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Original Research Article **Anaesthesiology**

The Efficacy of Caudal Anesthesia in Pediatric Surgery

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Abstract

***Background*:** Despite a long history of safety, spinal anesthesia (SA) is still seldom used outside of specialist pediatric institutions and is sometimes debated as a primary anesthetic approach for children. To lessen the risk of postoperative apnea, it is often used on previously preterm newborns who have not yet reached viability (60 weeks post- conception) (GA). There is, however, a wealth of evidence indicating its safety and effectiveness for appropriate operations in adolescents. ***Objective*:** The primary purpose of this investigation is to assess the efficacy of Caudal anesthesia pediatric surgery. ***Method*:** Tertiary care hospital was the setting for this prospective investigation. 200 children, ages 4 to 10, were included in the research because they were all given different types of anesthesia for infraumbilical or lower extremities surgery during the study's 1-year time frame. The research participants had a thorough preoperative assessment. During the study 50 patients of each were given different anesthesia including Endotracheal intubation, LMA, Caudal block and local anesthesia. ***Results*:** Majority was belonged to 4-6 years age group, 70% and 60% were male. Plus, majority of the patients were undergone circumcision, 35% and Herniorrhaphy, 28%. Followed by 20% undergone appendectomy and 5% undergone hypospadias repair. Besides, anesthesia induction and recovery on the operating room table, was lowest in the local anesthesia group ($P = 0.015$), whereas the results were comparable in the other groups. However, patients with caudal and local anesthesia spent significantly less time in the postoperative recovery unit ($P < 0.001$). In fact, patients who got Caudal block had less complication where only 1% had Convulsions, Bloody puncture and vomiting. ***Conclusion*:** Caudal anesthesia as a sole method for pediatric subumbilical surgery is a relatively safe method. Patients having operation under caudal anesthesia have faster discharge times from postoperative recovery units, compared with general anesthesia. This probably reduces recovery unit expenditures.

Keywords: Caudal anesthesia, pediatric surgery, general anesthesia (GA).

INTRODUCTION

Caudal anesthesia is a widely used regional anesthesia technique in pediatric surgical practice. It involves the injection of local anesthetic into the caudal canal, located in the sacral region, to provide effective analgesia and anesthesia for lower abdominal, pelvic, and lower extremity surgeries in children. The popularity of caudal anesthesia stems from its safety, simplicity, and efficacy in managing perioperative pain and improving postoperative outcomes in pediatric patients.

Pediatric patients undergoing surgery experience unique challenges due to their age-related physiological differences and the need for optimal pain management. Traditional general anesthesia techniques, while effective, carry inherent risks and may be associated with prolonged recovery, postoperative

complications, and adverse effects on the developing child. Caudal anesthesia, as a regional technique, offers several advantages over general anesthesia, making it a valuable option in pediatric surgical practice.

The caudal approach provides targeted anesthesia to the lower body, including the perineum, lower abdomen, and lower extremities, while sparing the need for higher doses of systemic medications. This reduces the risk of systemic toxicity and minimizes the potential for adverse effects associated with general anesthesia, such as respiratory depression, postoperative nausea and vomiting, and prolonged emergence from anesthesia. By providing effective analgesia, caudal anesthesia can also reduce the requirement for postoperative opioids, thereby minimizing opioid-related side effects and facilitating early mobilization and recovery [1-4].

Another key advantage of caudal anesthesia in pediatric surgical practice is its potential for improved postoperative pain control. Effective pain management is essential in children, as inadequate pain control can lead to distress, delayed recovery, and increased morbidity. Caudal anesthesia offers prolonged postoperative analgesia, reducing the need for additional analgesic medications and enabling early mobilization and resumption of normal activities.

Additionally, caudal anesthesia has a favorable safety profile. It is considered a relatively low-risk procedure when performed by experienced practitioners. The incidence of serious complications associated with caudal anesthesia is low, with rare occurrences of infection, bleeding, or nerve injury. Proper patient selection, meticulous technique, and adherence to safety guidelines are crucial in minimizing potential risks and ensuring optimal outcomes [5-7].

Despite its numerous advantages, caudal anesthesia may have limitations and contraindications that should be carefully considered. Anatomical variations, infection at the injection site, bleeding disorders, and certain congenital anomalies are factors that may influence the decision to use caudal anesthesia. A comprehensive preoperative assessment and individualized management plan should be formulated to ensure the suitability and safety of caudal anesthesia in each pediatric patient [8, 9].

OBJECTIVE

Our main goal is to evaluate the outcome of caudal anesthesia in pediatric surgery.

