

Total Intravenous Anaesthesia in a 550-Gram Extremely Preterm Neonate Undergoing Surgery for Meconium Ileus

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ABSTRACT

Anaesthetic management in extremely preterm neonates requires more than standard protocols and instead demands a highly individualised approach. The authors report the case of an extremely low birth weight (ELBW) male infant, born at 26 weeks and 4 days of gestation with a birth weight of 550 g, who developed signs of meconium ileus in his second week of life, necessitating an urgent laparotomy. Given his delicate health and the risk of cardiac complications from gas anaesthetics, anaesthesia was initiated and continued using a total intravenous anaesthesia (TIVA) method with fentanyl, ketamine, atracurium, and a carefully adjusted propofol infusion. Intraoperative management prioritised physiological stability, ensuring normothermia, euglycaemia, and adequate fluid balance, along with sufficient anaesthetic depth. The surgery proceeded uneventfully, and the infant remained haemodynamically stable throughout; he was successfully extubated on postoperative day 12 with no anaesthesia-related complications. This case underscores the importance of a meticulously planned, team-based, and individualised anaesthetic strategy in the care of ELBW neonates undergoing surgery.

Key Words: Total intravenous anaesthesia, Extremely premature neonate, Meconium ileus, Propofol.

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INTRODUCTION

Providing anaesthesia for extremely low birth weight (ELBW) infants is not straightforward. These infants weighing 1,000 grams or less have fragile physiology and very limited reserves.¹ Even small changes in blood pressure (BP) or temperature can have serious consequences. Every aspect of care must be planned with precision.¹

Premature neonates are typically delivered before reaching 37 weeks of gestation. They can be further categorised according to birth weight: exceedingly low birth weight (<1,000 g), very low birth weight (<1,500 g), and low birth weight (<2,500 g).² According to the World Health Organization, approximately 15 million children are born prematurely each year, accounting for more than 10% of all live births worldwide.² Approximately 5% of these infants are classified as extremely preterm, meaning they were born before 28 weeks of gestation. This group is at the highest risk of death, long-term health complications, and birth defects, which affect 10% to 20% of cases. Common health issues observed in this population include neurodevelopmental, cardiovascular, and gastrointestinal issues.

Inhaled anaesthetic agents are widely used, but in neonates, they can reduce cardiac performance and lower BP, which is risky. Reduced tissue perfusion in such vulnerable patients can worsen outcomes.^{3,4} For this reason, some teams opt for total intravenous anaesthesia (TIVA), which offers greater control and avoids some of the cardiovascular effects of inhaled medicines.⁵

This report describes the anaesthetic management for a 550-gram infant born at 26 weeks and 4 days of gestation weeks. He underwent emergency surgery for meconium ileus. TIVA was chosen due to his fragile condition. The course of anaesthesia and the outcome are discussed in this case report.

CASE REPORT

A male infant was born at 26 weeks and 4 days of gestation *via* Caesarean section due to foetal distress. He weighed 550 grams at birth. Immediately after delivery, he required endotracheal intubation and was admitted to the neonatal intensive care unit (NICU) for mechanical ventilation. The infant was ventilated using pressure-controlled synchronised intermittent mandatory ventilation (SIMV-PC) with the following initial parameters: peak inspiratory pressure (PIP) of 20 cmH₂O, positive end-expiratory pressure (PEEP) of 5 cmH₂O, respiratory rate of 40 breaths per minute, inspiratory time (Ti) of 0.35 seconds, and FiO₂ titrated between 0.30 and 0.40 to maintain oxygen saturation between 92 and 96%. On day 16 of life, he developed abdominal distension along with bilious gastric aspirates. An abdominal x-ray revealed dilated bowel loops, raising concern

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for meconium ileus. Due to the failure of medical management, a surgical exploration through laparotomy was planned.

At the time of surgery, his weight had increased to 630 grams. The infant was stable on the ventilator, with a heart rate around 160 bpm, a mean arterial pressure of 34 mmHg, and oxygen saturation between 95 and 96%. The American Society of Anesthesiologists (ASA) physical status was assigned as IV E, reflecting the patient's extreme prematurity, physiological instability, and the urgent nature of the surgery due to suspected bowel compromise. Volatile anaesthetics were avoided to minimise the risk of cardiac depression, and a TIVA technique was selected. Induction was done with fentanyl (2 µg/kg) and ketamine (1 mg/kg), followed by atracurium (0.5 mg/kg). Anaesthesia was maintained using a continuous propofol infusion at 50-100 µg/kg/min *via* syringe pump.

Monitoring during surgery included ECG, pulse oximetry, non-invasive BP measurement, and temperature tracking. The infant received glucose-containing warmed fluids. Normothermia and stable glucose and electrolyte levels were maintained throughout. Haemodynamic parameters remained within normal limits.

The surgical procedure involved ileal resection and stoma formation, with minimal blood loss. The infant remained intubated after surgery and was successfully extubated on the 12th postoperative day. No anaesthesia-related complications were observed.

DISCUSSION

In this case, the decision to use TIVA over volatile anaesthetic agents was guided by the infant's extreme prematurity, ELBW, and physiologic vulnerability. Inhaled agents are known to depress myocardial contractility and reduce systemic vascular resistance, which can precipitate profound hypotension in neonates with immature cardiovascular systems and minimal compensatory capacity.³ Therefore, a TIVA strategy was employed to optimise intraoperative haemodynamic stability.

Ketamine was included in the anaesthetic regimen due to its well-established sympathomimetic effects, which support systemic vascular tone and cardiac output in preterm neonates with compromised haemodynamic reserve.⁶ Propofol served as the primary hypnotic agent and was administered *via* a carefully titrated continuous infusion, thereby avoiding the abrupt haemodynamic shifts associated with bolus administration.⁷ The adjunct use of fentanyl provided effective analgesia and reduced the required dose of propofol, further minimising cardiovascular depression. Together, this combination allowed for stable haemodynamic conditions throughout the procedure.

Intraoperative management also emphasised the meticulous maintenance of normothermia and euglycaemia, both of which are critical in neonates undergoing surgery. Hypothermia, defined as a core temperature <36 °C, affects up to 83% of neonates in the operating theatre and is associated with an increased risk of infection, coagulopathy, prolonged mechanical

ventilation, and extended intensive care stay.⁸ Likewise, hypoglycaemia is a frequent perioperative complication in ELBW infants due to their limited glycogen reserves and underdeveloped gluconeogenic pathways. In accordance with European and American Academy of Paediatrics (AAP) guidelines, warmed isotonic fluids containing 1-2.5% dextrose were administered, and temperature and glucose levels were continuously monitored.⁹

The postoperative course was uncomplicated, and the infant was successfully extubated on postoperative day 12 with no anaesthesia-related morbidity. This case demonstrates that a carefully planned and executed TIVA protocol, incorporating agent selection, dose titration, and comprehensive physiological support, can yield favourable outcomes in extremely preterm neonates. When applied in the context of multidisciplinary care and vigilant monitoring, TIVA represents a viable and potentially superior alternative to inhalational anaesthesia in this highly fragile population.

PATIENT'S CONSENT:

Informed consent was taken from the patient's guardian for publication of the case details.

COMPETING INTEREST:

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

EY: Study concept and design, anaesthesia management, and editing of the manuscript.

BK: Perioperative care, literature review, and drafting of the manuscript.

Both authors approved the final version of the manuscript to be published.

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