Journal of the
Bahrain Medical Society

ORIGINAL RESEARCH

Comparing Postoperative Analgesia of Caudal and Penile Blockade using Bupivacaine in Children Undergoing Hypospadias Repair

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Received date: December 12, 2022; **Accepted date:** February 19 , 2023; **Published date:** June 30, 2023

Abstract

Background & Objectives: Caudal epidural and dorsal nerve penile blockade are commonly used for analgesia during and after hypospadias repair in children. Comparative studies to recommend the most effective block are in dearth. This study aims to compare penile block versus caudal block with bupivacaine for hypospadias repair in children in terms of post-operative effectiveness, pain management, and complications.

Methodology: The study was conducted on 60 male children, aged 1-9 years, undergoing hypospadias surgery under general anesthesia. The subjects were randomly divided into two groups: (A: caudal block, n=30, and B: penile block, n=30). A postoperative pain assessment was conducted using FLACC scale until 24 hours post-surgery.

Results: The patients from the A and B groups were comparable in age, weight, and ASA classification. All patients in the 2 groups did not feel pain post-operatively throughout the first 6 hours. One patient (3.4%) from each of the A and B groups started to feel pain 6 hours, and 9 hours, respectively after surgery. Eight patients (26.7%) in group A and 6 patients (20%) in group B felt pain throughout 6 to 24 hours after surgery. Four patients from group A and 1 patient from group B developed nausea and vomiting during the first 24 hours post-surgery.

Conclusion: The penile blockade proved to be more effective in lowering postoperative pain scores, with fewer side effects, thereby decreasing the need for rescue analgesia.

Keywords: Caudal block, Bupivacaine, Caudal epidural, Hypospadias repair, Penile block

Introduction

Hypospadias is an anatomical congenital malformation of the male external genitalia. It is characterized by abnormal development of the urethral fold and the ventral foreskin of the penis leading to abnormal positioning of the urethral opening. The abnormal opening can form anywhere from just below the end of the penis to the scrotum.

There are different degrees of hypospadias;varying from minor to severe. Though pain after surgery

has been a neglected topic until recently, nowadays pain-free surgery has become an important aspect of care that includes even paediatric patients.[1] Perioperative pain relief in children can be provided either by the use of various opioids or analgesics during a conventional general anaesthetic or by employing various regional nerve block techniques.

Penile block has been widely and effectively used for various types of penile surgeries including circumcisions and reconstructive procedures.[2] Moreover, due to the recent improvements in composition, dosage and concentration of local anaesthetics, caudal anaesthesia has become one of the most used and accepted regional blocks for children undergoing hypospadias repair and other penile procedures. However, the caudal block has been found to be associated with some issues after distal hypospadias repair, depending upon adequate analgesia and unimpaired micturition, especially when no suprapubic catheter is in place.[2]

In short, different modalities of the anaesthetic blockade are in use and literatures suggest variable findings regarding the efficacy of these methods.[3,4,5]

A study done in Germany compared caudal anaesthesia (CA) with penile blocks (PB) and concluded that maturation was significantly less impaired in the penile block group than in the caudal anaesthesia group (5/33 versus 15/27; $p<0.05$).[2]

An Indian study comparing penile block with general anaesthesia, operative pain relief, time to first rescue analgesia and time to first feed showed statistically significant differences. The study concluded that penile block was very effective when used along with light sedation for distal penile surgeries of less than 2 hours duration as compared to standard general anaesthesia (GA).[6]

Many early studies have shown that penile block and caudal block provided similar outcomes of pain scores. Beyaz et al.7 showed that caudal block provided similar postoperative analgesic effects without major complications for children under general anaesthesia.

Caudal anaesthesia is the most performed regional anaesthetic technique. According to some investigators, the caudal block has almost replaced the use of penile block and can be used for various infraumbilical surgical procedures in children.[4] The majority of studies on the caudal block are focused on lasting analgesia and reduced side effects.[3,4]

Mahin[8] reported that a caudal block is better in pain management than a penile block, where 27.9% of patients who were given a caudal block developed pain as compared to 51.2% of patients who had a penile block.

With varying opinions and reports on both the anaesthetic methods for penile procedures, it becomes difficult for surgeons to choose a method that may demonstrate to be effective by lowering postoperative pain scores, having fewer side effects, and reducing the need for rescue analgesia. Hence, the present study aimed to compare the caudal block and penile block in children undergoing hypospadias surgery with postoperative pain score, analgesia length, severity, side effects, and the necessity for rescue analgesia. Efforts may shift to choosing one of the techniques between the two as the standard of care in the hospital setup.

