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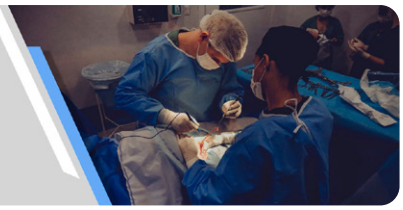

Comparison between the Caudal Block and Other Methods of Postoperative Pain Relief in Children Undergoing Circumcision: A Prospective Randomized Study.

Zeana A. Gawe[1*], Hasan M. Isa[2], Zania Abdulsattar[3,1], Fayza Haider[4], Enjy E. Khedr[5], Eslam M. Khalifa[6]

Abstract

Background: Caudal block (CB), dorsal nerve penile block (DPNB), and systemic opioids are common techniques used in pediatric surgeries to provide analgesia for penile surgery such as circumcision. This study aimed to compare the effectiveness of the CB with other methods of postoperative pain release.

Methods: This prospective, randomized, case-controlled trial was conducted in the main pediatric operation theater and post-anesthesia recovery unit (PACU). Successive children aged 3 months to 3 years who had American Society of Anesthesiologists Physical Status classification I and had undergone elective circumcision surgery were recruited. Children were randomized to one of 3 groups, CB (Group A), systemic opioids (Group B), or DPNB (Group C). Patients were injected with 0.75 to 1 mL/kg 0.25% bupivacaine in group A, fentanyl 1-3 µg/kg in group B, and 0.3 mL/kg 0.25% bupivacaine in group C. The need for analgesia and parental satisfaction were assessed during the first 6 hours postoperatively. The Face, Leg, Activity, and Cry Consolability (FLACC) pain scale and behaviors were used to observe and compare the three groups.

Results: Participants' heart rate was higher among group C, while it was the lowest in group A during the observation period ($P<0.05$). High pain, crying, movement, agitation, and posture scales were observed among group C followed by group B, while group A showed the lowest scores. Patients who received penile block had expressed a longer time to achieve the "relaxed and comfortable" status but with no significant difference with the other two groups. Moreover, types of regional block were mainly the significant predictor of pain scale at 5, 10, 20, 30, and 60 minutes post-operative.

Conclusions: For postoperative pain management, the study has shown that CB is proven to produce higher levels of analgesia and a longer period of pain release compared to penile block, even if both methods help relieve pain during pediatric surgical procedures.

Keywords: Caudal; Pediatric; Penile block; Opioids; Circumcision; Postoperative analgesia

Introduction

The surgical approach, the patient's characteristics, and the duration of surgery are some of the elements that affect the choice of anesthesia or pain

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management strategies in pediatric surgery [1] Caudal block (CB) and dorsal nerve penile block (DPNB) are frequently chosen because they provide efficient pain management with fewer side effects.[1,2] Opioids, yet, might be chosen in some circumstances, such as if the surgery is expected to go longer or if the patient is unable to tolerate regional anesthetic. To ensure safe and effective pain management before and after surgery, anesthesiologists and surgeons have to carefully evaluate the most appropriate anesthetic and analgesic procedures for each patient.[3,4] The CB involves the injection of a local anesthetic into the sacral canal, blocking the spinal nerves responsible for carrying the pain signals from the lower abdomen, perineum, and genital organs.[5,6] Penile block, on the other hand, involves the injection of a local anesthetic around the base of the penis, blocking the dorsal nerve responsible for carrying the pain signals from the penis.[5,6] Although both techniques are effective,6 studies have shown that CB provides a higher level of analgesia and a longer duration of pain relief compared to penile block. [1,3,5,7] In addition, opioids, belong to a class of analgesics, they act by attaching to opioid receptors in the brain and spinal cord. For relief of pain, they are frequently utilized in a variety of surgical procedures and can be given intravenously, and in intramuscular injections. Although opioids are considered highly effective in pain control, they can lead to several adverse effects, such as nausea, vertigo, and respiratory depression, some of which can be dangerous[3,7-9]. According to a study published in 2021 in the International Journal of Surgery Open Access comparing CB and DPNB, CB provided longer and more effective analgesia compared to other methods of postoperative pain management.[1,2] Patients who received opioids as medication supplements to control the pain reflex from surgery that led to tachycardia and hypertension might have undesirable effects such as respiratory depression, executive nausea and vomiting, and vertigo.[2,3] This study aimed to compare the effectiveness of CB with DPNB and systemic opioids in terms of intra- and post-operative pain management in pediatric patients undergoing circumcision surgeries in Bahrain.

Methods

This study followed the guidelines laid down in the Declaration of Helsinki of 1975, and as revised in Edinburgh 2000. This study was ethically approved by the Research and Research Ethics Committee Government Hospitals, Salmaniya Medical Complex (SMC), Kingdom of Bahrain, institution review board (IRB) approval number: 70130623, The trial was registered prior to patient enrollment at clinicaltrials.gov (Unique Protocol ID: 70130623, NCT06086106, Principal investigator: Zeana A. Gawe, Date of registration 30/08/2023), After obtaining approval from the IRB, informed written consent was obtained from the parents of the 90 boys, aged from 3 months up to 3 years who were scheduled to undergo circumcision surgery. The inclusion criteria were patients with an ASA Physical Status Classification I with normal levels of liver enzymes. Exclusion criteria were a history of allergic reactions to local anesthetics, bleeding diatheses, coagulopathy, infection at the injection site, spinal abnormality, penile abnormalities, and neuromuscular disorders.11 Participants' allocation is described in Figure 1.

