CASE REPORT

Continuous Caudal Epidural Anesthesia as the Primary Anesthetic Technique for Prolonged Neonatal Abdominal Surgery: a Case Report

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Abstract

Background

Caudal epidural anesthesia is one of the most commonly used regional anesthetic techniques in pediatric practice. However, reports describing continuous caudal epidural anesthesia as the primary anesthetic technique for prolonged neonatal upper abdominal surgery remain scarce. We report the successful use of continuous caudal epidural anesthesia combined with intravenous sedation in a neonate undergoing a 3.5-hour upper abdominal operation.

Case Presentation

A 25-day-old male neonate weighing 2.5 kg presented with duodenal obstruction, intestinal malrotation, annular pancreas, and pulmonary infection. Because of the patient's pulmonary infection, immature respiratory physiology, and the potential risks associated with general anesthesia, continuous caudal epidural anesthesia combined with intravenous sedation was selected as the primary anesthetic technique.

After intravenous sedation with ketamine, a 22-gauge catheter was inserted through the sacral hiatus into the caudal epidural space. Following negative aspiration, 3 mL of 0.25% bupivacaine was administered. The patient subsequently underwent Roux-en-Y duodenojejunostomy and Ladd procedure. Approximately three hours later, regression of the block was managed with an additional 2.5 mL of 1% lidocaine through the epidural catheter.

The operation lasted approximately 3.5 hours and was completed without conversion to general anesthesia. Oxygen saturation remained above 90% throughout the procedure, and hemodynamic parameters remained stable. No respiratory complications, neurological deficits, local anesthetic toxicity, or catheter-related complications were observed. The patient was discharged on postoperative day seven without complications.

Conclusion

Continuous caudal epidural anesthesia combined with intravenous sedation provided effective anesthesia for prolonged neonatal upper abdominal surgery while avoiding routine endotracheal intubation. This technique may represent a practical alternative for selected neonatal patients, particularly in resource-limited settings.

Keywords: Neonate; Continuous caudal epidural anesthesia; Upper abdominal surgery; Bupivacaine; Lidocaine

Introduction

Neonatal anesthesia remains challenging because of physiological immaturity and increased susceptibility to respiratory and cardiovascular instability. General anesthesia is commonly employed for major abdominal surgery but frequently requires endotracheal intubation and mechanical ventilation. In neonates with pulmonary disease, airway manipulation may increase perioperative respiratory complications[1,2].

Caudal epidural anesthesia is among the most frequently performed regional anesthetic techniques in pediatric practice because of its simplicity, safety profile, and effectiveness in providing surgical anesthesia and analgesia. It has been widely used for pediatric abdominal surgical procedures and postoperative pain management. However, reports describing continuous caudal epidural anesthesia as the primary anesthetic technique for prolonged neonatal abdominal surgery remain scarce[3–6].

Continuous caudal catheterization offers the potential advantages of prolonged anesthesia, reduced systemic anesthetic requirements, preservation of spontaneous respiration, and improved perioperative comfort[5,6]. These advantages may be particularly valuable in resource-limited settings where anesthetic drugs and equipment are not always readily available[7].

To the best of our knowledge, no previous report from Malawi has described the use of continuous caudal epidural anesthesia as the primary anesthetic technique for prolonged neonatal upper abdominal surgery. We report a successful case involving a neonate undergoing a 3.5-hour upper abdominal procedure.

Case Presentation

A 25-day-old male neonate weighing 2.5 kg was admitted to Mzuzu Central Hospital, Malawi, with a diagnosis of duodenal obstruction, intestinal malrotation, annular pancreas, and pulmonary infection. The patient was classified as ASA physical status III because of pulmonary infection and underlying gastrointestinal pathology.

Following multidisciplinary evaluation, surgical correction

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consisting of Roux-en-Y duodenojejunostomy combined with a Ladd procedure was planned. Given the patient's pulmonary infection, immature neonatal respiratory physiology, and the potential risks associated with general anesthesia, including postoperative respiratory deterioration, prolonged mechanical ventilation, delayed extubation, and ventilator-associated pulmonary complications, continuous caudal epidural anesthesia combined with intravenous sedation was selected as the primary anesthetic technique. This approach was intended to preserve spontaneous respiration, minimize airway intervention, and reduce perioperative respiratory risk.

After arrival in the operating room, intravenous access was established and standard monitoring was applied, including electrocardiography, non-invasive blood pressure monitoring, and pulse oximetry. Atropine (0.01 mg/kg) was administered intravenously, followed by ketamine (2 mg/kg) for sedation.

Once adequate sedation had been achieved, the patient was positioned laterally and the sacral hiatus was identified. Under aseptic conditions, a 22-gauge intravenous catheter was inserted through the sacral hiatus into the caudal epidural space and advanced several centimeters cephalad through the sacral canal. After confirming negative aspiration for blood, 3 mL of 0.25% bupivacaine was injected through the catheter. The catheter was connected to an extension tube and secured carefully to prevent displacement.

