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ANESTHETIC MANAGEMENT OF A 5-DAYS-OLD INFANT UNDERGOING CERVICAL MENINGOMYELOCELE REPAIR: A CASE REPORT

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Abstract

Cervical meningomyelocele is a rare form of neural tube defect (NTD) that presents significant anesthetic and surgical challenges, particularly concerning airway management and intraoperative stability. The presence of a large posterior cervical mass restricts neck mobility, increasing the risk of difficult intubation. We report the case of a 5-days-old term neonate with a 6×6 cm cervical meningomyelocele who underwent surgical repair. This report details the anesthetic considerations, including airway management challenges, intraoperative ventilation strategies, fluid balance, and postoperative care. A ramp positioning technique facilitated successful intubation, and elective postoperative ventilation ensured a smooth recovery. This case highlights the importance of multidisciplinary planning and advanced airway management techniques in neonatal anesthesia for complex congenital conditions [1].

INTRODUCTION

Neural tube defects (NTDs) result from the failure of neural tube closure during embryogenesis, leading to congenital anomalies such as meningomyelocele, the most severe form of spina bifida [2]. While NTDs are more common in the lumbosacral region, cervical meningomyelocele is extremely rare, accounting for less than 5% of cases. The presence of meningeal herniation and spinal cord involvement poses significant challenges for neurosurgical correction and anesthetic management [3].

The primary anesthetic concerns in these neonates include difficult airway management, restricted neck mobility, and perioperative respiratory instability. Additionally, neonates have immature thermoregulation and metabolic systems, increasing the risk of hypothermia and hypoglycemia during surgery [4]. Early surgical repair is indicated to prevent infection, cerebrospinal fluid (CSF) leakage, and neurological deterioration, but requires meticulous anesthetic planning [5].

This case report describes the anesthetic considerations in a 5-day-old neonate undergoing cervical meningomyelocele repair, focusing on airway management strategies, intraoperative ventilation, temperature regulation, and postoperative ventilatory support.

Case Presentation

A 5-day-old term male neonate birth weight was (2.78 kg) was born via normal vaginal delivery cried immediately after birth with an Apgar score of 9 no NICU admissions . The neonate is presented with a 6×6 cm soft, non-pulsatile mass at the nape of the neck, covered with intact skin. Neurological examination revealed normal limb movements, no motor deficits, and no hydrocephalus. Preoperative MRI confirmed a cervical meningomyelocele without brainstem herniation or associated anomalies [6].

Given the posterior cervical mass baby was planned for surgical excision, significant airway management difficulties were anticipated, including restricted neck extension and difficult intubation. A detailed anesthetic plan was formulated, emphasizing airway management, intraoperative stability, and postoperative ventilatory strategies.

Anesthetic Management

The operating room (OR) was pre-warmed to prevent neonatal hypothermia, and an overhead warmer and warming mattress were used intraoperatively. Standard neonatal monitoring included - Electrocardiography (ECG), Non-invasive blood pressure (NIBP), Pulse oximetry (SpO_2), End-tidal CO_2 ($ETCO_2$) monitoring via capnography. A 24G IV cannula was secured, and 10% dextrose Intravenous infusion was administered to maintain euglycemia [7].

The presence of a large posterior cervical swelling posed a significant intubation challenge. A ramp position was created using two folded towels under the shoulders, allowing the cervical swelling to rest in the gap while optimizing airway alignment [8].

Induction was performed with sevoflurane in oxygen, followed by IV fentanyl (1 µg/kg) for analgesia and rocuronium (0.6 mg/kg) for muscle relaxation. Direct laryngoscopy using a Miller size 0 blade was attempted, and a 2.5 mm cuffed endotracheal tube (ETT) was successfully inserted. Correct placement was confirmed by capnography and auscultation [9].

Once the neonate was securely intubated using a ramp positioning technique and proper airway management was achieved, intraoperative management focused on maintaining physiological stability and optimizing surgical conditions during the four-hour procedure[9]. The neonate was ventilated using volume-controlled ventilation with a tidal volume of 20 mL and a respiratory rate of 30 breaths per minute, while the fraction of inspired oxygen (FiO_2) was maintained at 28% to ensure adequate. Hemodynamic parameters were continuously monitored; the heart rate remained stable at approximately 150 beats per minute, blood pressure was maintained around 69/45 mmHg, and oxygen saturation (SpO_2) stayed at 100% throughout the surgery.[5]

Sevoflurane was used for maintenance of anesthesia, providing a stable and controllable depth of anesthesia throughout the procedure. Intermittent boluses of intravenous fentanyl (0.5 µg/kg) were administered to ensure adequate analgesia. The use of sevoflurane, with its rapid onset and offset, was particularly beneficial for managing the delicate physiology of the neonate while allowing for swift adjustments to anesthetic depth as needed.

