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Case Report

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Emergency Exploratory Laparotomy For Midgut Volvulus With Intestinal Malrotation In Neonates Under Thoracic Segmental Spinal Anesthesia

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Abstract

Introduction: Malrotation of the intestines is a developmental abnormality that permits spontaneous abnormal rotation of the midgut around the mesentery which present with intestinal obstruction. The most serious complication of malrotation is midgut volvulus can rapidly compromise the intestinal blood supply causing infarction. Thoracic segmental spinal anesthesia has been demonstrated as a safe and effective method and has been shown as beneficial in maintaining hemodynamic stability for these patients and reducing side effects encountered with general anesthesia.

Case History: A case of 6 days old male baby, 2 kg by weight, presented a UNM children hospital with chief complaint of distended abdomen with bilious vomiting after every feed, unable to pass stool since birth. Preoperative work up and abdomen USG was done which suggest midgut volvulus with intestinal obstruction, severe dehydration with pre-renal failure. Preoperative resuscitation was done in NICU. Preoperative anesthetic checkup was done and planned for the emergency exploratory laparotomy under thoracic segmental spinal anesthesia. Patient was given Inj. Ketamine for sedation. Under aseptic precaution, thoracic segmental spinal anesthesia with isobaric Inj. Levobupivacaine with additive inj. Dexmedetomidine was given. O2 via facemask was given and patient was hemodynamically stable throughout the procedure and postoperatively.

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Conclusion:

Midgut volvulus is a true surgical emergency. Surgery is only definitive treatment of malrotation and midgut volvulus. Thoracic segmental spinal anesthesia as a newer modality of induction is safe for major abdominal surgeries like exploratory laparotomy as it is associated with decrease perioperative opioid requirement, early recovery of bowel function, comparatively less post-operative respiratory complications which result in shorter length of hospital stay.

Keywords:

Emergency Exploratory laparotomy, Midgut volvulus, Intestinal malrotation, Neonates, Thoracic segmental spinal anesthesia

INTRODUCTION

Midgut volvulus is a life-threatening condition in neonates, commonly associated with intestinal malrotation which is a congenital anomaly that arises from improper rotation and fixation of the intestine during embryonic development.[1] The incidence of malrotation is estimated to be approximately 1 in 500 live births, though midgut volvulus complicates only about 10% of these cases. Neonates with midgut volvulus often present within the first few weeks of life, although it may occur at any time in infancy. Key risk factors include prematurity and low birth weight. [2]

Clinically, neonates with midgut volvulus typically present with sudden onset of bilious vomiting, which is a hallmark sign of the condition. Abdominal distension, irritability, and signs of shock such as lethargy, tachycardia, and hypotension may also be present. If untreated, midgut volvulus can lead to compromised blood flow to the intestine, resulting in bowel ischemia, necrosis, and perforation. These complications elevate the risk of sepsis, multi-organ failure, and death. Diagnostic modalities include imaging techniques such as abdominal ultrasound and upper gastrointestinal contrast studies which confirm the presence of malrotation and volvulus.[3]

Surgical intervention is the definitive treatment for midgut volvulus with the Ladd procedure being the standard approach. The procedure involves untwisting the volvulus, repositioning the bowel and preventing future episodes by widening the mesenteric base and removing Ladd's bands which are obstructive peritoneal attachments. [4] Emergency exploratory laparotomy is often required in acute cases where bowel ischemia or necrosis is suspected. In severe cases of necrosis bowel resection may be necessary, though this carries a significant risk of short bowel syndrome. In neonates, early recognition and prompt surgical management are crucial to avoid catastrophic outcomes.[5]

Anesthesia for neonates undergoing surgical intervention for midgut volvulus presents unique challenges, as these patients are often critically ill and have a high risk of perioperative complications. Neonates are particularly vulnerable to hypothermia, respiratory distress, and cardiovascular instability. Traditionally, general anesthesia has been the preferred technique, often supplemented by regional anesthesia. However, thoracic segmental spinal anesthesia has gained popularity in recent years due to its efficacy and safety profile, especially in critically ill neonates.[6]

