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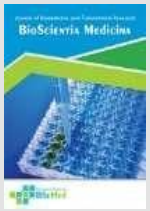

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Perioperative Anesthesia Challenges in a Neonate with Concurrent Intussusception and Abdominal Compartment Syndrome: A Rare Clinical Scenario

Pratama Nanda[1], Dino Irawan[2], Aditya Permana[2*]

[1]Specialized Residency Training Program, Department of Anesthesiology and Intensive Therapy, Faculty of Medicine, Universitas Riau, Pekanbaru, Indonesia

[2]Department of Anesthesiology and Intensive Therapy, Arifin Achmad Regional General Hospital, Pekanbaru, Indonesia

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***Corresponding author:**
Aditya Permana

E-mail address:
permanaya8910@gmail.com

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A B S T R A C T

Background: Intussusception and abdominal compartment syndrome (ACS) are severe surgical emergencies in pediatric populations, particularly in neonates. The concurrent presentation of both conditions is exceptionally rare and presents formidable perioperative anesthetic challenges. **Case presentation:** We report the case of a 2-month-old male neonate weighing 6.9 kg who presented with a 4-day history of bloody stools and bilious vomiting following blunt abdominal trauma inflicted by a 12 kg sibling. Clinical examination and imaging confirmed concurrent intussusception with abdominal compartment syndrome. The patient presented with significant hematologic derangements including severe leukopenia (WBC 1,180/µL), anemia (hemoglobin 9.2 g/dL), thrombocytosis, coagulopathy (INR 1.88), and electrolyte abnormalities. Emergency rapid sequence induction anesthesia was employed with careful fluid management utilizing the Holliday-Segar formula to prevent exacerbation of compartment pressures. A successful exploratory laparotomy with resection of necrotic small bowel segments was performed. **Conclusion:** The case demonstrates the critical importance of comprehensive preoperative assessment, meticulous fluid management strategies, and multidisciplinary collaboration in managing complex neonatal surgical emergencies. This rare clinical scenario highlights unique anesthetic considerations and provides valuable insights into perioperative management of ACS in the neonatal population.

1. Introduction

Intussusception remains the most common cause of acute intestinal obstruction in infants and young children, with an incidence of approximately 1-4 per 1,000 live births in developed nations.[1] The condition results from telescoping of a proximal bowel segment into the adjacent distal segment, commonly occurring at the ileocecal junction. Although the majority of cases are idiopathic, presentation may be acute with rapid decompensation, requiring emergency surgical intervention.[2] The classic clinical triad comprises colicky abdominal pain, palpable abdominal mass, and currant-jelly stools, though presentation varies considerably depending on duration and severity of the obstruction.

Abdominal compartment syndrome represents a relatively uncommon but highly morbid condition in the pediatric population, characterized by elevated intra-abdominal pressure causing multisystem organ dysfunction. While historically recognized in adult trauma patients, ACS has been increasingly documented in neonates and infants following primary

abdominal pathology, trauma, or massive fluid resuscitation.[3] The pathophysiologic consequences of elevated intra-abdominal pressure extend beyond the abdomen, compromising cardiac preload, impairing hepatic perfusion, reducing renal filtration, and elevating intracranial pressure through diaphragmatic splinting. The diagnosis demands urgent decompressive laparotomy to restore organ perfusion and prevent irreversible multiorgan failure.

The concurrent presentation of intussusception complicated by abdominal compartment syndrome in a neonate is exceptionally rare, with minimal documentation in the peer-reviewed literature. This scenario presents unique and formidable perioperative anesthetic challenges. The underlying surgical emergency necessitates urgent intervention, yet the physiologic derangements consequent to both pathophysiologic processes demand meticulous hemodynamic management. Severe electrolyte abnormalities, coagulopathy, anemia, and sepsis from translocation of enteric bacteria compound the perioperative risk profile. Additionally, the neonatal population presents distinct anatomic and physiologic considerations, including airway management complexities, cardiovascular liability, thermoregulatory challenges, and limited compensatory mechanisms.