Materials and methods

Ethical consideration: this study was approved by the Sudanese Medical Specialization Board Institutional Ethics Committee. Written consent was obtained from the parents of the children before enrolling children in this study.

Study design: A prospective randomized controlled clinical research was conducted among 60 children who underwent surgery for hypospadias repair.

Sample size: The sample size was determined using PASS (PASS 13 software NCSS statistical software Inc., Kaysville, Utah, USA). In each group, 30 patients were included to achieve the power of 80% with a significant level of 0.05 using a two-sided two-sample t-test.

Study area and period: This study was conducted during April to September 2017 at AlRebat University Hospital and Soba University hospital located in Khartoum State, Sudan

Inclusion criteria: Male children aged (1 – 9 years), ASA (I or II), and body weight up to (25 Kg) were included in this study.

Exclusion criteria: Parental unwillingness, ASA physical status III and IV, history of developmental delay of milestones or mental retardation, Children with pre-existing neurological or spinal disease, neuromuscular disorders, cardio-respiratory or other systemic diseases, bleeding diathesis, infection at the site of block, abnormalities of sacrum, allergy to local anaesthetics were excluded from this study.

Procedure: All patients underwent general anaesthesia for the surgery, anaesthesia induced either by intravenous anaesthetic (Ketamine, Propofol) or inhalation anaesthetic (Halothane). After intubation, an inhalation agent (halothane, isoflurane) was used for the maintenance of anaesthesia. All patients were monitored intraoperatively with 3led ECG, non-invasive blood pressure, and peripheral pulse oximeter.

Children were assigned randomly into two groups; Group A (n=30): children who underwent caudal block using 0.25% bupivacaine, 0.5ml/kg before skin incision, while, Group B (n=30): children who underwent penile block using 0.25% bupivacaine, 0.1 ml/kg at the end of the procedure and ensured that it should not interfere with the plane of dissection. The vital signs and pain scores were recorded in an hourly basis for the first three hours and then every 3 hours for the rest of the 24 hours.

The postoperative pain was evaluated by FLACC (face, legs, activity, crying, and consolability) pain scale.

Statistical analysis

Continuous variables were presented as mean and standard deviation, and discrete variables were presented as frequencies and percentages. T-test and chi-square were used to assess differences between the two groups. A P-value less than 0.05 was considered statistically significant. All analyses were done using SPSS Statistics for Windows, version 25.0 (IBM Corp., Armonk, NY).

Results

The patient's ages ranged from 1 – 9 years, their weights ranged from 4 – 25 kg. All patients had an ASA of either 1 or 2. Baseline characteristics for the two groups are shown in (Table 1).

Respiratory rate, heart rate, systolic blood pressure, diastolic blood pressure, and side effects were all slightly lower in the dorsal penile group, with no statistical significance (Table 2).

Four patients (13.3%) of the caudal group had nausea and vomiting as a side effect, and only 1 (3.3%) of the dorsal penile group had such side effect. Figure 1 and 2 illustrate the differences in RR, HR, SBP, and DBP, among the two groups throughout the first 24 hours.

In the caudal group, 8 patients experienced pain (6 mild and 2 moderate) in the first 24 hours.. In the dorsal penile group, 6 patients experienced pain (5 mild and 1 moderate) where the difference was not statistically significant. None of the patients experienced severe pain. Those who felt mild pain received oral paracetamol/ibuprofen as rescue analgesia and those who felt moderate pain received a diclofenac injection.

The shortest onset of pain for the caudal group was at the 6th hour, while for the dorsal penile group, it was at the 9th hour. (Figure 3)

Table 1: Baseline characteristics for the two groups.

	Group A: Caudal (n=30)		Group B: Dorsal Penile (n=30)	
	Mean	SD	Mean	SD
Age(years)	3.5	1.75	3.7	1.96
Weight (Kg)	14.8	5.06	15	5.8
ASA	1.1	0.03	1	0.18

Table 2: Outcome comparison between caudal blockade and dorsal penile nerve blockade.

