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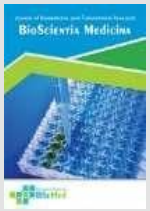

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Anesthesia Approach for Nephrectomy in Full-Term Neonate with Suspected Wilms Tumor and Patent Foramen Ovale: A Case Report

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A B S T R A C T

Background: Nephrectomy for Wilms tumor presents a considerable challenge in pediatric anesthesia. This study aimed to describe the anesthesia approach for nephrectomy in a full-term neonate with suspected Wilms tumor and patent foramen ovale. **Case presentation:** A 25-day-old male neonate was referred with a longstanding intraabdominal mass present since birth. Echocardiography revealed a patent foramen ovale with a diameter of 2.7 mm and a left-to-right shunt. The patient also had a diagnosis of partial ileus obstruction, likely caused by the tumor's pressure on the left kidney. Preoperative fasting adhered to a "6-4-3-1" regimen. Normoglycemia was maintained throughout the perioperative period. The case was managed under general anesthesia without the use of the rapid sequence induction technique. Caudal analgesia was administered using 1.14 ml of 0.175% bupivacaine. Vigilant monitoring of blood loss, prevention of hypothermia, and effective pain management are vital aspects of the surgical procedure. For postoperative pain management, analgesia and morphine infusion were employed. The patient was then transferred to the neonatal intensive care unit (NICU) for observation for any signs of complications related to anesthesia and surgery. **Conclusion:** Nephrectomy in neonates is one of the challenges of pediatric anesthesia. Pre-anesthesia preparation in relation to hypertension control, analgesia plan and postoperative care site, transfusion strategy, and management of intravascular extension.

1. Introduction

Wilms tumor is the prevailing form of kidney cancer in the pediatric population and usually emerges between the ages of 3 and 5 years.[1] Standard treatment includes nephrectomy and chemotherapy combination.[1] The primary reasons for undergoing nephrectomy differ across various regions of the world, as well as among different age groups and genders. Some areas report a higher incidence of benign conditions, while others observe a greater prevalence of malignancies.[2]

Neonates undergoing surgical procedures face a greater susceptibility to anesthesia-related complications. Due to the dynamic nature of neonatal physiologies and their ability to experience pain in response to harmful stimuli, it is imperative to both minimize physiological stress caused by surgical manipulation and effectively manage cardiovascular responses to anesthesia in neonates.[3] Pre-anesthesia preparation involves maintaining normovolemic status, controlling hypertension, planning analgesia, and determining post-operative care location, transfusion strategies, and intravascular extension management. The potential for significant bleeding, hemodynamic instability, surgical interventions affecting ventilation, and tumor rupture leading to disease upstaging underscores the need for good intraoperative communication between anesthesia, surgeons, oncologists, and intensivists. Postoperatively, active involvement in pain

management can enhance patient comfort and expedite recovery.[4,5] This study aimed to describe the anesthesia approach for nephrectomy in full-term neonates with suspected Wilms tumors and patent foramen ovale.

2. Case Presentation

A 25-day-old male was referred from a district hospital to our institution, a tertiary teaching hospital, for enlarging intraabdominal mass that had been present since birth. He has been vomiting after every milk intake since he was 7 days old, occurring 3-5 times per day, with a volume of 5-10 ml. At the presentation, he appeared somewhat active, and bowel movements were present but limited. He was born via cesarean section at term, with a birth weight of 2830 grams and an APGAR score of 9. At presentation, his weight decreased to 2620 grams.

A generalized physical examination revealed a heart rate of 135 beats per minute, with a holosystolic murmur (grade III/6) at the left sternal border, spanning from the second to the fifth intercostal space (ICS). The abdomen appeared enlarged and tense, with a palpable mass sized 8x6 cm, characterized by well-defined borders and a firm texture extending from the hypochondrium to the epigastrium (Figure 1). Micturition was noted within the diaper. There were also signs of jaundice in both the sclera and the skin. No other notable findings were identified during the examination.