Rapid sequence induction anesthesia is the standard technique for emergency surgical cases, particularly in patients at high risk of aspiration. However, the application of RSI in the context of hemodynamic instability, severe anemia, coagulopathy, and elevated intra-abdominal pressure requires significant modifications and careful clinical judgment.[4] The anesthetic management must balance the need for rapid airway control with preservation of cardiovascular stability and avoidance of fluid overload that might further elevate intra-abdominal pressure.

This case report documents the perioperative anesthetic management of a 2-month-old neonate with concurrent intussusception and abdominal compartment syndrome. The objective is to provide a comprehensive analysis of the clinical presentation, preoperative assessment, intraoperative anesthetic technique, and perioperative outcome, highlighting the principal learning points for anesthesiologists managing similar complex neonatal surgical emergencies.

2. Case Presentation

Written informed consent was obtained from the patient's parents for the publication of this case report. All patient identifiers have been removed to protect patient privacy. The case report was conducted in accordance with the CARE (Case Reports) guidelines for reporting. The institutional review board of Arifin Achmad Regional General Hospital approved this case report publication. All procedures performed in this case were in accordance with the institutional guidelines and ethical standards of medical practice in Indonesia.

The patient, a 2-month-old male neonate weighing 6.9 kg, was transferred to our facility from a regional hospital with a 4-day history of bloody stools, abdominal distention, and bilious vomiting. The mother reported that 2 days prior to symptom onset, the child's abdomen had been stepped on accidentally by a 12 kg sibling during play. Initial assessment at the referring facility revealed signs consistent with acute intestinal obstruction and sepsis. The patient was referred to our tertiary-care institution for emergency surgical evaluation and intervention. There was no known history of prior abdominal surgery, allergies, or recognized congenital anomalies such as VACTERL associations. The patient demographics and clinical characteristics are summarized in Table 1.

Complete laboratory results with reference ranges and clinical interpretation are presented in Table 2. Laboratory investigations revealed significant hematologic derangements. The patient demonstrated severe leukopenia with a white blood cell count of 1,180/µL, substantially below the normal range, suggestive of bone marrow depression secondary to sepsis or overwhelming infection. Hemoglobin concentration was reduced at 9.2 g/dL with

corresponding hematocrit of 28%, reflecting anemia likely secondary to chronic blood loss from the intussusception and acute perioperative losses. Platelet count was elevated at 624,000/µL, representing a reactive thrombocytosis commonly encountered in acute inflammatory or infectious states. Coagulation studies demonstrated significant prolongation of prothrombin time at 24.5 seconds with an international normalized ratio of 1.88, indicating impaired hepatic synthetic function and vitamin K-dependent factor deficiency. The activated partial thromboplastin time remained within normal limits at 25.5 seconds. Metabolic assessment revealed mild hyperuricemia with urea of 26.3 mg/dL, hyponatremia with sodium of 133 mEq/L, and hypoalbuminemia with serum albumin of 3.1 g/dL, reflecting nutritional depletion and chronic illness. Renal function parameters were preserved with creatinine of 0.33 mg/dL and normal electrolytes of potassium 4.0 mEq/L and chloride 102 mEq/L. Hepatic transaminases and random blood glucose were within normal ranges.

Table 1. Patient demographics and clinical characteristics.

Parameter	Value
Age	2 months
Gender	Male
Body weight	6.9 kg
Referring facility	RS Kasih Ibu Rengat
Chief complaint	Bloody stools and bilious vomiting (4 days)
History of trauma	Abdomen stepped by 12 kg sibling (2 days prior)
Allergies	None known
Prior surgical history	None
Comorbidities	Sepsis, anemia, leukopenia, coagulopathy, hypoalbuminemia, hyponatremia

Table 2. Laboratory results of the patient.