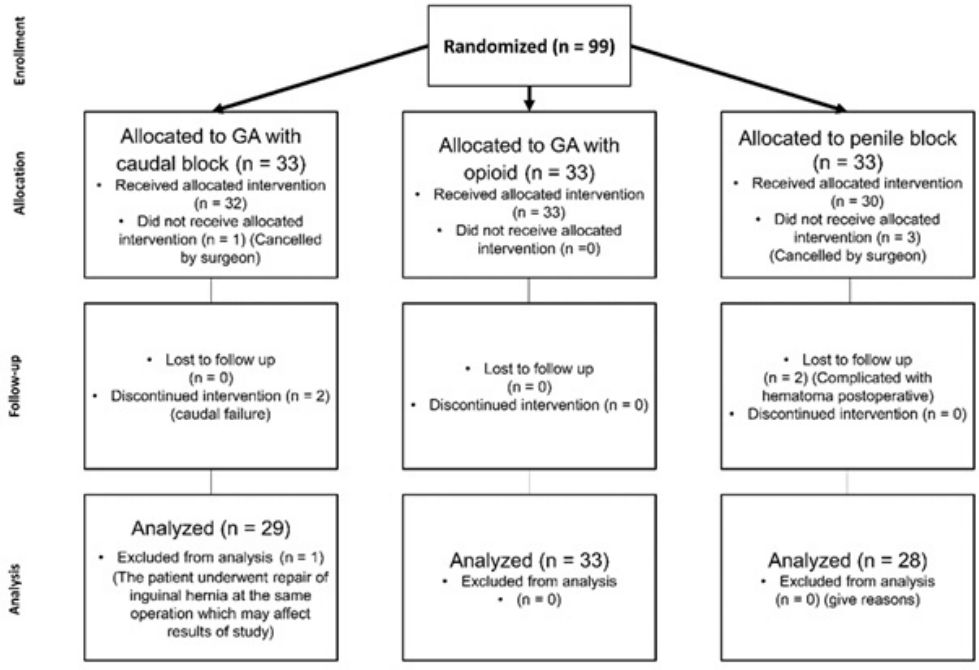

Figure 1: Allocation of subjects according to the CONSORT 2010 flow diagram.

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This study complies with the guidelines prescribed by the Consolidated Standards of Reporting Trials (CONSORT) checklist and was recruited over 4 months between May 2023 and the end of August 2023. This is a prospective, randomized, case-controlled observational study with a sample size of 90 male patients. The patients were divided into three groups, caudal block (group A), systemic opioids (group B), and dorsal penial block (group C). All patients had operations and were compared based on hemodynamic stability, pain scores, level of sedation, and analgesia need. In the post-anesthesia recovery unit (PACU), the patients were observed by an anesthesiologist who was blinded to the patient groups, followed up with the patients along with data recording in addition to observing the development of any complications. At the beginning of surgery inside the pediatric operation theater, the demographic data for all patients had been recorded such as age, height, and weight. In addition, the time of completing the administration of the CB and DPNB, the time needed to perform the block, and the time of the incision plus the surgery duration were also recorded. In the anesthesia chart, all patients in the 3 groups received general anesthesia and inhalation anesthetics with sevoflurane gas. The goal of delivering inhaled anesthetics is to produce the anesthetic state by establishing a specific concentration of anesthetic molecules in the central nervous system (CNS). Any increase in the concentration of sevoflurane has been noted and recorded during surgery. Mean arterial blood pressure, heart rate, respiratory rate, and oxygen saturation were observed systematically (using an electrocardiogram and pulse oximeter) and were recorded at a single point of time preoperatively (baseline), after incision, and postoperatively in the recovery room. All children in the 3 groups had an inhalation induction using sevoflurane 8% and oxygen 100% with a facemask induction of anesthesia for 2 to 4 minutes before having an intravenous (IV) cannula inserted. The sevoflurane concentration was reduced after the CB and DPNB were administrated and kept there until the surgery was finished. The airway was managed with a laryngeal mask airway (LMA). Sevoflurane was utilized at a low dose (0.5%–0.9%) to compare the efficacy of the different methods that have been used in this study and to define the required supplement of opioid doses that were used to relieve the pain. The patients were randomly selected to determine the type of anesthesia that we used for the research.

Caudal Block Blind Technique

The caudal block involves the injection of a local anesthetic bupivacaine dose of 0.75 to 1 mL/kg the maximum volume was 10 mL with 0.25% concentration into the caudal epidural space, targeting the sacral nerve roots to provide a highly effect and long-duration of analgesia and a safer surgical experience.8-11 It provides effective pain relief by blocking the transmission of pain signals. This technique is particularly advantageous for neonatal circumcisions, as it ensures a pain-free surgical experience, minimizing the potential adverse effects of pain and stress on infants. This technique can provide pain relief for up to several hours after the procedure and its performance is introduced via a landmark-based, blind technique. and performed by anesthesiologists. After aseptic preparation of the skin, a 2.5 cm A 22–25-gauge hypodermic needle (GE Datex Ohmeda, USA) was inserted at a right angle position to the skin until it pierced the sacrococcygeal ligament; the needle was then redirected at about 25° before being advanced to a depth of about 2 to 3 mm into the sacral canal while monitoring respiratory and hemodynamic variables. The vital signs and the important hemodynamic variables were recorded during and after the procedure. In group C, the procedure will be performed by administering a DPNB by a pediatric surgeon to relieve the pain post-operatively.