Thoracic segmental spinal anesthesia provides adequate analgesia and muscle relaxation for abdominal surgeries without the need for endotracheal intubation or mechanical ventilation, reducing the risk of respiratory complications. The anesthetic technique involves the administration of local anesthetic into the thoracic segment of the spinal cord, effectively blocking pain transmission in the corresponding dermatomes. It is particularly advantageous in neonates with compromised respiratory function or those at high risk for post-extubation complications. Additionally, thoracic spinal anesthesia reduces the need for opioids, minimizing the risk of opioid-related side effects such as respiratory depression and gastrointestinal dysmotility, which are particularly concerning in neonates.[7]

Thoracic segmental spinal anesthesia offers several advantages over general anesthesia or other regional anesthesia techniques in neonates undergoing surgery for midgut volvulus. Firstly, it avoids the potential respiratory complications associated with general anesthesia, such as postoperative apnea and the need for prolonged mechanical ventilation. Neonates have immature respiratory systems and are particularly susceptible to ventilator-induced lung injury,

making a non-invasive anesthetic approach highly beneficial.[8]

Secondly, thoracic segmental spinal anesthesia allows for faster recovery times, as neonates experience less postoperative sedation and fewer disturbances to their physiological parameters. It also eliminates the need for muscle relaxants and reduces the reliance on systemic analgesics, minimizing the risk of side effects like delayed gastric emptying and respiratory depression. Moreover, spinal anesthesia in neonates has been associated with a reduced incidence of intraoperative hypotension, bradycardia, and hypothermia, further improving surgical outcomes.[9]

CASE REPORT

A 6-day-old male neonate weighing 2 kg presented to the pediatric emergency department of UNM Children's Hospital with complaints of a distended abdomen and bilious vomiting after every feed. The parents reported that the baby had not passed stool since birth. These symptoms suggested an intestinal obstruction. On clinical examination, the neonate was lethargic, with signs of severe dehydration, and the abdomen was markedly distended.

Preoperative investigations included a bedside abdominal ultrasound (USG), which confirmed the diagnosis of midgut volvulus with intestinal malrotation and obstruction. Blood investigations revealed pre-renal failure secondary to severe dehydration, characterized by elevated serum creatinine and blood urea nitrogen. In the neonatal intensive care unit (NICU), the baby underwent aggressive resuscitation with intravenous fluids, electrolytes, and correction of metabolic acidosis. A nasogastric tube was inserted to decompress the stomach, and antibiotics were administered to prevent sepsis. The neonate's condition stabilized following resuscitation, and an emergency exploratory laparotomy was planned.

Given the baby's critical state and low weight, the anesthetic approach was carefully considered. General anesthesia in neonates, particularly those with compromised respiratory or cardiovascular function, poses significant risks, including postoperative apnea, hypoxia, and prolonged mechanical ventilation. After a thorough preoperative anesthetic evaluation, the decision was made to perform the surgery under thoracic segmental spinal anesthesia, a technique increasingly favoured in high-risk neonatal surgeries.

Thoracic segmental spinal anesthesia was selected for its ability to provide adequate analgesia and muscle relaxation without the need for endotracheal intubation or mechanical ventilation, both of which could pose additional risks to this neonate. Under aseptic precautions, sedation was induced using intravenous ketamine(1mg/kg).After achieving adequate sedation, thoracic spinal anesthesia was administered at the T7-8 level using a small-gauge 25 x 30 mm spinal needle. A dose of 0.06 mL of 0.5% isobaric levobupivacaine**,** a long-acting local anesthetic with a well-established safety profile, was administered. To prolong the duration of the block and provide additional sedation, dexmedetomidine, an alpha-2 adrenergic agonist, was used to coat the inner surface of the syringe. This technique enhanced the anesthetic effect without compromising the neonate's hemodynamic stability.

Throughout the procedure, oxygen was administered via a facemask to ensure adequate oxygenation. Intraoperative monitoring included continuous pulse oximetry, electrocardiography (ECG), non-invasive blood pressure monitoring, and urine output assessment to promptly detect any signs of cardiovascular instability. Intraoperatively iintravenous Dextrose 1% in Inj. Ringer lactate were administered to maintain adequate perfusion, and the baby received a blood transfusion to address intraoperative blood loss. The patient remained hemodynamically stable throughout the surgery, with no episodes of hypotension or bradycardia, which are common concerns in neonates undergoing major abdominal surgery.

