Perioperative Anesthetic Management of Left Hepatectomy in a 15-Month-Old Child with Hepatoblastoma: A Case Report

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ABSTRACT
A 15-month-old, 9.5-kg male child with hepatoblastoma was scheduled for elective left hepatectomy after five cycles of cisplatin–Adriamycin chemotherapy. He had abdominal distension and irritability but no other comorbidities, with age-appropriate development and normal liver function and coagulation parameters. The COPUR airway assessment score was 5–7. After placement of a thoracic epidural catheter, general anesthesia was induced with ketamine and suxamethonium following IV premedication with glycopyrrolate, midazolam, and fentanyl. The trachea was intubated with a 5.0-mm uncuffed endotracheal tube, and anesthesia was maintained with oxygen, nitrous oxide, isoflurane, and atracurium. Invasive monitoring included a right radial arterial line and a left internal jugular central venous catheter, and a urinary catheter was inserted. Pressure-controlled ventilation (tidal volume 8 mL/kg, PEEP 4 cmH_2O, FiO_2 0.5) was used. Two intraoperative arterial blood gases remained acceptable, with mild metabolic acidosis corrected using sodium bicarbonate. The estimated blood loss during left hepatectomy was about 400 mL. Intraoperative fluids included 500 mL normal saline and balanced crystalloid (Kabi Lyte), with transfusion of 130 mL packed red blood cells and 90 mL fresh frozen plasma (total input 1200 mL, urine output 200 mL). Hemodynamics were stable throughout. Thoracic epidural analgesia was provided with 0.25% bupivacaine intraoperatively and epidural buprenorphine boluses postoperatively, supplemented with intravenous paracetamol. Neuromuscular blockade was reversed with neostigmine 0.5 mg and glycopyrrolate 0.08 mg IV. The child was extubated uneventfully and transferred to the pediatric intensive care unit, with an uncomplicated postoperative course and no adverse events.
Conclusion: Major hepatic resection in an infant after cisplatin–adriamycin chemotherapy can be performed safely with thorough preoperative assessment, invasive monitoring, judicious fluid and blood product administration, and thoracic epidural analgesia. Combined general and neuraxial anesthesia contributed to stable hemodynamics and smooth recovery.
Keywords: Hepatoblastoma; hepatectomy; pediatric anesthesia; infant; thoracic epidural; invasive monitoring; chemotherapy.
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Introduction
Hepatoblastoma is the most common primary malignant liver tumor in early childhood and typically presents within the first three years of life [1, 2]. Management often includes neoadjuvant chemotherapy followed by partial hepatectomy or liver transplantation, depending on tumor stage and resectability [2, 3]. Cisplatin and Adriamycin are widely used in standard protocols and are associated with potential cardiotoxic, nephrotoxic, and ototoxic effects that are relevant to anesthetic care [2].
Major hepatectomy in infants is associated with a risk of significant blood loss, coagulopathy, hypothermia, and postoperative hepatic dysfunction in the setting of small circulating blood volume and limited physiological reserve [4, 5]. Anesthetic goals include maintaining adequate perfusion and oxygen delivery while avoiding fluid overload and excessive venous congestion, ensuring effective analgesia, and preventing metabolic derangements [4, 6]. This case report describes the perioperative anesthetic management of a 15-month-old child undergoing left hepatectomy for hepatoblastoma after cisplatin–adriamycin chemotherapy, with emphasis on invasive monitoring, fluid and blood management, and thoracic epidural analgesia

Case Presentation
A 15-month-old male child weighing 9.5 kg was scheduled for elective left hepatectomy for hepatoblastoma. He was born preterm by lower segment caesarean section with a birth weight of 3.5 kg and did not require neonatal intensive care. His developmental milestones and immunizations were appropriate for age, and there was no history of recurrent respiratory infections or other chronic illness. He had been well a few weeks prior and then developed progressive abdominal distension, irritability, and abdominal pain over about two weeks. Evaluation revealed a hepatic mass consistent with hepatoblastoma [1, 2]. He received five cycles of cisplatin–adriamycin chemotherapy via a chemoport. No clinically evident cardiotoxicity, nephrotoxicity, or severe myelosuppression was documented during chemotherapy [2].
The chemoport was later removed and a left hepatectomy was planned as definitive surgical management. At pre-anesthetic evaluation, the child was irritable but consolable, with visible abdominal distension. There was no history of jaundice, vomiting, respiratory difficulty, bleeding tendencies, or altered consciousness. Airway evaluation did not suggest difficulty. The COPUR airway assessment score was 5–7. Mouth opening and neck movements were acceptable for age. Cardiovascular examination revealed normal

heart sounds without murmurs. Respiratory examination showed equal bilateral air entry with no added sounds. There were no clinical signs of heart failure. Despite prior exposure to Adriamycin, there were no symptoms or signs of cardiac dysfunction, and echocardiography was not performed.