Dorsal Penile Block Anatomy and Technique

DPNB is used in children and adults for surgical procedures of the glans and shaft of the penis. The dorsal nerves (terminal branches of the pudendal nerve; sacral nerves S2–S4) lie bilaterally on the outer aspect of the dorsal arteries of the penis. From the base of the penis, the nerves are divided several times and encircle the shaft of the penis before reaching the glans. This block is often performed as a circumferential infiltration of the root of the penis (ring block). Two skin wheals are raised at the dorsal base of the penis, one on each side just below and medial to the pubic spine. A 25-gauge, 37.5-mm needle is introduced on each side, and the bupivacaine (1 to 1.5 mL) maximum dose 2 ml concentration 0.25% for infants is injected superficially and deep along the lower border of the pubic ramus to anesthetize the dorsal nerve. For a complete ring of infiltration, group B will relieve the pain postoperatively by giving systemic opioid analgesics.

Pain Postoperative Assessment

At the end of the surgery, all patients will be shifted to PACU, and the pain scores will be observed and evaluated by an anesthesiologist who is separate from the research or by the nurses without mentioning what type of methods for relieving pain were used.To gather information, a questionnaire consisting of two sections, the first section, demographic characteristics including age, and weight, and the second section consisting of Face, Legs, Activity, Cry, Consolability (FLACC) analgesia scale was used. The scores were observed and recorded during the first 5 min post op then 20 min, 30 min, and 60 min in PACU. FLACC scale is a standard tool to measure pain severity in which pain severity is scored from zero (analgesia) to 10 (maximum pain). This tool assesses pain in pediatric patients, preverbal children, and those who cannot express their pain verbally or accurately and is dependent on the assessment by the researcher based on the criteria of this scale. In this project, zero is analgesia,

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1–3 is for mild pain, 4–6 is for moderate pain, and 7–10 is for severe pain. The validity and reliability of this tool are approved in the study by BMC Pediatrics. The FLACC is also a useful tool for parents to detect pain in their infants young children and toddlers [13,14].

Statistical Analysis

The collected data were recorded then presented and statistically analyzed by computer using SPSS 27.0 for Windows (SPSS Inc., Chicago, IL, USA) and Prism Graphpad version 9.4.1 (Graphpad, San Diego, USA). A test of normality was done using the Kolmogorov-Smirnov test. Kruskal-Wallis test was used to compare between groups for numerical variables, while Chi-square and Fisher's Exact tests were used for categorical variables. Linear regression analysis was used to detect the predictors of pain scale. All tests were two-sided. The accepted level of significance in this work was $P \leq 0.05$. A P-value ≤ 0.01 was considered highly statistically significant and $P > 0.05$ was considered non-statistically significant.

Results

A total of 90 patients participated in this study. The study subjects were classified into 3 main groups. The first group (group A) received general anesthesia with CB including 29 patients. The second group (group B) represented general anesthesia with an opioid group with a total of 33 participants, while the last group (group C) with DPNB included 28 patients. Group B was significantly older in comparison with the other two groups, while group A was the youngest age group as described in Table 1. No significant difference had been observed regarding patients' weight or operation duration among the three groups.

Participants' heart rates are shown in Figure 2.

Group C showed a significantly higher mean heart rate intraoperatively and 5, 10, 20, 30, and 60 minutes postoperatively, while group B showed the lowest mean heart rate in the three groups ($P < 0.005$). The behavioral score is represented in Figure 3 which had been measured at 5, 10, 20, 30, and 60 minutes postoperatively

Table 1: Demographic data of children who underwent circumcision

Variables	Group A (n=29)	Group B (n=33)	Group C (n=28)	*P*-value*	Significant pairs**
	Mean±SD	Mean±SD	Mean±SD		
Age (months)	16.0±7.5	41.8±43.3	16.3±19.7	**0.002**	Group A vs Group B, Group B vs. Group C
Weight (kg)	10.3±2.4	11.3±3.8	9.0±5.1	0.13	
Operation duration (minutes)	14.6±3.5	15.1±4.6	16.3±6.1	0.523	
Sevo MAC	0.5±0.3	2.0±1.6	1.5±0.2	**<0.001**	Group A vs. Group B, Group A vs. Group C
Fentanyl intraoperative	9.9±5.4	22.1±9.1	16.4±5.4	**<0.001**	Group A vs. Group B, Group A vs. Group C, Group B vs. Group C
Fentanyl postoperative	4.8±3.1	10.5±4.6	5.2±2.5	**<0.001**	Group A vs. Group B, Group B vs. Group C

*Kruskal Wallis test, ** Significant Kruskal tests were followed by Bonferroni correction for multiple tests to calculate the adjusted p-value. The accepted level of significance in this work was ($p \leq 0.05$). The Significant p-value is in bold. SD means standard deviation.Sevoflurane molecular alveolar concentration (MAC) consumption was significantly lower in group A in comparison with the other two groups. Fentanyl consumption intra- and post-operative was higher in group B followed by group C, while the lowest level of consumption was among group A patients.