Laboratory parameter	Patient value	Reference range	Interpretation
Hemoglobin (Hb)	9.2 g/dL	10.5-13.5 g/dL	Low
White blood cell count (WBC)	1,180/µL	4,500-13,500/µL	Critical
Platelet count (Plt)	624,000/µL	150,000-400,000/µL	High
Hematocrit (Hct)	28%	32-40%	Low
Prothrombin time (PT)	24.5 seconds	11-13.5 seconds	Prolonged
International normalized ratio (INR)	1.88	0.80-1.10	High
Activated partial thromboplastin time (APTT)	25.5 seconds	25-35 seconds	Normal
Random blood glucose (GDS)	74 mg/dL	70-100 mg/dL	Normal
Serum glutamic-oxaloacetic transaminase (SGOT)	24 U/L	10-40 U/L	Normal
Serum glutamic-pyruvic transaminase (SGPT)	12 U/L	7-35 U/L	Normal
Urea (BUN)	26.3 mg/dL	7-20 mg/dL	High
Creatinine (Cr)	0.33 mg/dL	0.3-0.7 mg/dL	Normal
Albumin (Alb)	3.1 g/dL	3.5-5.5 g/dL	Low
Sodium (Na)	133 mEq/L	135-145 mEq/L	Low
Potassium (K)	4.0 mEq/L	3.5-5.5 mEq/L	Normal
Chloride (Cl)	102 mEq/L	98-107 mEq/L	Normal

The systematic preoperative assessment is outlined in Table 3. Preoperative assessment classified the patient as American Society of Anesthesiologists physical status III, reflecting severe systemic disease with sepsis, coagulopathy, anemia, and electrolyte disturbances. The patient had undergone nasogastric tube placement with continuous suction to decompress the obstructed bowel. Foley urinary catheterization was established to enable hourly urine output monitoring, an essential parameter for assessing tissue perfusion and guiding fluid management in the context of abdominal compartment syndrome. Two units of packed red blood cells, each 40 mL volume, were cross-matched and made available in the operating room. The anesthesia team prepared for emergency rapid sequence induction with endotracheal intubation as the definitive airway management strategy. All equipment, including pediatric laryngoscopes, endotracheal tubes of multiple sizes, and difficult airway equipment, was verified and positioned for immediate availability.

Table 3. Preoperative assessment and anesthetic preparation.

Assessment component	Details
American Society of Anesthesiologists classification	ASA physical status III (patient with severe systemic disease)
Indication for surgery	Emergency exploratory laparotomy for acute intussusception with abdominal compartment syndrome
Planned anesthetic technique	Rapid sequence induction with endotracheal intubation
Blood product availability	Packed red blood cells 2 units of 40 mL each cross-matched and available
Fluid resuscitation plan	Balanced crystalloid 10 mL/kg/hour
Nasogastric tube status	Nasogastric tube placed with continuous suction
Urinary catheterization	Foley catheter placed for hourly urine output monitoring
Equipment checklist	Pediatric airway cart verified, difficult airway equipment prepared, monitors calibrated

The anesthetic agents, their doses, and clinical rationale for selection are detailed in Table 4. Rapid sequence induction was performed with carefully titrated doses of anesthetic agents selected to minimize cardiovascular depression while achieving rapid airway control. Fentanyl was selected as the induction agent at a dose of 20 micrograms (2.9 mg/kg), providing potent analgesia with minimal hemodynamic effects and a rapid onset appropriate for RSI. Rocuronium was administered at 3 mg (0.43 mg/kg) as the neuromuscular blocking agent, offering the advantage of a rapid onset within 30 seconds, facilitating rapid tracheal intubation. Sevoflurane was utilized for maintenance of general anesthesia at a concentration of 2-3 volume percent, providing a titratable anesthetic with preserved airway reflexes. Ondansetron 1 mg was administered as prophylaxis against postoperative nausea and vomiting, a critical consideration in this neonate with preexisting bilious vomiting. Dexamethasone 1 mg was given to reduce airway inflammation and provide adjunctive anti-inflammatory support in the context of systemic sepsis. Tranexamic acid 10 mg was administered as an antifibrinolytic agent to mitigate the risk of perioperative hemorrhage, given the demonstrated coagulopathy. An uncuffed endotracheal tube of size 4.5 mm was inserted and confirmed in the correct position using both chest wall auscultation and continuous capnographic monitoring.