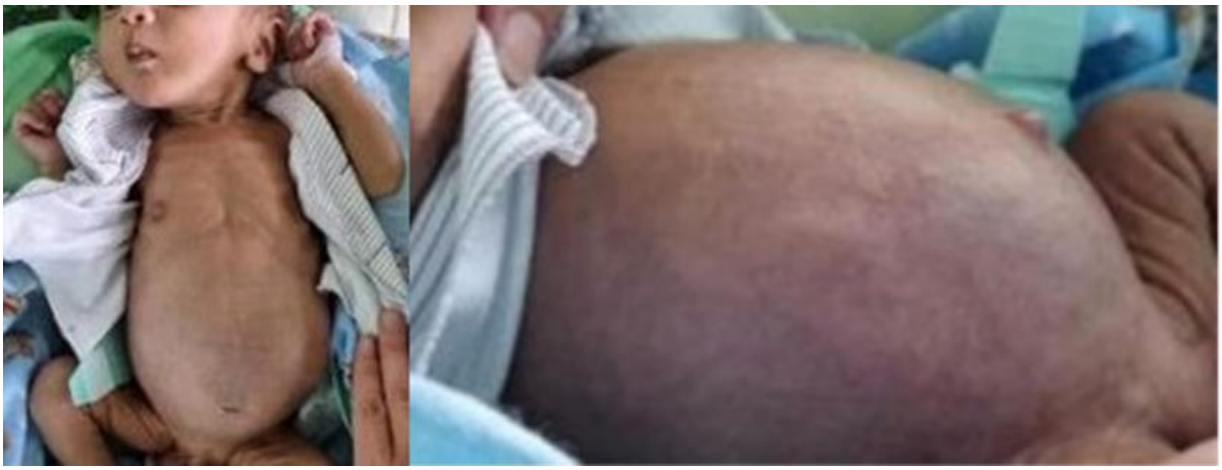

Figure 1. The physical appearance of the patient.

Laboratory investigations revealed only normochromic normocytic anemia (hemoglobin level of 11.50 g/dL and normal mean corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC)). Other blood panels were unremarkable. Abdominal CT scan showed a heterogeneous mass with mixed density located from the mid to lower pole of the left kidney with a claw sign, consistent with the appearance of a primary renal tumor, suspicious for congenital mesoblastic nephroma or possibly nephroblastoma, accompanied by caliectasis at the upper pole (Figure 2). The mass compressed the left renal vessels, pancreas, and stomach anteriorly, spleen and splenic vessels anterosuperior, and displaced the intestines to the right side, with possible bilateral hydroceles. Echocardiography results showed normal atrium, normal drainage of systemic and pulmonary veins, AV-VA concordance, balanced four-chamber view, cardiac output not measured, no patent ductus arteriosus (PDA), ventricular septal defect (VSD), or atrial septal defect (ASD), patent foramen ovale (PFO) with a diameter of 2.7 mm, left-to-right shunt, left aortic arch, normal aortic and semilunar valves, no

pericardial effusion, and normal left ventricular (LV) and right ventricular (RV) systolic function. These findings suggest a left-to-right shunt through the PFO.

Preoperatively, a standard and proper fasting procedure for neonates was applied. On the day of the surgery, received premedication with intravenous midazolam 0.2 mg and ketamine 5 mg. General anesthesia was induced using analgesic fentanyl 5 mcg, sevoflurane, and atracurium 2 mg. Intubation was performed and confirmed by auscultation. The patient was positioned in the Sims position, and caudal analgesia was administered with a mixture of 0.4 ml of 0.175% bupivacaine and 0.74 ml of NaCl 0.9%. Anesthesia was maintained using sevoflurane with oxygen and air mixture, while muscle relaxants were administered intermittently as required. Fluid balance was closely monitored, with a total of 175 mL of crystalloid. The patient's hemodynamics and temperature remained stable during the surgery, with a blood loss of 30 mL, and the patient was extubated in the operating room (Figure 3).

Postoperatively, the patient was admitted to the pediatric intensive care unit (PICU) and received analgesic regimens of continuous morphine 1 mg in 24 hours for three days, along with intravenous metamizole 20 mg every 8 hours. On the third postoperative day, the patient was transferred to a regular room, and on the fifth day, he was discharged without any complications.

