Case Report

DOI: 10.7860/JCDR/2026/85935.24229

Complex Challenges in Perioperative Care of a Preterm Neonate with Perforated Appendix in an Incarcerated Inguinoscrotal Hernia: A Case Report

Anaesthesia Section

AGATHIYAN ANBARASU[1], ANAND KUPPUSAMY[2], N MOHAMMED ARSHAD[3]

ABSTRACT

Perioperative management of extremely preterm neonates is challenging because of their immature respiratory, cardiovascular and metabolic systems, which make them highly vulnerable to perioperative instability. Hereby, the authors report the perioperative management of a 22-day-old male neonate, born at 27 weeks of gestation with a birth weight of 1.225 kg, who presented with an incarcerated right inguinoscrotal hernia at a post-conceptional age of 30 weeks. His initial neonatal course was complicated by respiratory distress syndrome requiring mechanical ventilation and surfactant therapy, followed by Continuous Positive Airway Pressure (CPAP) and gradual weaning to room air. For herniotomy, the authors planned an individualised, opioid-free multimodal anaesthetic technique to minimise the risk of postoperative apnoea. Intraoperative management focused on maintaining stable oxygenation, normothermia, normoglycaemia and haemodynamic stability in a very preterm neonate with limited physiological reserve. Intraoperatively, the authors encountered a rare finding of a perforated appendix within the hernial sac (Amyand's hernia), for which appendectomy along with hernia repair was done. Ultrasound-guided caudal analgesia using bupivacaine provided effective perioperative analgesia and supported the opioid-sparing anaesthetic technique. Postoperatively, the neonate was electively ventilated in Synchronised Intermittent Mandatory Ventilation (SIMV) mode, then weaned to nasal CPAP and finally to room air without any apnoeic episodes or major complications. The present case highlights the importance of proper planning, multidisciplinary coordination and the use of opioid-free anaesthesia with ultrasound-guided regional techniques in extremely preterm neonates. It also strengthens the limited literature on perforated appendix inside an incarcerated inguinoscrotal hernia in neonatal population.

Keywords: Analgesia, Caudal, Extremely premature

CASE REPORT

A 22-day-old male neonate weighing 1.425 kg presented with a right inguinoscrotal swelling for one day. Antenatal history was significant with oligohydramnios detected in the third trimester; the first and second trimesters were uneventful. The baby was delivered by emergency lower segment caesarean section at 27 weeks of gestation in view of spontaneous preterm labour and oligohydramnios. At birth, neonate weighed 1.225 kg and had APGAR (Appearance, Pulse, Grimace, Activity, Respiration) scores of 7 and 8 at one and five minutes, respectively. He required immediate Neonatal Intensive Care Unit (NICU) admission for respiratory distress syndrome, for which neonate was intubated and ventilated with synchronised intermittent mandatory ventilation for four days, followed by CPAP until day 11 of life, and then weaned to room air. The neonate gained 200 g weight over 22 days under close NICU care and nutritional support.

On examination at presentation, the baby was alert, well-hydrated, with no signs of respiratory distress or cardiovascular compromise. Baselines vitals were: heart rate 168/minute, non-invasive blood pressure 54/32 mmHg (mean 39 mmHg), respiratory rate 51/min and SpO_2 94% on room air; capillary blood glucose was 88 mg/dL. Routine blood investigations were within normal limits (Haemoglobin 13.2 gram/decilitre, platelet count 4,32,100/microlitre, bleeding time two minutes, clotting time 5 minutes). Ultrasound abdomen and scrotum showed a right incarcerated inguinoscrotal hernia with a non-peristaltic bowel loop but preserved vascularity. Gentle manual reduction of the hernia was attempted but was unsuccessful, and the swelling remained tense and irreducible. In view of the risk of strangulation, right open herniotomy was planned. The baby was categorised under American Society of Anaesthesiologists (ASA) physical status III.

Anaesthetic Management

Neonate was kept nil per oral for four hours, and maintenance fluid with Isolyte-P (multiple electrolyte solution in 5% dextrose) was given at 6 mL/hr through an infusion pump. Standard monitoring with Electrocardiogram (ECG), non-invasive blood pressure, pulse oximetry and temperature were established during transfer and in the operating room. The operating room temperature was maintained between 35-37°C and Intravenous (i.v.) fluids were warmed to prevent hypothermia. Considering the anatomical features of a very preterm neonate (relatively larger head, narrow nasal passages, larger tongue and floppy epiglottis), a difficult airway cart including a video laryngoscope was kept ready. The neonate was preoxygenated with 100% oxygen via face mask [Table/Fig-1] and premedicated with i.v. atropine 0.015 mg and i.v. ondansetron 0.14 mg. An opioid-free multimodal anaesthetic technique was chosen to reduce the risk of postoperative apnoea. Induction was done with i.v. ketamine 4 mg followed by i.v. cisatracurium 0.2 mg to facilitate tracheal intubation. The trachea was intubated with an uncuffed 2.5 mm Internal Diameter (ID) endotracheal tube using a Miller 00 blade, and the tube was fixed at 7 cm at the lip.