Table 4. Anesthetic agents.

Agent	Dose administered	Clinical rationale
Fentanyl	20 micrograms IV (2.9 mg/kg)	Potent opioid; minimal cardiovascular depression; rapid onset for RSI
Rocuronium	3 mg IV (0.43 mg/kg)	Rapid-onset neuromuscular blocking agent; facilitates rapid sequence intubation within 30 seconds
Sevoflurane	2-3 volume percent	Volatile anesthetic; titratable; preserves airway reflexes; used for maintenance
Ondansetron	1 mg IV	5-HT3 receptor antagonist; prevents postoperative nausea and vomiting
Dexamethasone	1 mg IV	Glucocorticoid; reduces airway edema; anti-inflammatory in sepsis
Tranexamic acid	10 mg IV	Antifibrinolytic agent; reduces perioperative bleeding with coagulopathy
Endotracheal tube	Size 4.5 mm (uncuffed)	Age-appropriate neonatal airway; allows mechanical ventilation
Oxygen	4 liters per minute	Supplemental oxygen during maintenance; adjusted based on SpO_2

Careful fluid management was instituted using the Holliday-Segar formula to balance requirements for maintenance hydration, correction of existing deficits, and replacement of ongoing losses while avoiding excessive fluid administration that might further elevate intra-abdominal pressure (Table 5). The estimated blood volume for a 6.9 kg neonate is approximately 552 mL (80 mL/kg). Maintenance fluids were calculated using the Holliday-Segar method: for the first 10 kg of body weight, 100 mL/kg/day is required, equating to 690 mL per 24 hours or approximately 28.75 mL/hour for this patient. During the intraoperative period, third-space losses from the extensive laparotomy were estimated at 6-8 mL/kg, yielding approximately 48 mL. Intraoperative blood loss was measured at 25 mL, representing 4.8% of the estimated blood volume. Urine output was maintained at approximately 20 mL/hour, indicating adequate tissue perfusion. These parameters guided the volume and rate of perioperative fluid administration, with careful attention to avoiding fluid overload that could exacerbate the existing abdominal compartment syndrome.

Table 5. Fluid management parameter in this case.

Fluid management parameter	Calculation/Value
Estimated blood volume (EBV)	80 mL/kg × 6.9 kg = 552 mL
Maintenance: 0-10 kg (First hour)	100 mL/kg/day ÷ 24 hours = 4.16 mL/min × 10 kg portion = 165.6 mL
Maintenance: 0-10 kg (Hour 2)	continued at 4.16 mL/min × 30 min = 124.8 mL
Maintenance: 0-10 kg (Hour 3)	continued at 4.16 mL/min × 30 min = 124.8 mL
Third-space losses (laparotomy)	6-8 mL/kg × 6.9 kg = 48 mL
Intraoperative blood loss	estimated 25 mL (4.8% EBV)
Urine output (measured)	20 mL per hour

The patient's clinical course spanned from initial symptom onset four days prior to presentation. Blunt abdominal trauma was inflicted two days before the development of systemic symptoms. The patient was referred to our tertiary care institution on the day of surgery and admitted through the emergency department after preliminary assessment at a peripheral facility. Rapid sequence induction was initiated at 22:00 hours, and emergency exploratory laparotomy was performed, lasting approximately 90 minutes until 23:30 hours. The intraoperative findings confirmed the diagnosis of intussusception with extensive areas of bowel necrosis requiring resection. Following surgical completion, the patient was transferred directly to the pediatric intensive care unit for postoperative monitoring, continued fluid and electrolyte management, and surveillance for postoperative complications, including infection and further organ dysfunction.