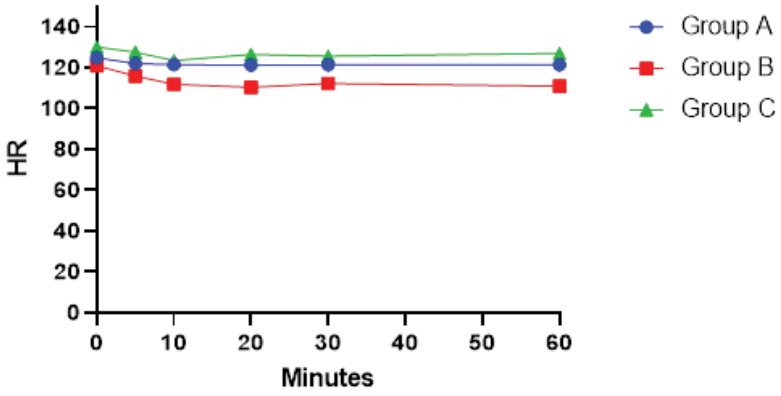

Figure 2: Heart rate (intraoperative, 5, 10, 20, 30, and 60 minutes postoperative) among studied groups

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Group C significantly demonstrated a higher percentage of severe discomfort in comparison with the other two groups at 5, 10, 20, and 30 minutes post-operatively (82.1%, 25.0%, 21.4%, and 3.6%, respectively). The percentage of severe discomfort in group B at 5, 10, 20, and 30 minutes post-operatively was 18.2%, 6.1%, 3.0%, and 0.0%, respectively, while only one patient expressed severe discomfort at 5, 10, and 20 minutes in group A.

The pain scale was much higher among group C, while group A showed the lowest mean pain scale (Figure 4).

Table 2 represents the crying scale (5, 10, 20, 30, and 60 minutes postoperatively) among the studied groups. Group C showed a higher percentage of crying in comparison with the other two groups, however, the relation was non-significant ($P > 0.05$).

The movement scale also was significantly different between the three groups at 5 and 20 minutes post-operatively (Table 3). Similarly, a significant difference had been shown between the 3 groups in the agitation scale at 5, 10, and 30 minutes postoperatively (Table 4).

Table 5 demonstrated a statistically significant difference between the three groups in the posture scale at 5 and 30 minutes post-operatively.