	Caudal (n=30)		Dorsal Penile (n=30)		P-value
	Mean	**SD**	**Mean**	**SD**	
Respiratory Rate	21	1.7	20	0.9	.097
Heart Rate	91.5	4.2	91.4	4	.925
Systolic Blood Pressure	96.1	3.2	94.5	3.3	.291
Diastolic Blood Pressure	58	0.9	56.8	1.8	.074
	Frequency	**%**	**Frequency**	**%**	**P-value**
FLACC Score					
Mild (1-3)	6	20%	5	16.7%	>0.05
Moderate (4-6)	2	6.7%	1	3.3%	
Side effects (nausea and vomiting)	4	13.3%	1	3.3%	.353

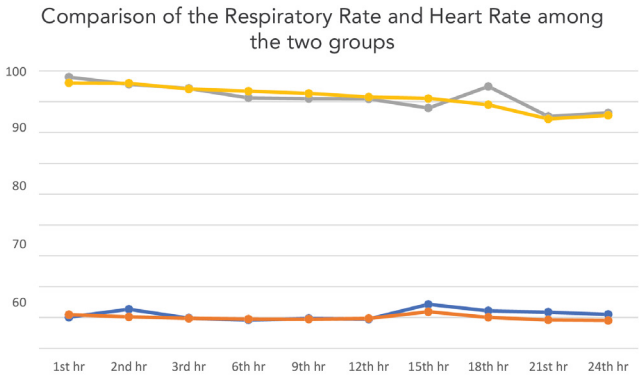

Figure 1: Respiratory rate and heart rate throughout the first 24 hours

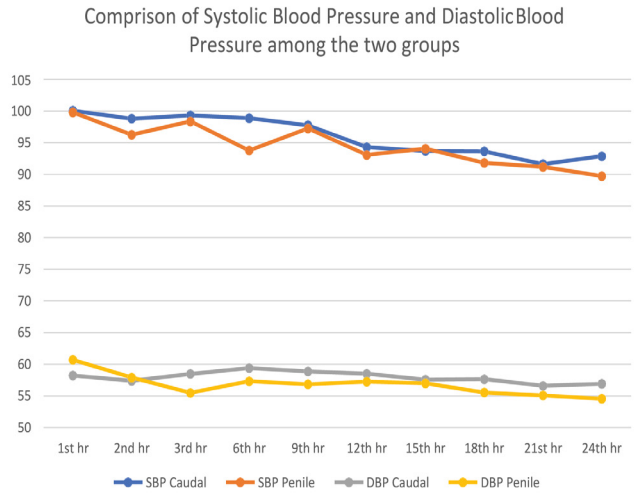

Figure 2: Systolic blood pressure and diastolic blood pressure throughout the first 24 hours

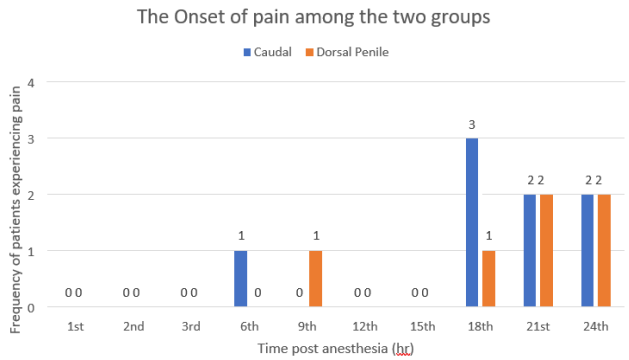

Figure 3: Onset of pain among the two groups

Discussion

This prospective study evaluated the analgesic effect of the caudal blockade and penile nerve block techniques in the first 24 hours post-surgery in children who underwent hypospadias repair. Although in both groups none of the patients felt pain for the first 6 hours after surgery, in the next 6 to 24 hours more patients from caudal blockade experienced pain as compared to the penile blockade. Similarly, more patients with caudal blockade suffered from side effects like nausea and vomiting during the first 24 hours post-surgery. In both groups, no patient suffered severe pain, and rescue algesia was given for mild and moderate pain. Collectively, the present results demonstrated that penile nerve block anaesthesia is more effective than caudal blockade with respect to pain management and reducing side effects in patients undergoing surgery for hypospadias. The results of the present study is at par with that of Kandra[8] who

reported the penile block provided better analgesia that lasted for a significantly long duration (82 hours) when compared with a caudal epidural in children undergoing primary hypospadias repair using a visual analogue scale (VAS) score.

In this study, the patient population was homogenous and was comparable with respect to the mean age, mean weight, and mean ASA, as a significant difference was not observed between the two groups.