Baseline laboratory findings were: Haemoglobin 11.3 g/dL, total leukocyte count 13.2 × 10⁹/L, platelet count 219,000/µL, total bilirubin 0.46 mg/dL, direct bilirubin 0.2 mg/dL, and INR 1.07. Serum sodium was 133 mEq/L and potassium 4.3 mEq/L. Liver enzymes and renal function tests were within normal limits as per the treating team. Alpha-fetoprotein was 94.1. There was no biochemical evidence of coagulopathy or significant hepatic dysfunction. The child was classified as ASA physical status I.

The anesthetic plan included general anesthesia with invasive arterial monitoring, central venous access, thoracic epidural analgesia, pressure-controlled ventilation, and cautious fluid and blood product administration [4, 6]. In the operating room, continuous electrocardiography, pulse oximetry, and capnography were established. A 22G peripheral intravenous cannula was in place. Premedication consisted of intravenous glycopyrrolate 0.04 mg, midazolam 0.5 mg, and fentanyl 20 µg. Anesthesia was induced with ketamine 20 mg IV. Neuromuscular relaxation for tracheal intubation was achieved with suxamethonium 20 mg IV. The trachea was intubated without difficulty using a 5.0-mm internal diameter uncuffed endotracheal tube, bilateral air entry was confirmed and the tube secured. Under aseptic precautions, a thoracic epidural catheter was placed using an 18G Tuohy needle, with the epidural space identified by the loss-of-resistance technique. A test dose of 1 mL of 2% lignocaine with adrenaline was administered. The catheter was advanced and fixed with 5 cm at the skin. A 22G arterial catheter was placed in the right radial artery for invasive blood pressure monitoring and arterial blood sampling [8]. A 4.5-Fr triple-lumen central venous catheter was inserted into the left internal jugular vein. A urinary catheter was placed for continuous urine output monitoring.

Anesthesia was maintained with a mixture of oxygen and nitrous oxide (FiO_2 0.5) and isoflurane. Neuromuscular blockade was maintained with atracurium in intermittent doses according to surgical requirements. Ventilation was set in pressure-controlled mode, targeting a tidal volume of approximately 8 mL/kg with a PEEP of 4 cmH_2O, and end-tidal CO_2 was maintained within the normal pediatric range [6].

Active warming measures were instituted, including forced-air warming and warmed intravenous fluids [4]. The thoracic epidural catheter was activated intraoperatively with 5 mL of 0.25% bupivacaine, followed later by an additional bolus of 2 mL of 0.25% bupivacaine to maintain analgesia. This provided effective intraoperative pain control and contributed to hemodynamic stability. Dynamic indices such as pulse pressure variation (PPV) were utilized to guide fluid management [11]. Two arterial blood gas analyses were performed during surgery and were within acceptable limits. Mild metabolic acidosis detected on one sample was corrected with 100 mg sodium bicarbonate administered intravenously. No significant electrolyte disturbances were observed. Normothermia was maintained throughout the procedure with active warming. The child underwent left hepatectomy. The estimated blood loss was approximately 400 mL. Intraoperative fluid therapy included 500 mL of normal saline and Kabi Lyte (balanced crystalloid), with total fluid input of 1200 mL [8]. Blood product transfusion consisted of 130 mL packed red blood cells and 90 mL fresh frozen plasma. Urine output was 200 mL. Invasive arterial pressure and heart rate remained stable throughout the procedure, with no clinically significant episodes of hypotension, bradycardia, arrhythmia, or desaturation. There were no complications related to vascular access or the thoracic epidural catheter. No massive transfusion, air embolism, or coagulopathy occurred. At the end of surgery, neuromuscular blockade was antagonized with intravenous neostigmine 0.5 mg and glycopyrrolate 0.08 mg. After adequate return of spontaneous respiratory efforts and protective airway reflexes, the child was fully awake with stable hemodynamics. Tracheal extubation was performed in the operating room and was uneventful, without desaturation, laryngospasm, or airway obstruction. He was transferred to the pediatric intensive care unit for postoperative monitoring.

In the PICU, the child remained hemodynamically stable with satisfactory oxygenation. Analgesia was provided via the thoracic epidural catheter using 0.125 % Bupivacaine infusion, along with intravenous paracetamol 15 mg/kg at regular intervals as part of multimodal analgesia. Pain control was adequate, and there were no signs of respiratory depression or hemodynamic instability attributable to neuraxial opioids.

Discussion

Major hepatic resection in infants and young children is a high-risk procedure because of the potential for substantial blood loss, coagulopathy, hypothermia, and postoperative hepatic dysfunction in the context of small circulating volume and limited reserve [4, 5]. Prior chemotherapy with cisplatin and Adriamycin further raises concerns about renal function, myocardial function, and overall physiological resilience [2].