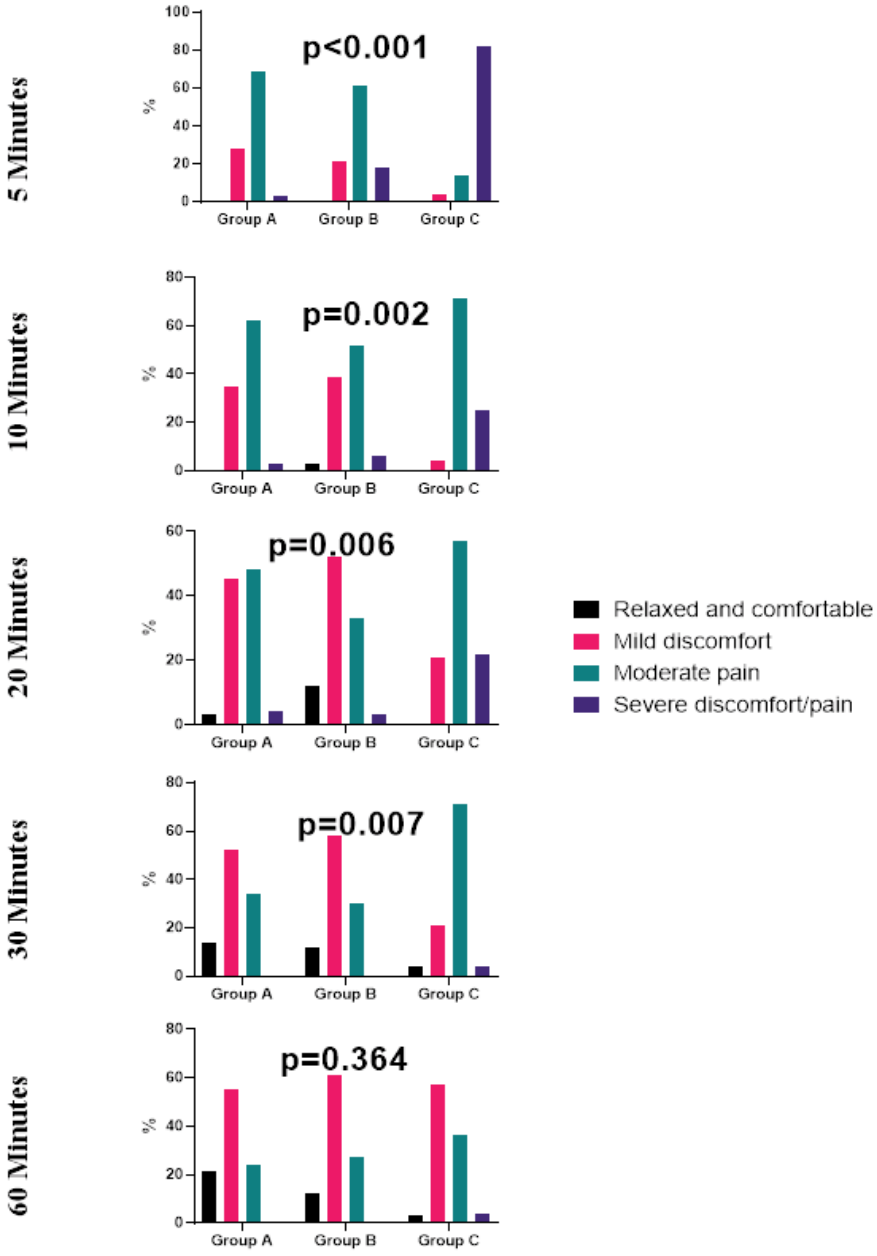

Figure 3: Behavioral score among studied groups. Fisher's exact test was used

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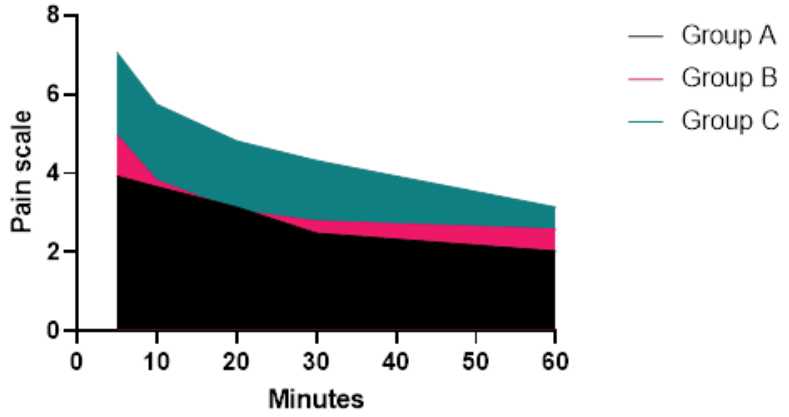

Figure 4: FLACC pain scale among studied groups.

Table 2: Crying, scale (5, 10, 20, 30, 60 minutes postoperative) among studied groups

Variables	Group A (n=29)	Group B (n=33)	Group C (n=28)	*P*-value
	N (%)	N (%)	N (%)	
Crying scale				
5 minutes postoperative				
Not crying	19 (65.5)	19 (57.6)	13 (46.4)	0.344*
Crying but responds to tender Loving care	10 (34.5)	14 (42.4)	15 (53.6)	
10 minutes postoperative				
Not crying	15 (51.7)	17 (51.5)	10 (35.7)	0.375*
Crying but responds to tender Loving care	14 (48.3)	16 (48.5)	18 (64.3)	
20 minutes postoperative				
Not crying	19 (65.5)	16 (48.5)	12 (42.9)	0.200*
Crying but responds to tender Loving care	10 (34.5)	17 (51.5)	16 (57.1)	
30 minutes postoperative				
Not crying	13 (44.8)	15 (45.5)	14 (50.0)	0.912*
Crying but responds to tender Loving care	16 (55.2)	18 (54.5)	14 (50.0)	
60 minutes postoperative				
Not crying	17 (58.6)	19 (57.6)	12 (42.9)	0.407*
Crying but responds to tender Loving care	12 (41.4)	14 (42.4)	16 (57.1)	

Table 3: Movement scale (5, 10, 20, 30, 60 minutes postoperative) among studied groups

Variables	Group A (n=29)	Group B (n=33)	Group C (n=28)	*P*-value
	N (%)	N (%)	N (%)	
5 minutes postoperative				
None	19 (65.5)	24 (72.7)	6 (21.4)	**<0.001***
Restlessness	8 (27.6)	7 (21.2)	6 (21.4)	
Thrashing	2 (6.9)	2 (6.1)	16 (57.1)	
10 minutes postoperative				
None	6 (20.7)	11 (33.3)	4 (14.8)	0.054*
Restlessness	14 (48.3)	6 (18.2)	8 (28.6)	
Thrashing	9 (31.0)	16 (48.5)	16 (57.1)	
20 minutes postoperative				
None	12 (41.4)	7 (21.2)	2 (7.1)	**0.004***
Restlessness	13 (44.8)	19 (57.6)	14 (50.0)	
Thrashing	2 (6.9)	7 (21.2)	12 (42.9)	

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30 minutes postoperative				
None	15 (51.7)	14 (42.4)	6 (21.4)	**0.130****
Restlessness	12 (41.4)	14 (42.4)	15 (53.6)	
Thrashing	2 (6.9)	5 (15.2)	7 (25.0)	
60 minutes postoperative				
None	22 (75.9)	21 (63.6)	14 (50.0)	0.247**
Restlessness	5 (17.5)	8 (24.2)	7 (25.0)	
Thrashing	2 (6.9)	4 (12.1)	7 (25.0)	

*Chi-square test **FET

Table 4: Agitation scale (5, 10, 20, 30, 60 minutes postoperative) among studied groups

Variables	Group A (n=29)	Group B (n=33)	Group C (n=28)	*P*-value
	N (%)	N (%)	N (%)	
5 minutes postoperative				
Asleep	11 (37.9)	7 (21.2)	7 (25.0)	**0.006***
Mild	14 (48.3)	16 (48.5)	5 (17.9)	
Hysterical	4 (13.8)	10 (30.3)	16 (57.1)	
10 minutes postoperative				
Asleep	13 (44.8)	13 (39.4)	2 (7.1)	**<0.001***
Mild	12 (41.4)	9 (27.3)	14 (50.0	
Hysterical	4 (13.8)	11 (33.3)	12 (42.9)	
20 minutes postoperative				
Asleep	10 (34.5)	6 (18.2)	1 (3.6)	0.058**
Mild	15 (51.7)	22 (66.7)	21 (75.0)	
Hysterical	4 (13.8)	5 (15.2)	6 (21.4)	
30 minutes postoperative				
Asleep	12 (41.4)	9 (27.3)	3 (10.7)	**<0.001****
Mild	17 (58.6)	21 (63.6)	16 (57.1)	
Hysterical	0 (0.0)	3 (9.1)	9 (32.1)	
60 minutes postoperative				
Asleep	18 (62.1)	19 (57.6)	17 (60.7)	0.879**
Mild	10 (34.5)	11 (33.3)	8 (28.6)	
Hysterical	1 (4.3)	3 (9.1)	3 (10.7)	

*Chi-square test **FET

Table 5: Posture scale (5, 10, 20, 30, 60 minutes postoperative) among studied groups.

