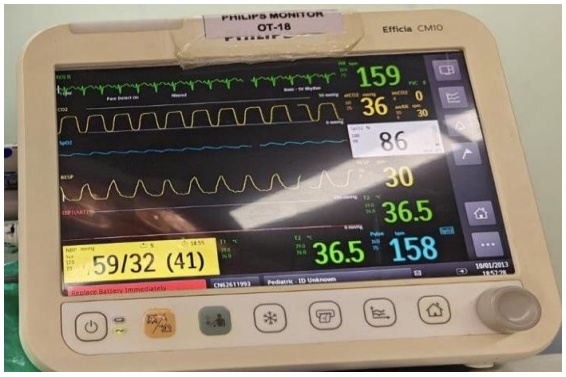


**Figure 1- Intraoperative Vitals**

Given the mixed TAPVC physiology and specific hemodynamic requirements, a combination of inotropic and vasoactive infusions was commenced. Infusion of Milrinone (10 mg in 50 mL NS) was started @ 0.5 µg/kg/min, at an infusion rate of 0.5 mL/hour offering inodilatory support and hence maintaining myocardial contractility along with reducing the pulmonary vascular resistance. In addition, Infusion Adrenaline (1mg in 50 mL NS) was initiated @ 0.05 µg/kg/min, at 0.5 mL/hour keeping adequate systemic perfusion pressure. Mean arterial pressure was carefully monitored in the range of 40-45 mmHg. A restrictive fluid strategy was employed, preventing any pulmonary congestion concerns and short operative time. A total of 20 mL of D10% was given intraoperatively with a total urine output of 5 mL and minimal estimated blood loss for a 2.5 hour surgical time. Central venous pressure was maintained at 2–5 mmHg and avoidance of fluid overload, prevented any exacerbation of pulmonary congestion in mixed TAPVCs. The patient's hemodynamics were stable throughout with a heart rate of 140–160 beats per minute with ionotropic support, SpO2 of 85-95%. Intraoperative ABG revealed a pH of 7.4, $paCO_2$ of 36 mmHg, $paO_2$ of 56 mmHg, HCO3- 22 mEq/L, and base excess of -2.5.

Surgery revealed a strangulated umbilical hernia with associated ischemic bowel requiring resection. The defect was surgically repaired. No intraoperative complications related to cardiac status were encountered. Postoperatively, the patient was transferred to the NICU (Figure 2) in an intubated state with only ongoing milrinone support. A postoperative chest X-ray confirmed appropriate endotracheal tube position and central venous line placement. On post-op day 1, patient continued on volume control ventilation, titrating FiO2 to maintain SpO2 >90%. By postoperative day 2, the patient was transitioned to synchronized intermittent mandatory ventilation with pressure support. Following hemodynamic stabilization and demonstration of

adequate oxygenation, the patient was handed over to the NICU for continued management and subsequently to the cardiovascular thoracic surgery team for planned definitive TAPVC repair.

**Figure 2- Postoperative NICU admission**

## Discussion

Management of the neonatal patient with unoperated TAPVC undergoing emergency non-cardiac surgery requires sophisticated integration of cardiac pathophysiology, age-appropriate pharmacology, and strategic monitoring [1]. The simultaneous presence of a strangulated hernia and mixed TAPVC necessitates careful coordination between surgical and anesthesia teams, with paramount emphasis on maintaining hemodynamic stability and avoiding pulmonary hypertensive crisis.

The right-to-left shunting present in mixed TAPVC mandates avoidance of factors that increase pulmonary vascular resistance relative to systemic vascular resistance. Hypoxemia, hypercarbia, and acidosis all precipitate pulmonary hypertension and worsen shunt flow, compromising systemic oxygenation [2]. Therefore, judicious ventilatory management targeting mild hypocarbia and normoxemia (rather than aggressive hyperoxia) is preferred. In patients with TAPVC presenting for emergency non-cardiac surgery, excessive fluid administration risks exacerbating pulmonary congestion and worsening pulmonary hypertension [3].

This case used a restrictive fluid approach (20 mL intraoperatively with 5 mL urine output) to permit hemodynamic stability while maintaining renal perfusion and avoiding fluid overload. This strategy, combined with inotropic support, proved effective in this brief operative procedure. Inotropic support with milrinone offers a distinct advantage in this population by providing inotropic support while reducing pulmonary vascular resistance—a property particularly valuable in the context of TAPVC [4]. Infusion of Adrenaline at a dose of 0.05 mcg/kg/minute offers adequate hemodynamic support excluding the unnecessary alpha-adrenergic effects which would lead to pulmonary vasoconstriction. Normothermia is of paramount importance as hypothermia triggers increased metabolic demands thereby augmenting shunt flow [5]. Preoperative preparation, vigilant intraoperative monitoring with judicious fluid administration allowed for a successful outcome. This case renders the significance of multidisciplinary and evidence-based protocols in managing neonates under emergency with complex congenital heart diseases.

## Conclusion

Coordinated anesthetic approach, surgical planning and interdisciplinary communication led to successful management of a neonate with mixed TAPVC. Major goals were proper ventilatory management, restrictive fluid administration, and meticulous monitoring, combined with evidence-based use of milrinone and adrenaline, met the surgical objectives maintaining hemodynamic stability and permitting safe definitive cardiac repair. This case epitomizes the need for a case to case, physiologically sound and safe anesthesia in intricate cardiac disease in neonates.

### Acknowledgment

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