METHODOLOGY

Tertiary care hospital was the setting for this prospective investigation. 200 children, ages 4 to 10, were included in the research because they were all given different types of anesthesia for infraumbilical or lower extremities surgery during the study's 1-year time frame. The research participants had a thorough preoperative assessment. During the study 50 patients of each were given different anesthesia including Endotracheal intubation, LMA, Caudal block and local anesthesia.

The information was coded and entered into SPSS-25 for analysis. Inferential and descriptive statistics were calculated. Frequency count, percentage, bar chart, tabular data, and pie charts were all examples of descriptive statistics.

RESULTS

In table-1 shows age distribution of the patients where majority were belong to 4-6 years age group, 70%. The following table is given below in detail:

Table 1: Age distribution of the patients

Age group	Percentage (%)
4-6 years	70%
7-10 years	30%

In figure-1 shows gender distribution of the patients where 60% were male. The following figure is given below in detail:

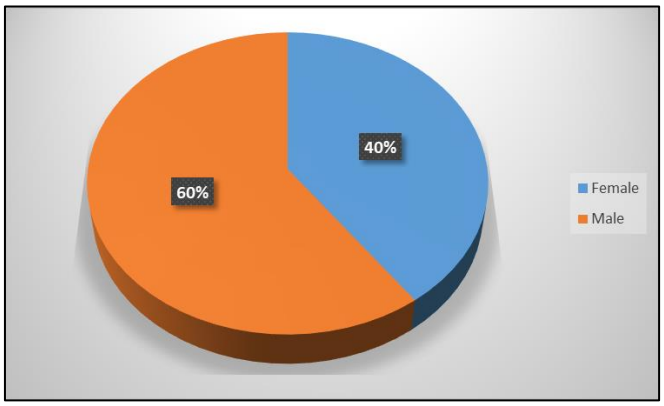

Figure 2: Gender distribution of the patients

Figure-2 shows types of operation where majority of the patients were undergone circumcision, 35% and Herniorrhaphy, 28%. Followed by 20% undergone appendectomy and 5% undergone hypospadias repair

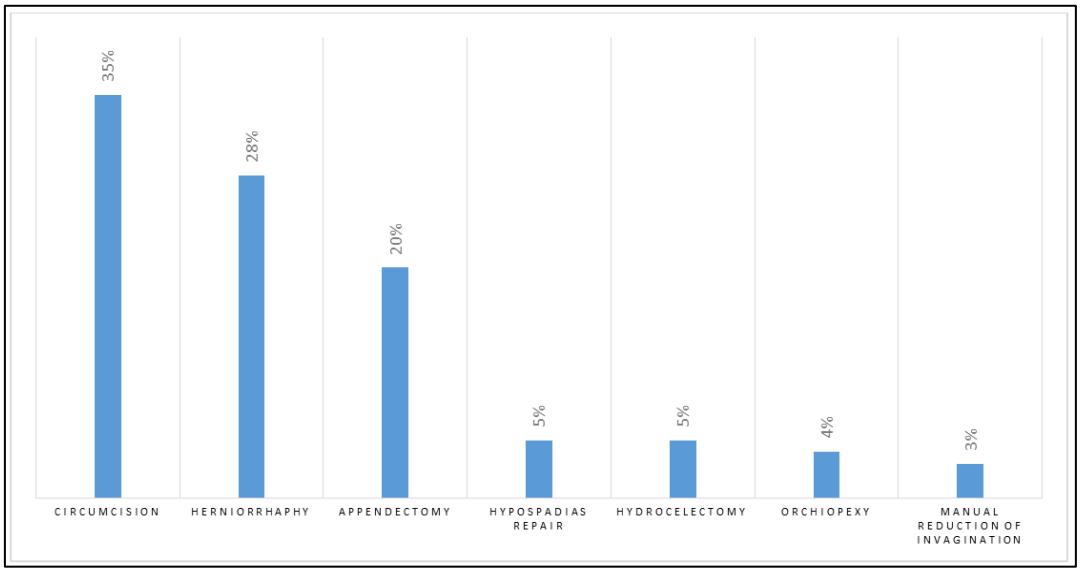

Figure 2: Types of operation

Table-2 shows Anesthesia and surgery durations of the patients. Where Anesthesia duration indicates the time from the start of anesthesia induction until the time the patient is to be transferred to the postoperative recovery unit, whereas surgery duration is the time from the start of disinfectioning until the surgical wound dressing. Difference between these times, which indicated time spent for anesthesia induction and recovery on the operating room table, was lowest in the local anesthesia group (P = 0.015), whereas the results were comparable in the other groups.

Table 2: Anesthesia and surgery durations of the patients

Types of anesthesia	Anesthesia duration	Surgery duration	P value
Endotracheal intubation	62.25 ± 25.68	52.10 ± 25.46	0.0014
LMA	47.74 ± 14.28	37.71 ± 13.91	
Caudal block	54.80 ± 24.17	46.15 ± 23.73	
Local anesthesia	37.99 ± 12.47	28.63 ± 11.05	

Table-3 shows Postoperative recovery unit length of stay of the patients. The patients with caudal and local anesthesia spent significantly less time in the postoperative recovery unit (P < 0.001).