Variables	Group A (n=29)	Group B (n=33)	Group C (n=28)	*P*-value
	N (%)	N (%)	N (%)	
5 minutes postoperative				
No special posture	12 (41.4)	14 (42.4)	2 (7.1)	**0.004***
Flexing legs and thighs	1 (37.9)	12 (36.4)	10 (35.7)	
Holding penis or groin	6 (20.7)	7 (21.2)	16 (57.1)	
10 minutes postoperative				
No special posture	13 (44.8)	14 (42.4)	4 (14.3)	0.118*
Flexing legs and thighs	9 (31.0)	11 (33.3)	14 (50.0)	
Holding penis or groin	7 (24.1)	8 (24.2)	10 (35.7)	
20 minutes postoperative				
No special posture	17 (58.6)	12 (36.4)	6 (21.4)	0.065*
Flexing legs and thighs	8 (27.6)	12 (36.4)	12 (42.9)	
Holding penis or groin	4 (13.8)	9 (27.3)	10 (35.7)	

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30 minutes postoperative				
No special posture	13 (44.8)	9 (27.3)	7 (25.0)	0.013*
Flexing legs and thighs	15 (51.7)	18 (54.5)	10 (35.7)	
Holding penis or groin	1 (3.4)	6 (18.2)	11 (39.3)	
60 minutes postoperative				
No special posture	22 (75.9)	18 (54.5)	14 (50.0)	0.204**
Flexing legs and thighs	6 (20.7)	10 (30.3)	8 (28.6)	
Holding penis or groin	1 (3.4)	5 (15.2)	6 (21.4)	

*Chi-square test **FET

Discussion

The circumcision of children is the most commonly performed surgical procedure in the world. [1-3] Likely, the greatest target for us as anesthesiologists is to control the pain postoperatively. Various techniques are used to manage pain [4-6]. Two of these techniques are CB and DPNB, both considered regional blocks and involve the administration of local anesthesia. Additionally, systemic opioids have shown potential for alleviating postoperative pain. [3,4] This study aimed to explore the benefits and limitations of these techniques and provide insights into their effectiveness and impact on circumcised patients. by evaluating the use of CB, penile block, and opioids, we can recognize their usefulness in promoting safe and painless circumcision surgery. [6,7] The CB technique involves the injection of a local anesthetic Bupivacaine dose of 0.75 to 1 mL/kg with 0.25% concentration into the caudal epidural space, targeting the sacral nerve roots to provide a highly effective and longer duration analgesia and a safer surgical experience. [8-11] It provides effective pain relief by blocking the transmission of pain signals. This technique is particularly advantageous for neonatal circumcisions, as it ensures a pain-free surgical experience, minimizing the potential adverse effects of pain and stress on infants. Moreover, it can provide pain relief for up to several hours after the procedure[7,8]. Furthermore, CB allows for safer anesthesia since it avoids the need for opioids during general anesthesia, mitigating the associated risks. [8-10] On the other hand, penile block offers immediate relief by acting directly at the surgical site. Its localized effect leads to faster recovery. [12,13] This method of pain relief is particularly useful in infants and children who walk and are booked as day-case surgery for early ambulation and discharge. In addition, it avoids the use of opioids during surgery and unwanted side effects such as nausea and vomiting compared to the CB whose effectiveness lasts longer.4-8 Adding to this is the diffusion of the anesthetic agent within the surrounding tissues which may affect sensory and motor functions and cause obstacles or complications.[11,12] While caudal and penile block anesthetics are commonly used, opioids also play a vital role in pain management during circumcision procedures. [3-6] Opioids are systemic narcotic agents administered intravenously to provide analgesia. [9-11]. These medications act on opioid receptors in the central nervous system, blocking pain signals effectively. They offer a broader range of analgesia and are particularly useful when supplemental pain relief is required [2,3]. Nonetheless, the use of opioids must be carefully monitored due to their potential side effects such as respiratory depression, nausea, vomiting, and constipation. [4,8,9] Similar to the findings of this study, according to a study published in the Journal of Anesthesia and Clinical Research which compared the effectiveness of CB and DPNB in providing postoperative analgesia in pediatric patients undergoing penile surgery, the CB was found to be more effective in providing analgesia in pediatric patients undergoing lower abdominal surgeries compared to penile block[1]. In our study, the results showed that patients who underwent CB had significantly lower pain scores compared to patients who received penile block $P < 0.001$. In addition, patients who received caudal block required fewer rescue analgesics, had less nausea and vomiting, and experienced fewer side effects compared to patients who received DPNB. Moreover, the CB was noted to reduce the Sevoflurane MAC consumption significantly in comparison with the other two groups $P < 0.001$. Fentanyl consumption intra- and post-operative was higher in group B followed by group C, while the lowest level of consumption was among group A patients. Another study was published in 2020 by Salama et al, in the Journal of Oxford Academics, which also compared CB to penile block for postoperative analgesia in children undergoing hypospadias repair and showed that FLACC pain scores, the time to first need for analgesia, and the total rescue analgesic requirement were significantly lower in CB compared with DPNB ($P<0.01$ each). However, the postoperative time of ambulation was significantly lower in DPNB compared with CB, $P < 0.05.7$. The current study showed that the CB provided better surgical conditions, making the surgery easier to perform, and reduced FLACC pain scores compared with the DNPB group ($P < 0.01$). Also, the time to first need for analgesia and the total rescue analgesic requirement was significantly lower in the CB group $P < 0.001$ each. Yet, the postoperative time of ambulation was significantly lower than the in DPNB group compared with the CB group ($P < 0.05$). One more