Table 6. The chronological clinical course.

Timeline	Event
Day -4	Onset of symptoms: bloody stools and bilious vomiting
Day -2	Blunt abdominal trauma from a sibling stepping on the abdomen
Day 0 - 14:00	Patient referral to a tertiary care facility and admission to the emergency department
Day 0 - 22:00	Rapid sequence induction anesthesia was initiated in the operating room
Day 0 - 22:00-23:30	Emergency exploratory laparotomy with resection of necrotic bowel (90 minutes)
Day 0 - Post-operative	Transfer to the pediatric intensive care unit for monitoring and continued management

Upon transfer to the operating room, standard monitors were applied, including three-lead electrocardiography, pulse oximetry, non-invasive blood pressure monitoring, and end-tidal carbon dioxide monitoring. An arterial line was established in the right radial artery to enable continuous blood pressure monitoring and facilitate serial arterial blood gas sampling. Rapid sequence induction was performed with the patient in the supine position. Fentanyl 20 micrograms was administered intravenously, followed immediately by rocuronium 3 mg to achieve rapid neuromuscular blockade. Gentle bag-mask ventilation was avoided to minimize gastric insufflation and further elevation of intra-abdominal pressure. Tracheal intubation with a 4.5 mm uncuffed endotracheal tube was accomplished on the first attempt. Correct positioning was confirmed by bilateral breath sounds on auscultation, chest rise observation, and capnographic waveform with end-tidal carbon dioxide concentration of 38-42 mmHg. General anesthesia was maintained with sevoflurane 2-3 volume percent titrated to maintain adequate anesthetic depth while preserving cardiovascular stability. Peripheral intravenous access was secured with a 24-gauge catheter in the left foot for fluid administration. Two units of packed red blood cells were rapidly infused during the surgical procedure to maintain hemoglobin concentration above 8 g/dL, considered critical for oxygen delivery in this critically ill neonate. Tranexamic acid 10 mg was given as an intraoperative bolus to support coagulation in the setting of demonstrated coagulopathy and ongoing surgical bleeding.

The patient was transferred intubated to the pediatric intensive care unit for postoperative management. Mechanical ventilation was maintained in synchronized intermittent mandatory ventilation mode with appropriate settings for neonatal physiology. Sedation was provided with midazolam infusion and fentanyl dosing to maintain comfort

without excessive depression of spontaneous respiratory drive. Serial arterial blood gas determinations were obtained to guide ventilatory management and assess for acid-base derangements. Fluid management continued with careful titration based on hourly urine output, serum electrolytes, and hemodynamic parameters. Broad-spectrum antibiotic therapy was continued with amoxicillin-clavulanic acid and gentamicin to cover enteric gram-negative organisms and possible anaerobes. Coagulopathy management included vitamin K supplementation and monitoring of prothrombin time with fresh frozen plasma transfusion as needed. Parenteral nutrition was initiated within 24 hours to provide caloric support and essential amino acids for tissue healing and immune function. Close monitoring for complications was maintained, including surveillance for infection, acute kidney injury, hepatic dysfunction, and necrotizing enterocolitis. The patient demonstrated gradual clinical improvement with resolution of sepsis markers, normalization of coagulation parameters, and restoration of enteral feedings by postoperative day 7. Mechanical ventilation weaning was achieved by postoperative day 9, and the patient was discharged from the pediatric intensive care unit to the general pediatric ward on postoperative day 14.