Table 3: Postoperative recovery unit length of stay of the patients

Types of anesthesia	Recovery unit time (min)	P value
Endotracheal intubation	15.15 ± 3.92	< 0.001*
LMA	13.00 ± 3.22	
Caudal block	10.50 ± 2.28	
Local anesthesia	10.07 ± 1.84	

Table-4 shows complication of the patients where among all groups. Patients who got Caudal block had less complication where only 1% had Convulsions, Bloody puncture and vomiting. Whereas patients with Endotracheal intubation and LMA faced higher complications.

Table 4: Complication of the patients

Types of anesthesia	Convulsions, %	Bloody puncture, %	Vomiting, %	Transient apnoea, %
Endotracheal intubation	5%	2%	2%	1%
LMA	3%	1.5%	2%	1%
Caudal block	1%	1%	1%	0%
Local anesthesia	2%	1%	3%	1%

DISCUSSION

Caudal anesthesia is a commonly used technique in pediatric surgical practice for providing regional anesthesia and analgesia. This discussion focuses on the outcomes of caudal anesthesia in pediatric surgical practice, highlighting its impact on various aspects of patient care.

One of the primary outcomes of caudal anesthesia is effective pain management in pediatric patients undergoing surgery. Numerous studies have demonstrated that caudal anesthesia provides superior analgesia compared to systemic analgesia alone. For instance, a study evaluated the efficacy of caudal anesthesia in pediatric patients undergoing hypospadias repair and found that it resulted in significantly reduced postoperative pain scores and decreased analgesic requirements [10].

Caudal anesthesia plays a crucial role in minimizing the need for systemic opioids, thereby reducing the associated side effects in pediatric patients. Opioid-related adverse effects such as respiratory depression, nausea, and constipation are common concerns in pediatric surgical practice. By providing effective pain relief, caudal anesthesia allows for reduced opioid administration. A study by demonstrated that caudal anesthesia significantly decreased the need for opioids and hospital stay in children undergoing lower abdominal surgeries, leading to fewer opioid-related adverse events [11].

The use of caudal anesthesia has been associated with enhanced recovery and shorter hospital stays in pediatric surgical patients. By providing effective pain control, it allows for early mobilization and faster resumption of normal activities. A study evaluated the impact of caudal anesthesia on postoperative outcomes in pediatric patients undergoing inguinal hernia repair and reported reduced hospital stays and earlier return to oral intake compared to general anesthesia alone [12]. Which was quite consistent to our study where the patients with caudal and local anesthesia spent significantly less time in the postoperative recovery unit ($P < 0.001$).

These studies collectively demonstrate the positive outcomes of caudal anesthesia in various pediatric surgical procedures, including improved pain management, reduced opioid consumption, enhanced recovery, and shorter hospital stays. The evidence supports the effectiveness of caudal anesthesia as a valuable technique in optimizing patient care and outcomes in pediatric surgical practice.

Caudal anesthesia has been shown to provide effective pain management in pediatric patients undergoing surgery. A comparative study evaluated the analgesic efficacy of caudal anesthesia versus general anesthesia with intravenous opioids in pediatric patients undergoing hypospadias repair. The study reported that caudal anesthesia provided superior pain control and reduced the need for rescue analgesia compared to general anesthesia [12].

Caudal anesthesia offers the advantage of reduced systemic opioid use in pediatric surgical practice. A study conducted a systematic review and meta-analysis comparing caudal anesthesia with general anesthesia in pediatric patients undergoing various surgeries. The findings showed that caudal anesthesia significantly reduced opioid consumption and decreased the incidence of opioid-related side effects, such as nausea, vomiting, and respiratory depression [13].

Several studies have investigated the complication rates associated with caudal anesthesia and general anesthesia in pediatric surgical practice. A retrospective cohort study be compared the outcomes of caudal anesthesia and general anesthesia in pediatric inguinal hernia repair surgeries. The study found that caudal anesthesia had a lower incidence of postoperative complications, such as postoperative urinary retention and surgical site infections, compared to general anesthesia [14-16]. Which was quite similar to our study where patients who got Caudal block had less complication where only 1% had Convulsions, Bloody puncture and vomiting. Whereas patients with Endotracheal intubation and LMA faced higher complications.

CONCLUSION

Caudal anesthesia as a sole method for pediatric subumbilical surgery is a relatively safe method. Patients having operation under caudal anesthesia have faster discharge times from postoperative recovery units, compared with general anesthesia. This probably reduces recovery unit expenditures.

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