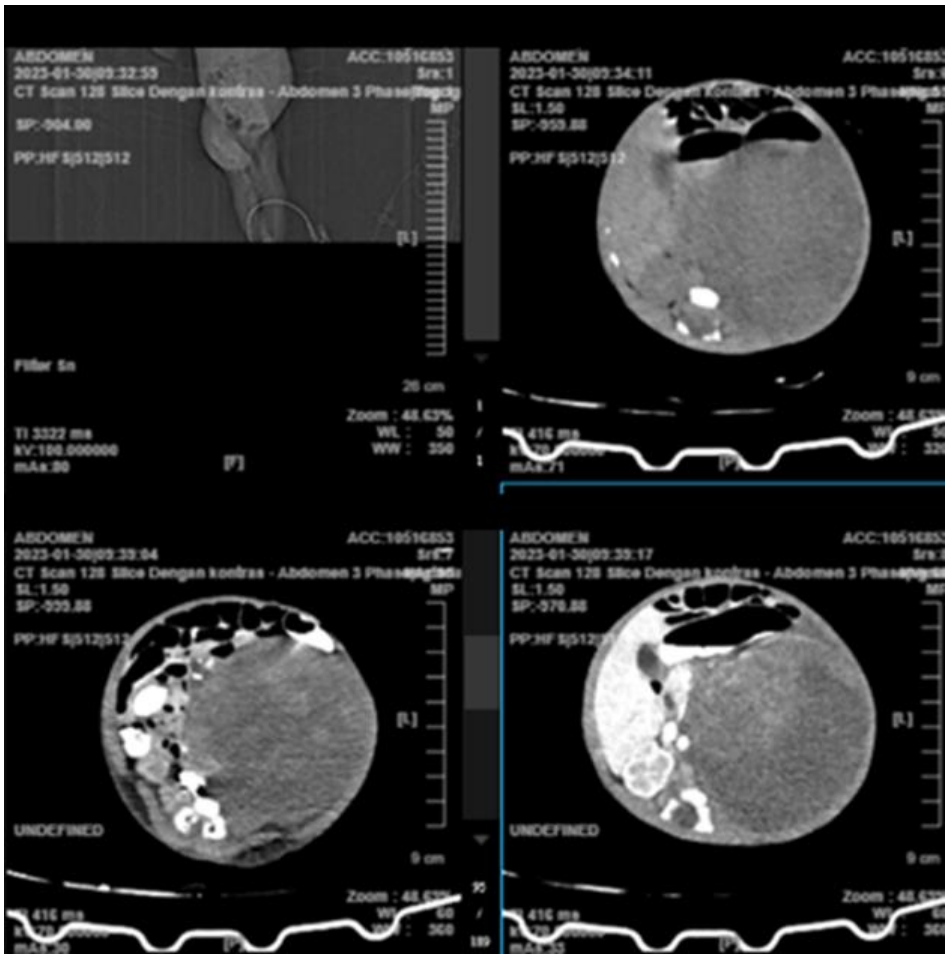

Figure 2. Abdominal CT scan.

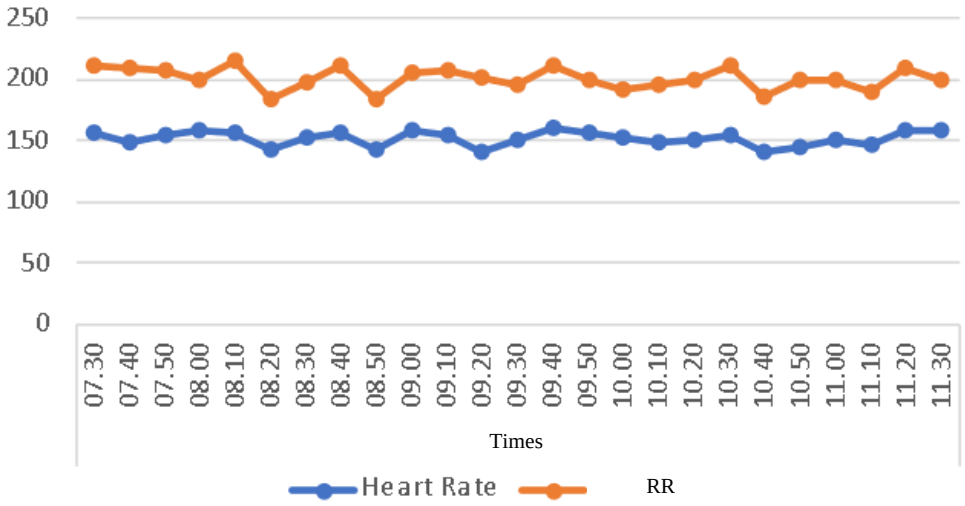

Figure 3. Patient's perioperative hemodynamic.