study published in the Journal Anesthesia Essay and Research issued in 2022 showed a better effect of CB on perioperative pain control and reduction of the anesthetic agent in pediatric infra umbilical surgery compared to non-CB anesthesia. It was a prospective randomized trial study that found that patients who received CB intraoperatively as pain control compared to opioids as an analgesic method to relieve the pain intra and postoperatively required fewer hypnotics and sedatives while remaining vitally stable also had a high analgesic efficacy added to produced excellent perioperative effects including early discharge from the recovery room and avoid the side effects due to opioids. The 24th h FLACC mean score was also significantly lower in the CB group compared with opioids without CB, $P < 0.001.8$. In the current study, we observed that the surgeon's tendency is that the DPNB is preferable for children from the age of three years and up, those who walk to avoid the motor block, and early discharge from recovery. Likewise, the result showed that the CB provided denser analgesic and prolonged compared to DNPB making the children more comfortable and calm in PACU post-operation based on the nurse's observation and pain scores scale monitoring. However, further studies are needed to explore the effectiveness of adding various adjuvants to prolong CB duration as clonidine and ketamine dependent on the surgery location and the age of the children[11,12]. In our study, caudal and penile blocks both significantly improve the efficiency and quality of pain management during circumcision procedures. That consecutively reduces opioid doses used intra- and post-operatively. On the other hand, regarding analgesic duration, the CB had a long duration of sedative effective in PACU which was observed according to pain scale observation and behaviors [8,13,18], the agitation was lower in CB compared to DPNB which was noted in children who complained of pain after 20 minutes but this finding was not statistically significant $P <0.058$. We needed to give fentanyl 1 to 2 µg/kg postoperatively for pain release $P = 0.001$. In addition, the crying score was less in CB compared to DPNB during the first 5 to 10 minutes $P = 0.017$. Regarding motor block and movement, it was noted that DPNB has less duration of motor block compared to CB after 20 minutes but this finding was not significant $P = 0.059$. The results also showed that CB had a longer time on micturition versus DPNB because it did not affect the autonomic innervation of the bladder. While CB inhibits the parasympathetic outflow of the spinal cord and that affects somatic efferent and afferent conduction which may affect micturition [10]. The advantages of using regional anesthesia techniques include a reduction in the use of opioids and their related side effects[7-10] Considering the risk points, DPNB can cause a hematoma, opioids can lead to respiratory depression plus nausea and vomiting, while CB can cause delayed micturition, failed block, and cerebrospinal fluid aspiration due to puncture of dura[17]. In our study, no differences were seen between the CB and DNPB in the incidence of nausea and vomiting while two children in the opioids group were complicated with nausea and vomiting (6.7%). Metzelder et al noted that DNPB had less potential urinary retention than CB [15]. Therefore, the CB may be considered the preferred technique for providing prolonged analgesia compared with DPNB in pediatrics, yet this study showed that DPNB provides pain relief and early movement postoperative in children who walk, compared with CB in circumcision surgery. However, CB provides a highly effective and long duration of analgesia, a safer surgical experience, and less consumption of opioids post-operatively [2,11,18]

Conclusion

In conclusion, the present prospective, randomized controlled clinical trial showed that while both CB and DPNB are effective techniques in providing analgesia in pediatric surgeries and have less vomiting and nausea compared to opioids, the CB was shown to provide a higher level of analgesia, a longer duration of pain relief, fewer side effects and a lower requirement for rescue analgesics compared to DPNB. Further studies are still needed to compare CB with other types of regional blocks such as pudendal nerve block.

Declarations

Ethics approval and consent to participate:

This study was ethically approved by the Research Committee for Government Hospitals, Salmaniya Medical Complex, Kingdom of Bahrain (IRB number: 70130623).

Consent for publication: Not applicable.

Conflict of Interest: There are no conflicts of interest

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Authors' Contributions

This manuscript has been read and approved by all the authors, all the requirements for authorship have been met, and each author believes that the manuscript represents honest work.