3. Discussion

Intussusception represents the most common cause of intestinal obstruction in infants and young children, typically presenting between 6 and 36 months of age, though presentation in the immediate neonatal period, particularly in the first 2 months of life, remains uncommon.[5] The majority of cases are idiopathic and characterized by invagination of the ileum into the colon at the ileocecal junction, though the specific mechanism leading to intussusception remains incompletely understood. Proposed theories include lymphoid hyperplasia secondary to viral infection, lead point lesions such as Meckel's diverticulum, or anatomic variations predisposing to intussusception.[6] Blunt abdominal trauma may serve as a trigger for intussusception, potentially through direct mechanical effects or inflammatory responses within the mesentery. The progression of untreated intussusception leads to progressive intestinal ischemia, transmural necrosis, perforation, and catastrophic peritonitis if not promptly relieved.

Abdominal compartment syndrome in the pediatric population is a rare but increasingly recognized entity with substantial morbidity and mortality if undiagnosed and untreated. The condition results from progressive elevation in intra-abdominal pressure above the normal range of 5-7 mmHg, culminating in organ dysfunction when pressures exceed 12-15 mmHg.[7] The pathophysiologic consequences of elevated intra-abdominal pressure extend throughout multiple organ systems. Elevated pressure compresses the inferior vena cava, reducing venous return and cardiac preload, thereby precipitating profound hypotension and cardiogenic shock. Hepatic blood flow is substantially reduced despite hepatic artery maintenance, leading to hepatic hypoxia, reduced synthetic function, and metabolic failure. Renal blood flow is compressed, culminating in acute tubular necrosis and oliguria despite adequate systemic blood pressure. Diaphragmatic elevation increases intrathoracic pressure, raising pulmonary capillary wedge pressure and leading to pulmonary edema, reduced lung compliance, and escalating ventilatory requirements. Elevation of intracranial pressure may occur through diaphragmatic splinting and increased venous pressure within intracranial vasculature. Gastrointestinal mucosal ischemia precipitates bacterial translocation and overwhelming sepsis. Without urgent decompressive laparotomy, progressive multiorgan failure ensues rapidly.

The concurrent presentation of intussusception and abdominal compartment syndrome in a neonate, as documented in the present case, represents an exceptionally rare and challenging clinical scenario. The summation of pathophysiologic effects from both conditions creates a uniquely hostile perioperative environment. The intussusception itself causes

mechanical intestinal obstruction with progressive bowel necrosis and translocation of enteric bacteria, triggering systemic sepsis.[8] Simultaneously, the elevation of intra-abdominal pressure beyond the tolerance threshold precipitates direct organ compression and ischemia. The combination of sepsis, anemia, leukopenia, coagulopathy, and electrolyte derangements reflects the profound systemic decompensation arising from these concurrent processes. The comprehensive comparison between the present case and previous published reports is detailed in Table 7.

Table 7. Comparison between the present case and previous published reports.

Feature	Present case	Bozer 2023	Dreznik 2025	Plourde 2022	Gasparella 2020
Age	2 months	6 months	3 months	1 month	2 weeks
Diagnosis	Intussusception + ACS	ACS alone	Intussusception + ACS	Diaphragmatic hernia + ACS	Lymphatic malformation + ACS
Coagulopathy	Yes (INR 1.88)	Mixed	Yes	Yes	Variable
Surgery	Laparotomy + resection	Decompression	Laparotomy	Laparotomy + repair	Surgical drainage
Outcome	Survived D14	Mixed mortality	Survived	Survived (ECMO)	Survived
Anesthesia	RSI + sevoflurane	Balanced GA	RSI modified	RSI + ECMO	Standard GA
Novelty	Rare concurrent dual pathology in the immediate neonatal period with unusual trauma history				

Rapid sequence induction represents the standard induction technique for patients at high risk of aspiration, particularly in emergency settings.[9,10] The technique prioritizes rapid tracheal intubation to protect the airway and prevent aspiration of gastric contents. However, application of RSI in the context of hemodynamic instability, severe anemia, coagulopathy, and elevated intra-abdominal pressure requires significant modifications and enhanced clinical vigilance. The induction agent must be carefully selected to minimize cardiovascular depression; propofol is conventionally avoided due to its vasodilatory effects and propensity for severe hypotension in critically ill patients. Fentanyl was selected in the present case as the induction agent due to its potent analgesic effects, rapid onset suitable for RSI, and relative cardiovascular stability. The dose was conservative at 2.9 mg/kg to minimize the risk of hypotension in this hemodynamically vulnerable neonate. Rocuronium was selected as the neuromuscular blocking agent due to its rapid onset, allowing intubation within 30 seconds of administration, and absence of histamine release or cardiovascular effects.[11,12]