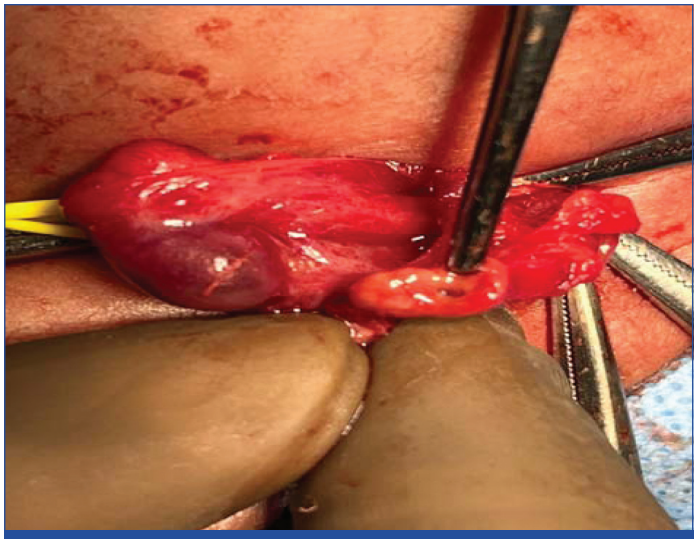
The baby was ventilated with pressure-controlled ventilation [Table/Fig-2] with peak inspiratory pressure of 10 cmH_2O, positive end expiratory pressure 2 cmH_2O, respiratory rate 40/minute and target tidal volume 7-8 millilitre, with FiO_2 0.5 in a 1:1 air/oxygen mixture. Anaesthesia was maintained with sevoflurane around 1%. Ventilation was adjusted to maintain SpO_2 88-92% and End-Tidal CO_2 ($ETCO_2$) 40-45 mmHg; nitrous oxide was avoided to prevent bowel distension.

[Table/Fig-1]: Preoxygenation in the operating room.

[Table/Fig-2]: Pressure-controlled ventilation intraoperatively.

Ultrasound-guided caudal block was given with 1 mL of 0.25% bupivacaine for intra and postoperative analgesia [Table/Fig-3]. Intraoperative fluids were continued at 6 mL/hr (Isolyte-P). Blood glucose and core temperature were monitored closely. Haemodynamics remained stable with heart rate 160-180/min, $ETCO_2$ 40-45 mmHg and temperature around 37°C. Intraoperatively, a rare finding of a perforated appendix inside the hernial sac was noted (Type 2 Amyand's hernia, Losanoff Basson classification) [Table/Fig-4]. The appendix was inflamed and perforated at the tip, with minimal local contamination (no pus, no localised abscess and no peritoneal spill); the herniated bowel loops were viable, with preserved colour and peristalsis. Appendectomy was performed, the peritoneal cavity and hernial sac were thoroughly irrigated, and right herniotomy with high ligation of the sac was completed. This finding changed the surgical plan from herniotomy to appendectomy with herniotomy and also guided the decision for antibiotic plan.

[Table/Fig-3]: Ultrasound-guided caudal analgesia intraoperatively.



[Table/Fig-4]: Intraoperative finding of perforated appendix inside the hernial sac.

At the end of surgery, in view of extreme prematurity, recent Respiratory Distress Syndrome (RDS) and the intra-abdominal contamination, elective postoperative mechanical ventilation was decided. The neonate was shifted back to NICU as intubated for further management. Postoperatively, he was ventilated in SIMV mode and later shifted to nasal CPAP after he attempted adequate spontaneous respiration and haemodynamic stability [Table/Fig-5]. Extubation was done after a successful spontaneous breathing trial, ensuring adequate respiratory attempts, acceptable blood gases, no apnoeic episodes and normothermia. He was gradually weaned from nasal CPAP to room air within six hours.

[Table/Fig-5]: Nasal CPAP ventilation in postoperative period.

Analgesia was maintained with i.v. paracetamol 20 mg thrice daily and pain was assessed using a Neonatal Infant Pain Scale (NIPS), which remained in the mild range. The baby was observed closely for apnoea, desaturation, bradycardia and signs of sepsis for at least 48 hours post-extubation, and no complications were noted. The neonate continued to gain weight and was discharged in good condition on 42nd day of life at a weight of 2.015 kg, with advice for regular follow-up. The baby eventually had good long term outcome.