The exploratory laparotomy confirmed the diagnosis of midgut volvulus with extensive bowel ischemia. The volvulus was untwisted, and a Ladd procedure was performed to prevent recurrence. The bowel was deemed viable, and no resection was necessary. The surgery was completed successfully, with no intraoperative complications.

Postoperatively, the baby was transferred back to the NICU for monitoring and further management. The neonate recovered well from anesthesia, with no signs of respiratory depression or need for postoperative ventilatory support. Pain control was effectively managed with the residual effects of the spinal block and minimal additional analgesia. The patient remained stable during the postoperative period, and bowel function returned within 48 hours, allowing for the gradual reintroduction of feeds.

DISCUSSION

Midgut volvulus with intestinal malrotation is a rare but life-threatening surgical emergency in neonates. Early diagnosis and prompt surgical intervention are critical for prevention of morbidity and mortality. The case of a 6-day-old neonate presented here highlights the successful use of thoracic segmental spinal anesthesia during emergency exploratory laparotomy for midgut volvulus. This technique is increasingly gaining recognition for its benefits in critically ill neonates particularly those at high risk for respiratory complications associated with general anesthesia.[10]

Neonates, particularly low-birth-weight infants, pose unique challenges for anaesthesiologists. Their immature physiological systems increase the risk of perioperative complications, such as hypothermia, hypotension, respiratory depression, and prolonged postoperative apnea, especially under general anesthesia. Several studies have demonstrated that spinal anesthesia offers significant advantages over general anesthesia in high-risk neonates. Craven et al[11] and Abajian et al[12] both reported that spinal anesthesia reduces the incidence of postoperative apnea, avoids airway manipulation, and eliminates the need for mechanical ventilation, which can lead to ventilator-associated lung injury.

In this case thoracic spinal anesthesia provided effective anesthesia and analgesia allowing for a smooth intraoperative course without the need for intubation or mechanical ventilation. The addition of dexmedetomidine which has been shown to enhance the effects of spinal anesthesia, helped prolong the block and maintain hemodynamic stability. Mahmoud et al have demonstrated that the combination of levobupivacaine and dexmedetomidine is effective in maintaining intraoperative stability in neonates.[13] Dexmedetomidine reduces the need for additional sedation and analgesics, which are often associated with adverse effects in neonates.

One of the key advantages of thoracic spinal anesthesia in neonates, as seen in this case, is the reduction in opioid requirements, thereby minimizing opioid-related side effects such as respiratory depression and delayed gastric emptying. In addition, the rapid recovery observed in this case aligns with findings from Williams et al reported that neonates receiving spinal anesthesia demonstrated faster return of bowel function and earlier postoperative feeding.[14] These findings suggest that spinal anesthesia can lead to shorter hospital stays and improved postoperative outcomes in neonatal patients.

Thoracic spinal anesthesia has also been described as safe and effective in other neonatal surgeries, including inguinal hernia repairs and lower abdominal procedures. The technique has been particularly useful in neonates with respiratory comorbidities, such as bronchopulmonary dysplasia, where intubation and prolonged mechanical ventilation pose significant risks.[15] While the use of thoracic spinal anesthesia in neonatal surgery for midgut volvulus is less common, this case report adds to the growing body of literature supporting its utility in high-risk neonates undergoing major abdominal surgery.

The success of thoracic segmental spinal anesthesia in this case reinforces the notion that this anesthetic approach may be a viable alternative to general anesthesia in neonates undergoing emergency abdominal surgeries, particularly in those with underlying respiratory or cardiovascular compromise. However, it is important to recognize the need for further research to establish standardized protocols and long-term outcomes of this technique in larger populations of neonatal patients.

CONCLUSION

Thoracic segmental spinal anesthesia is a safe and effective alternative to general anesthesia in neonates undergoing emergency exploratory laparotomy for midgut volvulus with intestinal malrotation. By offering superior respiratory and

hemodynamic stability, it minimizes perioperative complications and facilitates smoother postoperative recovery.

Conflict Of Interest : None

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