In this case, the child had normal preoperative liver function and coagulation profile, and no clinical evidence of cardiotoxicity or nephrotoxicity. Nonetheless, perioperative management was planned assuming a risk of hemodynamic instability and major blood loss. Invasive arterial pressure monitoring and central venous access were used to permit continuous

hemodynamic assessment [8]. Dynamic indices such as pulse pressure variation (PPV) were employed to guide goal-directed fluid therapy to maintain PPV within an optimal range (10- 14%) to assess fluid responsiveness [11]. Serial arterial blood gases allowed prompt identification and correction of mild metabolic acidosis. Pressure-controlled ventilation with moderate PEEP and appropriate tidal volume ensured adequate gas exchange while limiting peak airway pressures, an important consideration in small children to preserve venous return and minimize barotrauma [6, 10].

Active warming strategies effectively prevented hypothermia, which is a known contributor to coagulopathy and metabolic disturbance during major abdominal surgery in infants [4]. Neuraxial techniques play an important role in upper abdominal surgery. Thoracic epidural analgesia in this child provided excellent intraoperative and postoperative pain control using local anesthetic intraoperatively and epidural buprenorphine postoperatively, supplemented by intravenous paracetamol. Effective analgesia likely contributed to stable intraoperative hemodynamics and allowed safe on-table extubation, with a smooth postoperative course [7].

The absence of complications in this case highlights that, with detailed preoperative evaluation, invasive monitoring, judicious fluid and blood product administration, and appropriate regional analgesia, major hepatectomy can be safely performed even in very young children who have received multi-agent chemotherapy.

Conclusion

Major hepatectomy for hepatoblastoma in infants presents significant anesthetic challenges, including the risk of major blood loss, coagulopathy, hypothermia, and postoperative hepatic dysfunction, compounded by prior chemotherapy. In this 15-month-old child, a combination of careful preoperative assessment, invasive arterial and central venous monitoring, pressure-controlled ventilation, goal-directed fluid and blood product therapy, and thoracic epidural analgesia permitted stable intraoperative hemodynamics, uneventful extubation, and smooth postoperative recovery without complications. This case supports the feasibility of safe major hepatic resection in infants after cisplatin–adriamycin chemotherapy when managed in a structured, multidisciplinary manner.

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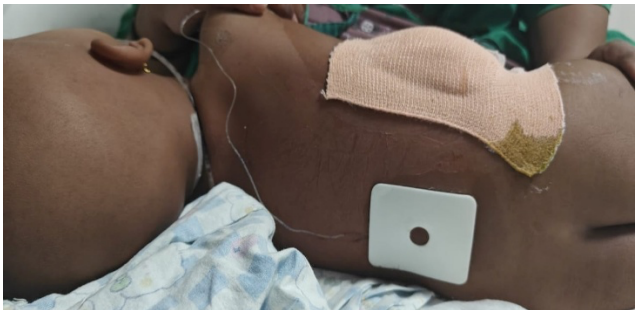

Fig.1: A thoracic epidural catheter was placed and secured appropriately

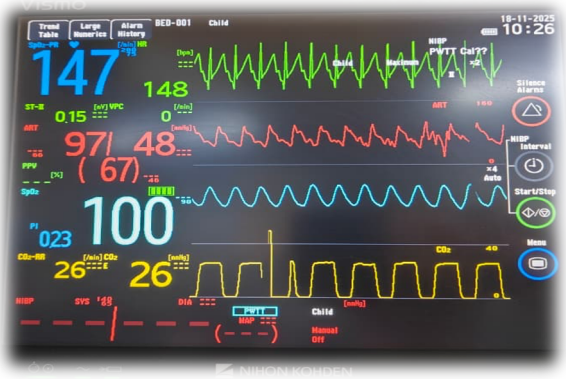

Fig. 2: Intraoperative monitor showing stable vital parameters

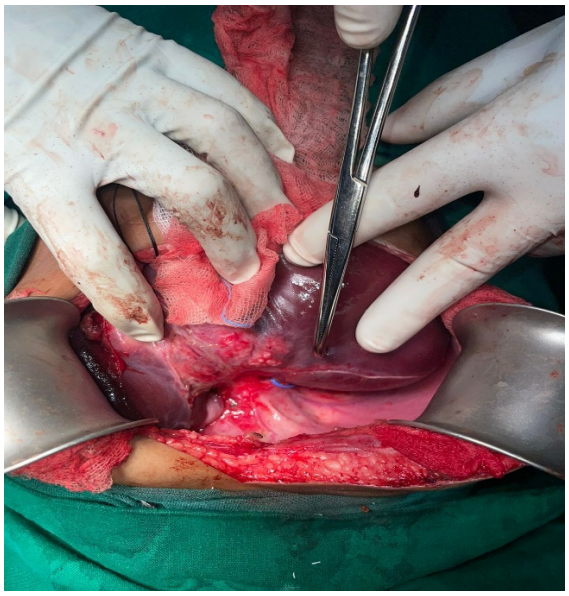

Fig. 3: Surgeon performing Hepatectomy