DISCUSSION

The perioperative management of extremely preterm neonate is one of the most challenging roles in paediatric anaesthesia due to their immature physiological status and increased risk of perioperative complications. Preterm neonates- particularly those born before 28 weeks of gestation are characterised by underdeveloped organ systems, including incomplete pulmonary surfactant synthesis,

unstable cardiovascular regulation, and metabolic immaturity, leading to increased risks of respiratory instability, haemodynamic fluctuations, hypoglycaemia, and temperature disturbances [1-3]. These physiological vulnerabilities make the anaesthetic management more complex.

In the patient of current study, the authors focused on maintaining oxygenation and ventilation within a safe range, preserving normothermia and giving individualised fluid therapy according to current paediatric fluid guidelines [4]. The present case shows the complex perioperative challenges in managing an extremely preterm neonate requiring surgery for an incarcerated inguinoscrotal hernia with an unexpectedly perforated appendix inside the hernial sac necessitating the need for change in surgical plan and antibiotic course. The combination of extreme prematurity, recent respiratory distress syndrome and intra-abdominal infection significantly increased anaesthetic and surgical risk and required careful planning and close coordination between the anaesthesiologist, surgeon and neonatologist. The authors planned an opioid-free multimodal technique using ketamine and sevoflurane along with ultrasound-guided caudal analgesia. This approach was chosen to provide good analgesia while reducing the risk of postoperative apnoea and respiratory depression, which are common concerns in preterm neonates when opioids are used. Studies have shown that ultrasound-guided caudal or epidural techniques have improved success rates and reduced complications in neonates and infants compared with landmark-based approaches, especially when anatomy is immature [5,6]. Airway, fluid and temperature management are key anaesthetic challenges in such cases. The potential for a difficult airway due to the relatively large head, large tongue and floppy epiglottis in preterm neonates was addressed by proper preparation and keeping a video laryngoscope and other airway adjuncts ready. Fluid administration was guided by current recommendations for perioperative fluid therapy in children, keeping in mind the limited cardiovascular reserve of the neonate. Warmed fluids helped us maintain normothermia throughout the perioperative period.

Alternative anaesthetic strategies in this scenario could have included an opioid-based technique using fentanyl, or total intravenous anaesthesia. We avoided a predominantly opioid-based technique because of the high risk of postoperative apnoea and prolonged ventilation in an extremely preterm neonate [7,8]. Total intravenous anaesthesia with agents like propofol was also not chosen because of concerns regarding haemodynamic instability and limited safety data in very preterm neonates. In the present case, inhalational anaesthesia combined with ultrasound-guided caudal block and elective postoperative mechanical ventilation appeared to be a safe and practical option.

Similar condition with perforated appendix in neonatal Amyand's hernia was reported previously by Sandhu A et al., in which the neonate was born at term which makes it less complex for anaesthetic management compared to our preterm neonate requiring more complex anaesthetic care [9].

Previous literature supported the higher incidence of neonatal Amyand's hernia, especially in right side, because of their anatomical factors and patent processus vaginalis. Livaditi E et al., highlighted the need for intraoperative vigilance for appendicitis and need for routine sac inspection in neonatal hernias and necessitating the unplanned surgical intervention and antibiotics adjustments [10]. Similarly Baldassarre E et al., reported the incidence of right Amyand's hernia is higher than the left-sided in neonates, due to its anatomical proximity to the right internal inguinal ring adjacent to the cecum, facilitated by a congenital patent processus vaginalis and heightened by their weak abdominal walls [11]. Similarly Ngom G et al., emphasised the rarity of Amyand's hernia and their right-sided predominance and need for urgent inguinal exploration with sac inspection in neonates [12]. Mohamed A et al., emphasised the need for high suspicion for Amyand's hernia despite radiological diagnosis and examination of sac intraoperatively [13].

The current case illustrates that careful fluid management is critical and the individualised fluid therapy is necessary in neonates due to their limited physiological reserve. Caudal blockade is an effective and safe technique for postoperative pain management in paediatric patients. The technical difficulty of administering caudal analgesia in a neonate with immature anatomy was successfully managed with ultrasound. Ultrasound guidance improves the success rate of caudal blockade and reduces the risk of complications compared to landmark-based techniques. The decision to use opioid-free anaesthesia was crucial in minimising the risk of postoperative apnoea which is a common complication in preterm neonates.

CONCLUSION(S)

Perioperative management of extremely preterm neonate undergoing surgery is complex and demands careful planning and monitoring. This case highlights that an opioid-free multimodal anaesthetic strategy combined with ultrasound-guided caudal analgesia can provide stable intraoperative conditions and effective pain relief while limiting postoperative respiratory complications in such patients. The unexpected intraoperative finding of a perforated appendix within the incarcerated hernial sac further emphasises the need to be prepared for modifying the surgical and anaesthetic plan. Proper communication between the anaesthesiologist, surgeon and neonatologist is crucial. Strict adherence to haemodynamic, ventilation, temperature and glucose management was crucial for the favourable outcome in a high-risk neonate. The present case strengthens the limited literature on perioperative management of extremely preterm neonate with Amyand's hernia and supports the use of individualised, opioid-sparing strategies.