Recognizing the neonate's high susceptibility to heat loss, the operating room was pre-warmed, and a warming mattress and overhead warming lights were employed to maintain normothermia. All intravenous fluids, including maintenance fluids with 10% dextrose, were pre-warmed and carefully administered to prevent hypoglycemia and maintain a stable fluid balance[8]. Fluid administration was meticulously titrated based on the neonate's urine output, which was monitored to ensure a minimum output of 1 mL/kg per hour. Blood loss during the surgery was minimal, recorded at less than 10 mL, and was managed effectively with appropriate fluid replacement.

Additionally, neuromuscular blockade was monitored to ensure that the effects of ataracurium (administered at 0.1 mg/kg for muscle relaxation) were appropriately titrated, thereby minimizing residual paralysis postoperatively[3]. The combination of precise ventilation settings, rigorous temperature and fluid management, and continuous hemodynamic monitoring helped maintain intraoperative stability and set the stage for a smooth transition to postoperative care.

POSTOPERATIVE MANAGEMENT

Due to the risk of airway edema and prolonged surgical duration, the decision was made to continue elective postoperative ventilation. The neonate was transferred to the NICU on synchronized intermittent mandatory ventilation (SIMV) with an FiO_2 of 40%.

Following the successful surgical repair of the cervical meningomyelocele, the neonate was transferred to the Neonatal Intensive Care Unit (NICU) for meticulous postoperative monitoring. Given the prolonged surgical duration, potential airway edema, and the risk of respiratory compromise, elective mechanical ventilation was continued in the immediate postoperative period. The neonate was placed on synchronized intermittent mandatory ventilation (SIMV) with careful weaning planned over the next 12 to 24 hours. Sedation was maintained using intermittent doses of fentanyl to ensure patient comfort while avoiding excessive respiratory depression.

Airway patency was a primary concern due to the prolonged intubation, possible airway edema, and limited cervical mobility. A leak test was performed prior to extubation to assess the risk of post-extubation stridor. Additionally, humidified oxygen therapy and nebulized epinephrine were readily available in case of airway edema. The neonate was extubated uneventfully on postoperative day 1, showing adequate respiratory effort and stable oxygenation. Continuous SpO_2 monitoring was maintained, and the infant was supported with nasal cannula oxygen therapy for an additional 6 hours post-extubation to ensure respiratory stability.

The surgical site was regularly assessed for signs of infection, CSF leakage, or dehiscence. Prophylactic antibiotics (ampicillin and gentamicin) were continued for 48 hours postoperatively to minimize the risk of surgical site infections and meningitis. A sterile dressing was maintained over the incision. Serial ultrasound scans were performed to monitor for any postoperative hydrocephalus.

Postoperative analgesia was provided via IV paracetamol (15 mg/kg). The neonate was closely monitored for signs of respiratory distress, airway edema, and neurological deterioration. Blood gas analysis remained stable, and extubation was performed on postoperative day one following confirmation of spontaneous breathing and normal blood gases [5]. The neonate was discharged from the NICU 3 days later without complications.

DISCUSSION

Cervical meningomyelocele presents unique anesthetic challenges, particularly in airway management. The Difficult Airway Society (DAS) Guidelines recommend a stepwise approach, including preoxygenation, preparation for failed intubation, and early consideration of fiberoptic intubation [7]. In neonates with restricted neck mobility, video laryngoscopy or fiberoptic intubation may be preferred; however, in this case, ramp positioning with direct laryngoscopy was successful[11].

Neonates are highly susceptible to hypothermia, requiring active warming strategies during surgery [8]. Similarly, immature glucose metabolism necessitates careful glucose monitoring to prevent hypoglycemia-related complications [9].

Neonatal intensive care environments pose a significant risk of infections due to immature immune function, prolonged hospital stays, and medical device use. One of the key concerns in neonates undergoing major surgical procedures, such as meningomyelocele repair, is the potential for biofilm formation on invasive medical devices like endotracheal tubes, central venous catheters, and surgical implants.Biofilm-associated infections are notoriously resistant to conventional antibiotics and contribute to increased morbidity and prolonged hospital stays in neonates [13].

The decision to continue postoperative ventilation was guided by concerns about airway edema and prolonged surgical duration, aligning with current recommendations for neonatal neurosurgical patients [10].

CONCLUSION

This case highlights the importance of advanced airway management techniques in neonates with cervical anomalies. Successful intubation was achieved using ramp positioning, while elective postoperative ventilation ensured a smooth recovery. A multidisciplinary approach is essential for optimizing anesthetic and surgical outcomes in neonatal neurosurgical procedures.

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