Case Report

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CONGENITAL DIAPHRAGMATIC HERNIA REPAIR UNDER THORACIC SEGMENTAL SPINAL ANESTHESIA.

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Abstract

INTRODUCTION: Congenital diaphragmatic hernia (CDH) is a rare condition where an incomplete closure of developing diaphragm results in herniation of the abdominal viscera into thoracic cavity. The thoracic crowding and increased pressure detrimentally affect the developing cardiopulmonary system. Thoracic segmental spinal anesthesia offers many advantages in such patients at high risk for morbidity and mortality under general anesthesia.

CASE HISTORY: Presenting a case of 4 months old male, 7.3 kg weight child presented with chief complaint of vomiting for 4 days immediately after feeding associated with respiratory distress. Preoperative work up and Chest x-ray was done suggested left congenital diaphragmatic hernia. Diaphragmatic hernia repair was planned under thoracic segmental spinal anesthesia. Patient was given premedication of Inj. Ketamine and Inj. Dexmedetomidine. Under aseptic precaution, thoracic segmental spinal anesthesia with isobaric Inj. Levobupivacaine 0.5% 0.3 ml with additive inj. Dexmedetomidine was given. Intraoperatively IV fluid Injection Inj. Ringer lactate was given. O2 was given via facemask & Patient was hemodynamically stable intraoperatively and postoperatively.

CONCLUSION: Congenital diaphragmatic hernia remains one of the most challenging conditions for pediatric anesthetists, surgeons and intensivists to treat successfully. Spinal anesthesia has advantage over general anesthesia as spinal anesthesia has little effect on respiration and cardiac complication, which avoid airway instrumentation, avoids postoperative ventilation and provide post-operative better analgesia, earlier recovery of bowel function, and decreased complication which result in a shorten length of in hospital stay.

Keywords:- Diaphragmatic Hernia, Surgical intervention, segmental spinal anesthesia, Outcome.

INTRODUCTION

Congenital diaphragmatic hernia (CDH) is a rare and severe condition characterized by an incomplete closure of the diaphragm during fetal development, leading to herniation of abdominal viscera into the thoracic cavity. This anatomical defect results in significant thoracic crowding and increased intrathoracic pressure, which adversely affects the developing cardiopulmonary system. The pathophysiology of CDH involves the malposition of abdominal contents into the chest cavity impairing lung growth and function. Consequently, affected neonates often present with respiratory distress and pulmonary hypoplasia immediately after birth.

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There are two primary types of CDH: Bochdalek hernia, which occurs posterolaterally and is the most common, and Morgagni hernia, which is less frequent and occurs anteriorly.[1]

Presentation at birth typically includes severe respiratory distress, cyanosis, and a scaphoid abdomen. The initial management of neonates with CDH in the Neonatal Intensive Care Unit (NICU) focuses on stabilizing respiratory and hemodynamic status. This involves the use of mechanical ventilation, sometimes necessitating high-frequency oscillatory ventilation or extracorporeal membrane oxygenation (ECMO) in severe cases. The goal is to optimize oxygenation and perfusion while minimizing barotrauma to the hypoplastic lungs. Early surgical intervention is crucial for the survival and long-term outcomes of infants with CDH. The timing and approach to surgery depend on the severity of pulmonary hypoplasia and associated anomalies. Traditionally, surgical repair involves the reduction of herniated abdominal contents back into the abdominal cavity and closure of the diaphragmatic defect, often with the use of a synthetic patch in cases of large defects. This intervention is ideally performed once the neonate is stabilized, typically within the first few days of life, to mitigate the risks of ongoing pulmonary and circulatory compromise.[2]

Though almost all patients with congenital diaphragmatic hernia present immediately after birth with respiratory distress rarely the patients may remain asymptomatic for a few months following which they tend to present with various non-specific complaints. The symptoms in this late-onset group may commonly include recurrent chest infections, abdominal pain and vomiting. Since these symptoms are non-specific there is often delay in the diagnosis of late-presenting CDH. However once diagnosed the management in almost all cases is surgical interventions depending upon site and size of the diaphragmatic defect.[3]

The choice of anesthesia for surgical correction of CDH is critical, given the fragile physiology of these patients. General anesthesia is commonly used, providing the advantage of controlled ventilation and the ability to manage significant hemodynamic fluctuations. However, it is associated with potential respiratory and cardiac complications, including the need for postoperative mechanical ventilation and an increased risk of prolonged hospital stay. In contrast, thoracic segmental spinal anesthesia presents a viable alternative, particularly in high-risk patients. Local anaesthetics, such as isobaric levobupivacaine, are commonly used for this purpose. The addition of adjuvants like dexmedetomidine can enhance the quality and duration of anesthesia.[4]

Segmental spinal anesthesia offers several advantages over general anesthesia in the context of CDH repair. It minimizes respiratory compromise by avoiding endotracheal intubation and mechanical ventilation, reducing the risk of ventilator-associated lung injury. Moreover, it facilitates hemodynamic stability by avoiding the systemic effects of general anaesthetics. This technique also contributes to better postoperative analgesia, quicker recovery of bowel function, and a shorter duration of hospital stay. Thoracic segmental spinal anesthesia represents a promising approach for CDH repair, offering a safer and potentially more effective alternative to traditional general anesthesia. [5]

CASE REPORT

A 4-month-old male infant weighing 7.3 kg was brought to our hospital with a primary complaint of vomiting immediately after feeding, associated with respiratory distress for the past four days. The infant's medical history was otherwise unremarkable. On examination, the child appeared in significant respiratory distress with tachypnoea, intercostal retractions On auscultation there was decreased breath sounds on the left side of the chest. In view of presence of significant respiratory distress and reduced air entry on left side a chest X Ray was ordered which showed a left-sided diaphragmatic hernia with bowel loops visible in the thoracic cavity and a left-sided pleural effusion. These findings were consistent with a congenital diaphragmatic hernia (CDH). Further preoperative workup, including blood gases and echocardiography, confirmed the diagnosis and showed no significant cardiac anomalies.