3. Discussion

Compression of a tumor within the abdominal cavity could lead to nausea and vomiting and could also affect gastric motility. If these symptoms were observed, endotracheal intubation should be performed using the rapid sequence induction (RSI) technique to prevent the potential for gastric regurgitation.[5] However, in pediatric cases, the conventional RSI approach may not always be suitable due to disparities in psychological, anatomical, and physiological factors. Approximately half of anesthetists would not routinely employ RSI in a child assumed to have a full stomach, even when the risk of aspiration was similar to that of an adult, which underscores the variability in the application and the need for further research in this area.[6] Regarding the patient mentioned, despite presenting in the Emergency Department with symptoms like nausea, vomiting, and findings of compression of a tumor within the abdominal cavity, the patient has shown no complaints since admission to the ward. In this specific case, it seems that fasting alone as a preparation measure is adequate, as there have been no indications or complaints necessitating RSI.

In the 2022 guidelines from the European Society of Anaesthesiology and Intensive Care (ESAIC), the new fasting regimen known as "6-4-3-1" (6 hours for solids, 4 hours for formula and nonhuman milk, 3 hours for breast milk, 1 hour for clear fluids) is recommended. Allowing the patient to consume clear fluids up to just one hour before the operation proved beneficial in preventing the adverse effects typically associated with extended fasting, such as dehydration, hunger, and thirst.[7,8] Newborns and premature infants face a heightened susceptibility to experiencing difficulties with glycogenolysis and gluconeogenesis. Neonates have limited glycogen reserves, making them vulnerable to developing hypoglycemia even after relatively brief periods of fasting.

Hypoglycemia is a common occurrence in neonates, and several risk factors contribute to it. These factors include prematurity, perinatal stress or asphyxia, being born small for gestational age, maternal diabetes, and conditions like Wiedemann-Beckwith syndrome. The decision to administer glucose to compensate for preoperative fasting is determined by the duration of fasting.[9] Maintenance fluid requirements are calculated based on the glucose infusion rate (GIR), with a typical range of 5-8 mg/kg/min.[9–11] In this case, we administered dextrose at a rate of 12 ml/kg/hour of 2.5% dextrose, which helped achieve and maintain normoglycemic status. This approach ensures neonates and pediatric patients receive the appropriate glucose support to

prevent hypoglycemia during periods of fasting.

In the perioperative care of neonates with congenital heart defects, preventing factors that can increase pulmonary vascular resistance is crucial to avoid the reopening of fetal shunts, such as the foramen ovale and ductus arteriosus. The reopening of these shunts can indeed lead to right-to-left shunting, which can result in profound hypoxia and compromise the oxygenation of the newborn. These factors include sepsis, hypoxia, acidosis, hypercapnia, pain, and hypothermia.[12] It is crucial to actively prevent and manage these factors to ensure the well-being and optimal oxygenation of neonates undergoing surgery, particularly those with congenital heart defects.

During neonatal surgeries, careful observation of the surgical area was maintained, as infants typically tolerate a blood loss of approximately 50 to 75 mL before contemplating a transfusion of packed red blood cells. This amount corresponds to roughly 20% of their total circulating blood volume.[4] In this patient, we employed visual evaluation and arrived at an estimated blood loss of 20 ml. We administered a total of 175 ml of Ringer's lactate during the intraoperative period. Planning in advance is crucial to mitigate the potential for hypothermia in infants and young children.[4,13] To prevent this, we turned on the warmer pad, kept the room temperature at 20°C, covered the baby's scalp and extremities with a plastic cover, and utilized an infusion warmer to prevent heat loss and hypothermia intraoperatively.

Finally, caudal analgesia offers exceptional pain relief during and after surgery. The use of a caudal block with 1.3 mL/kg of 0.15% ropivacaine demonstrated a reduction in perioperative fentanyl consumption and effective postoperative pain relief when compared to cases where no caudal block was utilized.[14] Furthermore, the administration of single intravenous doses of metamizole for the purpose of preventing or treating postoperative pain was found to be well-tolerated for those up to 6 years of age.[15] We prescribed morphine infusion at 10-40 mcg/kg/hour and metamizole 10-15 mg/kg every 6 hours orally.[16] The patient was admitted to the pediatric intensive care unit (PICU) to closely monitor for potential complications, including postoperative apnea.[4]

4. Conclusion

Nephrectomy in neonates is one of the challenges of pediatric anesthesia. Pre-anesthesia preparation in relation to hypertension control, analgesia plan and postoperative care site, transfusion strategy, and management of intravascular extension. The potential for major bleeding, hemodynamic instability, surgical intervention on ventilation, and tumor rupture leading to upstaging of the disease, therefore, requires good intraoperative communication. Postoperatively, active involvement in pain management can improve patient comfort and hasten the return to activity.

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