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References

1. Karami T, Hoshyar H, Tavana AM. Comparing caudal block and penile block using rectal acetaminophen in postoperative analgesia of hypospadias repair: A randomized clinical trial study. Int J Surg Open 29 (2021): 9-13.
2. Cyna AM, Middleton P. Caudal epidural block versus other methods of postoperative pain relief for circumcision in boys. Cochrane Database Syst Rev. 4 (2008): CD003005.
3. Ekstein M, Weinbroum AA, Ben-Chaim J, et al. Comparison of caudal block vs. penile block vs. intravenous fentanyl only in children undergoing penile surgery: A prospective, randomized, double-blind study. Front Pediatr 9 (2021): 654015.
4. Walker BJ, Long JB, Sathyamoorthy M, et al. Complications in pediatric regional anesthesia. Anesth 129 (2018):721-732.
5. Baird R, Guilbault MP, Tessier R, Ansermino JM. A systematic review and meta-analysis of caudal blockade versus alternative analgesic strategies for pediatric inguinal hernia repair. J Pediatr Surg 48 (2013):1077-1085.
6. Sandeman DJ, Reiner D, Dilley AV, et al. A retrospective audit of three different regional anesthetic techniques for circumcision in children. Anaesth Intensive Care 38 (2010): 519-524.
7. Salama HG, Elsersi MH, Shabana TS, et al. Caudal block versus penile block for postoperative analgesia in children undergoing hypospadias repair. QJM: An Int J Med 113 (2020): hcaa052.006.
8. Gawe ZA, Isa HM, Almashaur MM, et al . The effect of caudal anesthesia block on perioperative pain control and reduction of the anesthetic agent in pediatric infraumbilical surgery: A prospective randomized trial study. Anesth Essays Res 16 (2022):301-306.
9. Beyaz SG. Comparison of postoperative analgesic efficacy of caudal block versus dorsal penile nerve block with levobupivacaine for circumcision in children. Korean J Pain 24 (2011): 31-35
10. Grossi P, Urmey WF. Peripheral nerve blocks for anaesthesia and postoperative analgesia. Curr Opin Anaesthesiol 16 (2003):493-501.
11. Naja ZM, Ziade FM, Kamel R, et al. The effectiveness of pudendal nerve block versus caudal block anesthesia for hypospadias in children. Anesth Analges 117 (2013): 14011407.
12. Lichtor JL, Mancini P. Ambulatory anesthesia. In: Barash PG, Cullen BF, editors. Clinical Anesthesia. 8th ed. Philadelphia: Wolters Kluwer Press; 2017.:2438-2448
13. Shamim F, Ullah H, Khan FA. Postoperative pain assessment using four behavioral scales in Pakistani children undergoing elective surgery. Saudi J Anaesth. 9 (2015):174-178.
14. Merkel S, Voepel-Lewis T, Shayevitz JR, et al. The FLACC: A behavioral scale for scoring postoperative pain in young children. J Pediatr Nurs 23 (1997): 293-797.
15. Metzelder ML, Kuebler JF, Glueer S, et al. Penile block is associated with less urinary retention than caudal anesthesia in distal hypospadia repair in children. World J Urol. 28 (2010): 87-91
16. Altaş C, Küçükosman G, Yurtlu BS, et al. Anesthesia methods used by anesthetic specialists for circumcision cases. National survey study for Turkey. Saudi Med J. 38 (2017): 75-81.
17. Kao S-C, Lin C-S. Caudal epidural block: An updated review of anatomy and techniques. BioMed Research International. 2017:1-5.
18. Giaufré E, Dalens B, Gombert A. Epidemiology and morbidity of regional anesthesia in children: a one-year prospective survey of the French-Language Society of Pediatric Anesthesiologists (ADARPEF). Pediatr Anesth 20 (2010): 1061-1069

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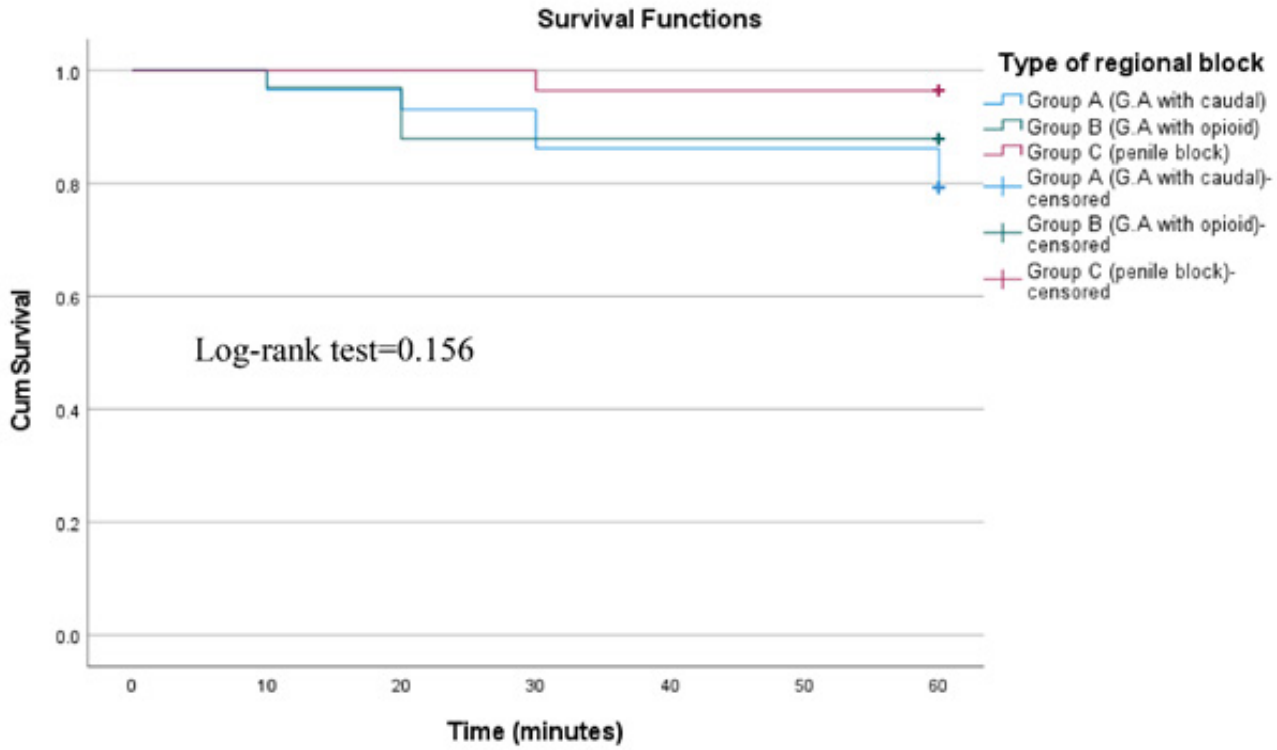

Supplementary Figure 1: Improvement in behavioral outcome for patients according to type of regional block.

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