Supplemental oxygen was administered via nasal cannula at a flow rate of 2 L/min throughout the procedure. Sedation was maintained with ketamine and propofol infusion.

Approximately three hours after the initial caudal injection, mild body movement was observed, indicating regression of the anesthetic block. Because the operation was nearing completion and catheter migration could not be completely excluded, an additional 2.5 mL of 1% lidocaine was administered through the epidural catheter. Lidocaine was selected instead of additional bupivacaine to reduce the risk of local anesthetic systemic toxicity and potential cardiotoxicity associated with inadvertent intravascular administration of bupivacaine[8,9].

The surgical procedure was completed successfully without conversion to general anesthesia. Total operative duration was approximately 3.5 hours. Oxygen saturation remained above 90% throughout the procedure, and blood pressure remained within the normal range for age.

Postoperatively, spontaneous movement of both lower extremities returned within one hour, indicating resolution of the neuraxial block. No respiratory complications, neurological deficits, signs of local anesthetic toxicity, or catheter-related complications were observed. The patient recovered uneventfully and was discharged on postoperative day seven.

Discussion

This case demonstrates the feasibility of continuous caudal epidural anesthesia as the primary anesthetic technique for prolonged neonatal abdominal surgery. Successful completion of a 3.5-hour upper abdominal operation without tracheal intubation or conversion to general anesthesia highlights the potential utility of this technique in carefully selected neonatal patients.

Several factors influenced the choice of anesthetic management in this case. The patient had a documented pulmonary infection, making avoidance of airway manipulation desirable. Endotracheal intubation and mechanical ventilation may increase the risk of perioperative respiratory complications in neonates with pre-existing pulmonary disease[1,2,10]. By combining continuous caudal epidural anesthesia with intravenous sedation, satisfactory surgical conditions were achieved while preserving spontaneous respiration throughout the procedure. Oxygen saturation remained above 90% during surgery, and no respiratory complications were observed postoperatively.

A notable feature of this case was the ability of continuous caudal epidural anesthesia to provide adequate surgical anesthesia for a prolonged upper abdominal procedure. Although caudal epidural anesthesia is widely used in pediatric anesthesia, it is most commonly reported for infraumbilical surgery and postoperative analgesia[3–6]. Reports describing its use as the primary anesthetic technique for prolonged neonatal upper abdominal surgery remain uncommon. In the present case, advancement of the catheter several centimeters cephalad through the sacral canal likely facilitated more extensive cranial spread of local anesthetic, allowing satisfactory anesthesia for Roux-en-Y duodenojejunostomy and Ladd procedure lasting approximately 3.5 hours.

Another important aspect of this case was the sequential use of bupivacaine and lidocaine. Initial anesthesia was established with 0.25% bupivacaine because of its prolonged duration of action and ability to provide stable intraoperative anesthesia. Approximately three hours after the initial injection, mild body movement suggested regression of the block. At that stage, the operation was approaching completion. Because prolonged surgery increases the possibility of catheter migration and because inadvertent intravascular administration of bupivacaine may result in severe cardiotoxicity, particularly in neonates[8,9], an additional dose of bupivacaine was intentionally avoided. Instead, 1% lidocaine was administered through the catheter. Given the relatively short remaining operative time, lidocaine provided an acceptable balance between efficacy and safety while minimizing concerns regarding potential bupivacaine-related cardiac toxicity.

Continuous caudal epidural anesthesia may reduce systemic anesthetic requirements and contribute to early postoperative comfort[5,6]. Stable hemodynamic conditions were maintained throughout the procedure, and spontaneous lower-extremity movement returned within one hour after surgery, suggesting complete resolution of the neuraxial block without neurological sequelae.

Several technical considerations should be emphasized. Secure fixation of the catheter is essential during lengthy procedures to prevent displacement and block failure. Aspiration should be performed before every injection to reduce the risk of inadvertent intravascular administration[8,9,11]. Furthermore, because neonatal skin is extremely delicate, padding should be placed between the catheter connector and the skin to prevent pressure-related injury.

This case also has implications for anesthetic practice in resource-limited settings. In many low- and middle-income countries, shortages of volatile anesthetics, airway equipment, and postoperative intensive care resources remain common. Continuous caudal epidural anesthesia may reduce dependence on these resources while still providing effective surgical anesthesia[7].

To the best of our knowledge, this represents the first

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reported case from Malawi describing continuous caudal epidural anesthesia as the primary anesthetic technique for prolonged neonatal upper abdominal surgery. Moreover, published reports describing successful use of continuous caudal epidural anesthesia as the primary anesthetic technique for neonatal upper abdominal surgery lasting more than three hours remain scarce. The present case therefore adds to the growing evidence supporting the feasibility of advanced regional anesthesia techniques in neonatal surgical care.

Declarations

This case report was prepared in accordance with the CARE Guidelines. Written informed consent for treatment and publication was obtained from the patient's legal guardian. According to local institutional policy, formal ethics committee approval was not required for publication of a single anonymized case report. No external funding was received. The authors declare no competing interests. All authors reviewed and approved the final version of the manuscript.

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