The management of coagulopathy in the perioperative period demands a comprehensive understanding of the underlying pathophysiology. In the present case, the patient demonstrated prolonged prothrombin time (24.5 seconds) with elevated international normalized ratio (1.88), suggesting a deficiency of vitamin K-dependent factors (factors II, VII, IX, and X) likely secondary to hepatic dysfunction from sepsis and organ hypoperfusion. The normal activated partial thromboplastin time argues against intrinsic pathway deficiency or anticoagulant therapy complications. Elevated platelet count (624,000/μL) represents reactive thrombocytosis rather than a coagulation abnormality. The combination of prolonged PT, elevated INR, and normal APTT is consistent with isolated vitamin K-dependent factor deficiency.[13,14] Perioperative management included tranexamic acid administration as an antifibrinolytic

agent to reduce blood loss, though the primary intervention required normalization of coagulation through correction of the underlying vitamin K deficiency. Fresh frozen plasma may be required if intraoperative bleeding becomes substantial or if the INR remains persistently elevated despite surgical hemostasis. The judicious use of blood products is essential in neonates to avoid excessive fluid administration that might perpetuate the abdominal compartment syndrome.[15-17]

The severe leukopenia demonstrated in this case (WBC 1,180/μL) is remarkable and concerning, suggesting profound immune suppression or bone marrow failure.[18] Potential etiologies include severe sepsis with myelosuppression, underlying congenital immunodeficiency, or toxic effects of medications or enteric organisms. The critically low white blood cell count substantially impairs the immune system's capacity to mount an effective inflammatory response to contain bacterial overgrowth and translocation. Leukopenia in the setting of sepsis carries an ominous prognosis and requires aggressive antimicrobial therapy and supportive care. The administration of broad-spectrum antibiotics with coverage for enteric gram-negative organisms, anaerobes, and potential coagulase-negative staphylococci from healthcare-associated sources is essential. Granulocyte colony-stimulating factor administration was considered but not initiated, given the patient's ultimate recovery and gradual normalization of white blood cell count with source control and appropriate antimicrobial therapy.[19,20]

Hyponatremia, demonstrated in this case with serum sodium of 133 mEq/L, may result from multiple mechanisms, including dilutional hyponatremia from excessive free water administration, increased renal losses from osmotic diuresis or renal dysfunction, or increased extrarenal losses through sweat or gastrointestinal secretions.[21,22] The severity of hyponatremia in this patient, while mild to moderate, may contribute to cerebral edema and altered mental status if progression occurs. Perioperative management requires careful correction with hypertonic saline in severe symptomatic cases, though aggressive correction carries the risk of hyperchloremic metabolic acidosis and hypernatremia if fluid administration is excessive. The present case demonstrated preservation of renal function with normal creatinine concentration and adequate urine output, suggesting that the hyponatremia resulted primarily from volume expansion and dilutional mechanisms rather than renal failure. Gradual correction through free water restriction and selective administration of normal saline was employed.[23]