In this study, there were no technical difficulties or major complications encountered during the surgery, indicating both blocks were performed successfully. After successful blocks, postoperative analgesia could be provided for more than 24 hours as it resulted in 46 patients (76.6%) in this study. None of the patients from either caudal block or penile block experienced pain for the first 6 hours after surgery, demonstrating similar pain scores for the initial period using 0.25% bupivacaine (0.5ml/kg), and 0.25% bupivacaine, (0.1 ml/kg), respectively. Weksler *et al*.[10] reported a similar analgesic efficacy of penile and caudal block using 1 ml/kg 0.25% bupivacaine among 100 children undergoing circumcision. However, Seyedhejazi *et. al*[4] evaluated the analgesic efficacy between caudal and penile blocks using bupivacaine 0.25%, 1 ml/kg (max 20 ml), and bupivacaine 0.5%, 0.1 ml/kg (max 2.5 ml), respectively and they reported a high success rate with no complication with caudal block as compared to penile block. The discrepancy could be attributed to the difference between the concentration and dose of the anaesthesia agent and the patient receiving a preoperative drug for the induction of anaesthesia. Other studies found similar postoperative pain scores for the initial 6 hours in both caudal block and penile block techniques using different analgesic agents.[7,11,12]

There were no post-operative major complications or neurological sequelae encountered in this study, except 4 patients from the caudal group and 1 patient from the penile group developed nausea and vomiting, while other studies have reported major complications after caudal and penile blocks.[11,12,13,14] In other studies, minor complications with low frequency are reported in patients who had the penile blockade, such as edema in 15.87%,15 hematoma in 4.8%, vomiting in 6.4%, and edema in 12.4%.[16]

A caudal blockade is the most performed regional anaesthetic method in children undergoing lower extremity surgical procedures including Hypospadias.[17] Penile blockade is a simple, effective, and easy-to-learn technique,[18,19] and also provides prolonged pain relief for up to 24 hours,[20] and it requires a lower number of procedures to achieve high success rates.[21] While Beyaz *et al*.[7] reported that both caudal and penile block procedures have similar postoperative analgesic effects with minor complications in children under general anaesthesia. Available literature shows controversy between the effectiveness of these two techniques, making it difficult for surgeons to choose one over the other in terms of suitability. To develop strong evidence about the effectiveness, more clinical trials should be conducted with big sample sizes and competent methodology.

In this study, our data show a penile block is a more effective anaesthetic technique than the caudal block technique in children who underwent surgical procedures for hypospadias. Our findings are in line with previous reports,[18-23] however, in contrast to the other reports where reported caudal is a better anaesthetic method than penile.[17,24- 26] The discrepancy in the results could be attributed to differences in the variables and statistical methods, pain assessment tools e.g. Face, Legs, Activity, Crying, and Consolability (FLACC), visual analog scale (VAS) score, nonuniformity in the mode of induction (e.g. inhalation versus intravenous), type of analgesic reagent (e.g. ketamine, fentanyl), dose concentration and patients age (e.g. very young children cannot explain the reason of cry and amplitude of pain), moreover the scoring tools are observational. To note, the literature is also,[21,27-28] Altogether, the literature evidence demonstrates that both the caudal and penile techniques have their own limitations and effectiveness in a specific clinical setup. But more important is that still, the pain is there and therefore future need is to develop a painless technique to relieve the children from post - surgery pain.

In the present study, the blood pressure and heart

rate were stable during the operation ensuring successful blocks in both techniques. Post-surgery, the heart and respiratory rates were stable in both groups with no significant difference. In both groups, mild and moderate rescue analgesia was required but a greater number of patients were from the caudal group than the penile group for rescue analgesia.

Limitations

A major limitation of this study is that the postoperative follow-up did not include a sedation score. Moreover, the patients received different drugs during the induction of anesthesia (ketamine and halothane) that interfered with the efficacy of the postoperative analgesia, and was not considered in this study. The FLACC tool which was used for the measurement of pain score was an observational tool having limited power.

Conclusion

The penile block appeared to be more efficient in lowering postoperative pain scores and delaying pain onset, decreasing the need for rescue analgesia, and lowering the side effects. Considering this fact, a penile block could be preferred for surgical procedures of hypospadias repair in children to get effective postoperative analgesia.

Source of funding

This study was not funded by internal or external funding sources.

Conflict of interest

None declared

Acknowledgments

The author would like to thank Dr. Sharada Sawant for writing and reviewing the manuscript and Ms. Shaima Alaamer from BDF-RMS, Bahrain for the statistical analysis of this study. We would also like to thank the language translation agency; Infinity Plus from Manama, Bahrain for language and grammar editing.

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