Acknowledgement

The authors acknowledge the support of the surgical team in the successful management of the current case. The authors were also grateful to the institution for providing the necessary facilities and finally they sincerely thank the patient and their family for their cooperation and consent.

REFERENCES

[1] Morniroli D, Tiraferri V, Maiocco G, De Rose DU, Cresi F, Coscia A, et al. Beyond survival: The lasting effects of premature birth. Frontiers in Pediatrics. 2023;11:01-12.
[2] Doherty TM, Hu A, Salik I. Physiology, Neonatal. [Updated 2023 Apr 24]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK539840/.
[3] British Association of Perinatal Medicine. Managing the difficult airway in the neonate: A framework for practice. London: British Association of Perinatal Medicine; 2020.
[4] Sümpelmann R, Becke K, Brenner S, Breschan C, Eich C, Höhne C, et al. Perioperative intravenous fluid therapy in children: Guidelines from the Association of the Scientific Medical Societies in Germany. Paediatr Anaesth. 2017;27(1):10-18. Doi: 10.1111/pan.13007.
[5] Willschke H, Bosenberg A, Marhofer P, Willschke J, Schwindt J, Weintraud M, et al. Epidural catheter placement in neonates: Sonoanatomy and feasibility of ultrasonographic guidance in term and preterm neonates. Reg Anesth Pain Med. 2007;32(1):34-40.
[6] Opfermann P, Kraft F, Obradovic M, Zadrazil M, Schmid W, Marhofer P. Ultrasound-guided caudal blockade and sedation for paediatric surgery: A retrospective cohort study. Anaesthesia. 2022;77(7):785-94. Doi: 10.1111/anae.15738.
[7] Maheshwari M, Sanwatsarkar S, Katakwar M. Pharmacology related to paediatric anaesthesia. Indian J Anaesth. 2019;63(9):698-706. Doi: 10.4103/ija.IJA_487_19.
[8] Paul M, Bamba C, Vinay V, Krishna B, Bharani Kumar B. Comparing opioid with opioid-free anesthesia technique in neonates undergoing tracheoesophageal fistula repair. Oman Med J. 2023;38(5):e547.
[9] Sandhu A, Liaqat N, Nayyar SI, Faryal R, Shafique S. Amyand's hernia with perforated appendix in a neonate. APSP J Case Rep. 2014;5(3):34.
[10] Livaditi E, Mavridis G, Christopoulos-Geroulanos G. Amyand's hernia in premature neonates: Report of two cases. Hernia. 2007;11(6):547-49. Available from: https://doi.org/10.1007/s10029-007-0242-3.
[11] Baldassarre E, Centonze A, Mazzei A, Rubino R. Amyand's hernia in premature twins. Hernia. 2009;13(2):229-30. Doi: 10.1007/s10029-008-0427-4.

[12] Ngom G, Amadou I, Ibrahima KA, Mubake A, Ndour O, Ndoye M. Amyand's hernia with perforated appendix in a neonate. BMJ Case Rep. 2010;2010:bcr0320102847.

[13] Mohamed A, Fagelnor A. Amyand's hernia in a neonate presenting with inguinoscrotal erythema: A difficult diagnosis. European J Pediatr Surg Rep. 2019;7(1):e69-e71.

PARTICULARS OF CONTRIBUTORS:
1. Postgraduate, Department of Anaesthesiology, SRM Medical College Hospital and Research Centre (SRMMCH&RC), Chennai, Tamil Nadu, India.
2. Professor, Department of Anaesthesiology, SRM Medical College Hospital and Research Centre (SRMMCH&RC), Chennai, Tamil Nadu, India.
3. Postgraduate, Department of Anaesthesiology, SRM Medical College Hospital and Research Centre (SRMMCH&RC), Chennai, Tamil Nadu, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Anand Kuppusamy,
Professor, Department of Anaesthesiology, SRM Medical College Hospital and Research Centre (SRMMCH&RC), Chennai-603203, Tamil Nadu, India.
E-mail: anandk@srmist.edu.in

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jan 13, 2026
- Manual Googling: Apr 13, 2026
- iThenticate Software: Apr 15, 2026 (20%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Dec 17, 2025**
Date of Peer Review: **Jan 15, 2026**
Date of Acceptance: **Apr 18, 2026**
Date of Publishing: **Aug 01, 2026**