The patient was admitted to the Pediatric Intensive Care Unit (PICU) for preoperative stabilization. He received supplemental oxygen via facemask and intravenous fluids. After resuscitation and stabilization, a multidisciplinary team decided to proceed with surgical repair of the CDH under thoracic segmental spinal anesthesia, given the patient's high risk for morbidity and mortality under general anesthesia.

In preparation for anesthesia, the infant was premedicated with intravenous ketamine (1mg/kg) and dexmedetomidine (0.4 microgram/ kg). Under aseptic conditions, thoracic segmental spinal anesthesia was (administered. The patient was positioned in the lateral decubitus position, and spinal needle was inserted at the T5-T6 interspace. Isobaric levobupivacaine 0.5% 0.3 ml with dexmedetomidine as an adjuvant was carefully injected into the cerebrospinal fluid. This technique was chosen to provide effective analgesia and muscle relaxation while preserving spontaneous respiration, thereby minimizing the risks associated with intubation and mechanical ventilation. Intraoperatively, the patient received intravenous fluids, including Ringer's lactate, to maintain hydration and electrolyte balance. Oxygen was administered via facemask throughout the procedure. The patient remained hemodynamically stable during the surgery, with consistent heart rate, blood pressure, and oxygen saturation levels. There were no significant fluctuations, and the patient did not require any vasopressor support.

The surgical team successfully reduced the herniated abdominal contents and repaired the diaphragmatic defect with a synthetic patch. The duration of the surgery was uneventful, and the patient maintained stable hemodynamics throughout. Postoperatively, the patient was monitored in the PICU. He continued to receive oxygen via facemask and intravenous fluids. Pain management was effectively controlled with the spinal anesthesia, and no additional analgesics were required in the immediate postoperative period.

The patient’s recovery was remarkable. He remained hemodynamically stable, showed no signs of respiratory distress, and exhibited early recovery of bowel function. The avoidance of general anesthesia and mechanical ventilation contributed to a smoother postoperative course, with no significant complications observed. The patient was discharged from the hospital on the seventh postoperative day, in good health and with satisfactory surgical outcomes.

DISCUSSION

The timely diagnosis and management of congenital diaphragmatic hernia (CDH) is crucial for optimizing patient outcomes. While CDH is often diagnosed prenatally or immediately after birth, late-presenting CDH poses unique challenges. In our case, the 4-month-old infant presented with respiratory distress and vomiting along with reduced air entry on right side of chest which led to the eventual diagnosis of CDH. This highlights the importance of considering CDH as a differential diagnosis in infants with unexplained gastrointestinal and respiratory symptoms.[6]

Late-presenting CDH is often associated with less severe pulmonary hypoplasia compared to CDH diagnosed at birth. However, it still carries significant morbidity and potential for rapid deterioration. The diagnostic process typically involves imaging studies such as chest X-rays and, if necessary, further confirmation with ultrasound or computed tomography (CT) scans. Early recognition and prompt surgical intervention are essential to prevent complications such as volvulus, strangulation of herniated organs, and progressive respiratory compromise.[7]

The choice of anesthesia for the surgical repair of CDH is critical, particularly in late-presenting cases. General anesthesia has traditionally been used for these procedures however, it carries the risk of postoperative mechanical ventilation and prolonged hospital stay due to its systemic effects on respiration and hemodynamics. In this situation thoracic segmental spinal anesthesia presents a viable alternative, especially for patients at high risk for morbidity under general anesthesia.[8]

A study by Verma D et al in the highlighted the benefits of spinal anesthesia in pediatric surgeries.[9] Their research demonstrated that spinal anesthesia reduced the incidence of respiratory complications and facilitated quicker postoperative recovery. Another study by Ponde V reviewed the use of regional anesthesia techniques, including spinal anesthesia, in various pediatric surgeries and emphasized their safety and efficacy. [10] Manasara MR reported a case of an adult with diaphragmatic hernia which was operated successfully under segmental spinal anesthesia. In this case segmental spinal anesthesia was preferred over general anesthesia because of compromised cardiovascular status of the patient undergoing surgery. The patient was successfully operated laparoscopically under segmental spinal anesthesia.[11]

In our case, the administration of thoracic segmental spinal anesthesia provided several benefits. The use of isobaric levobupivacaine with dexmedetomidine ensured effective analgesia and muscle relaxation while maintaining spontaneous

respiration. This approach minimized the risks associated with endotracheal intubation and mechanical ventilation.[12] The patient remained hemodynamically stable throughout the procedure, and the recovery was uneventful, with no significant complications.

CONCLUSION

Thoracic segmental spinal anesthesia represents a promising anesthetic technique for the surgical management of late-presenting CDH. It offers significant advantages over general anesthesia, particularly in reducing respiratory and cardiac complications, and facilitates a smoother postoperative recovery. This case and the supporting literature underscore the importance of considering spinal anesthesia as a viable alternative in high-risk pediatric patients.

Conflict of interest
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