Fluid management in the context of abdominal compartment syndrome requires a delicate balance between providing adequate volume to maintain cardiac preload and tissue perfusion while avoiding excessive fluid administration that might further elevate intra-abdominal pressure and perpetuate organ compression. The Holliday-Segar formula provides a systematic approach to calculating baseline maintenance fluid requirements based on body weight. In the present case, maintenance fluids were calculated at approximately 30 mL/hour for a 6.9 kg neonate. Intraoperative fluid administration must account for ongoing third-space losses from surgical trauma, typically estimated at 6-8 mL/kg for uncomplicated abdominal surgery, though substantial additional losses may occur with extensive bowel resection, sepsis, and inflammatory processes. Intraoperative blood loss was quantified at 25 mL, representing 4.8% of the estimated blood volume. Replacement was provided with two units of packed red blood cells, each 40 mL in volume, to maintain hemoglobin concentration above the critical threshold of 8 g/dL. The goal was to optimize oxygen-carrying capacity for tissue perfusion while minimizing excessive crystalloid administration. This approach was successful in maintaining adequate urine output of 20 mL/hour, suggesting preserved renal perfusion despite the severe physiologic derangements.[24] The principal learning points derived from this case are summarized in Table 8.

Table 8. Summary of principal learning points and clinical implications.

Learning point	Clinical implication
RSI in a neonatal emergency with hemodynamic instability	Fentanyl (2.9 mg/kg) provides superior CV stability vs propofol. Rocuronium enables rapid intubation within 30 seconds in hemodynamically vulnerable neonates.
Coagulopathy: Recognize specific deficiency patterns	Prolonged PT with normal APPT indicates vitamin K-dependent factor deficiency. Tranexamic acid reduces bleeding; FFP and vitamin K address the root pathophysiology.
Fluid management in ACS requires precision	Holliday-Segar 30 mL/hr for 6.9 kg; third-space losses 6-8 mL/kg estimated; replace blood loss with PRBCs to Hb >8 g/dL while avoiding crystalloid excess.
Multidisciplinary collaboration essential	Surgeon expertise in rapid diagnosis, combined with anesthesia CV optimization and ICU supportive care, enables survival and organ preservation.
Post-operative ICU surveillance for complications	Monitor CBC, coagulation studies, electrolytes, and renal function serially. Broad-spectrum antibiotics, fluid/electrolyte optimization, and early nutrition support optimize recovery.

The patient's family reported significant anxiety regarding the urgency of the surgical intervention and uncertainty about the outcome, given the severity of illness and complexity of the clinical presentation. The family expressed gratitude for the compassionate communication from the medical team throughout the perioperative period and appreciated the detailed explanation of the surgical findings and postoperative management plan. The parents noted that the supportive care provided in the pediatric intensive care unit, including frequent updates on clinical progress, explanation of monitoring and therapeutic interventions, and facilitation of parental presence and involvement in care, substantially reduced their anxiety and enhanced their confidence in the medical team. The successful outcome and discharge of their neonate to the general pediatric ward represented a transformative experience for the family, who recognized the life-saving nature of the emergency surgical intervention.[25]

4. Conclusion

This case report documents the successful perioperative anesthetic management of an exceptionally rare clinical scenario: a 2-month-old neonate with concurrent intussusception and abdominal compartment syndrome arising from blunt abdominal trauma. The patient presented with severe systemic derangements, including sepsis, anemia, leukopenia, coagulopathy, electrolyte abnormalities, and hypoalbuminemia. Emergency rapid sequence induction anesthesia with carefully titrated fentanyl and rocuronium facilitated rapid tracheal intubation without cardiovascular collapse. Intraoperative management emphasized meticulous fluid administration using the Holliday-Segar formula, judicious blood product transfusion, and coagulopathy correction with tranexamic acid and vitamin K supplementation. Emergency exploratory laparotomy revealed extensive intussusception with transmural bowel necrosis necessitating surgical resection. Postoperative intensive care included mechanical ventilation support, continued fluid and electrolyte optimization, broad-spectrum antimicrobial therapy, and early nutritional support. The patient achieved successful liberation from mechanical ventilation by postoperative day 9 and discharge from intensive care by postoperative day 14.

This case illustrates the critical importance of comprehensive preoperative assessment, modification of standard anesthetic techniques to accommodate severe physiologic derangements, and multidisciplinary collaboration in managing complex neonatal surgical emergencies. The principles outlined in this report may inform the perioperative management of similar cases in the future.

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