

**ORIGINAL RESEARCH**

# Comparison of Analgesic Effect of USG Guided Caudal Block Vs USG Guided Penile Block for Children Undergoing Circumcision Surgery

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**ABSTRACT**

**Background and Aim:** Circumcision is one of the oldest surgical procedures, practiced since ancient times. Worldwide, 30% of males undergo circumcision for both medical reasons and religious purposes. Although it is an ancient practice, it can be intimidating for children due to postoperative pain. **Materials and Methods:** The current study was conducted at GMERS Medical Hospital in Junagadh with two groups of children undergoing circumcision. Group A (n=12) received a USG-guided caudal block, while Group B (n=12) received a USG-guided penile block. The analgesic effects were compared using the FLACC score at intervals of 2, 4, 6, 8, 10, 12, 18, and 24 hours. **Results:** Both groups were similar in demographic profiles and surgery duration. The average time to first need for rescue analgesia given was paracetamol 15mg/kg was significantly longer in Group A ( $P < 0.005$ ) compared to Group B. The average heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were similar in both groups at various times. The mean FLACC score for Group A was significantly lower ( $P < 0.05$ ). In Group B, the FLACC score was significantly higher ( $P < 0.05$ ) postoperatively at 8, 10, 12, and 18 hours. **Conclusion:** The analgesic effect for children undergoing circumcision with a USG-guided caudal block lasts longer compared to those receiving a USG-guided penile block.

**Key Words:** Caudal block, Circumcision, FLACC score, USG guided penile block

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**INTRODUCTION**

Pediatric surgical centers frequently perform penile surgeries such as circumcision, circumcision revision, and the correction of penile torsion, chordee, or hypospadias. Pain management strategies include caudal, penile, pudendal, and ring blocks, alongside both opioid and non-opioid systemic analgesics, and topical agents. Despite the critical importance of effective pain control, there is no consensus on the most effective and safe method for managing perioperative pain in these children.<sup>1,2</sup>

There has been a growing trend towards the use of regional anesthesia in pediatric patients, forming a crucial part of both intraoperative and postoperative pain management. Caudal and penile blocks are the most commonly used regional techniques in children, often performed under general anesthesia. These techniques offer effective pain relief with minimal effects on breathing or hemodynamic stability.<sup>3,4</sup> However, they are occasionally associated with

significant complications, particularly in children, and have not consistently shown superiority over systemic analgesia in prospective studies. While regional anesthesia is generally considered safe for children, it is recommended to be used cautiously. Recent retrospective studies have evaluated different analgesic methods in children undergoing penile surgery, but prospective studies that assess outcomes beyond the immediate postoperative period are limited. Thus, it's essential to determine which anesthesia method most effectively provides long-lasting postoperative pain relief and supports enhanced recovery after penile surgery in children.<sup>5,6</sup> Ensuring the effective administration of block in circumcisions in children is crucial. This involves confirming the successful spread of local anesthesia using ultrasound and monitoring the child during the procedure. Whether the circumcision is conducted locally or regionally, continuous monitoring by an anesthesiologist is necessary to address any insufficient

anesthesia.<sup>7</sup> The primary aim of this study is to evaluate the effectiveness of Caudal Block versus Penile Block in children undergoing penile surgery.

## MATERIAL AND METHODS

After obtaining permission from the authorities and written consent from the parents, the study was conducted at GMERS Medical Hospital Junagadh. It involved group A (n=12) children undergoing circumcision surgery with a USG-guided caudal block and group B (n=12) children undergoing the procedure with a USG-guided penile block. The analgesic effects were compared using the FLACC score at intervals of 2, 4, 6, 8, 10, 12, 18 and 24 hours.

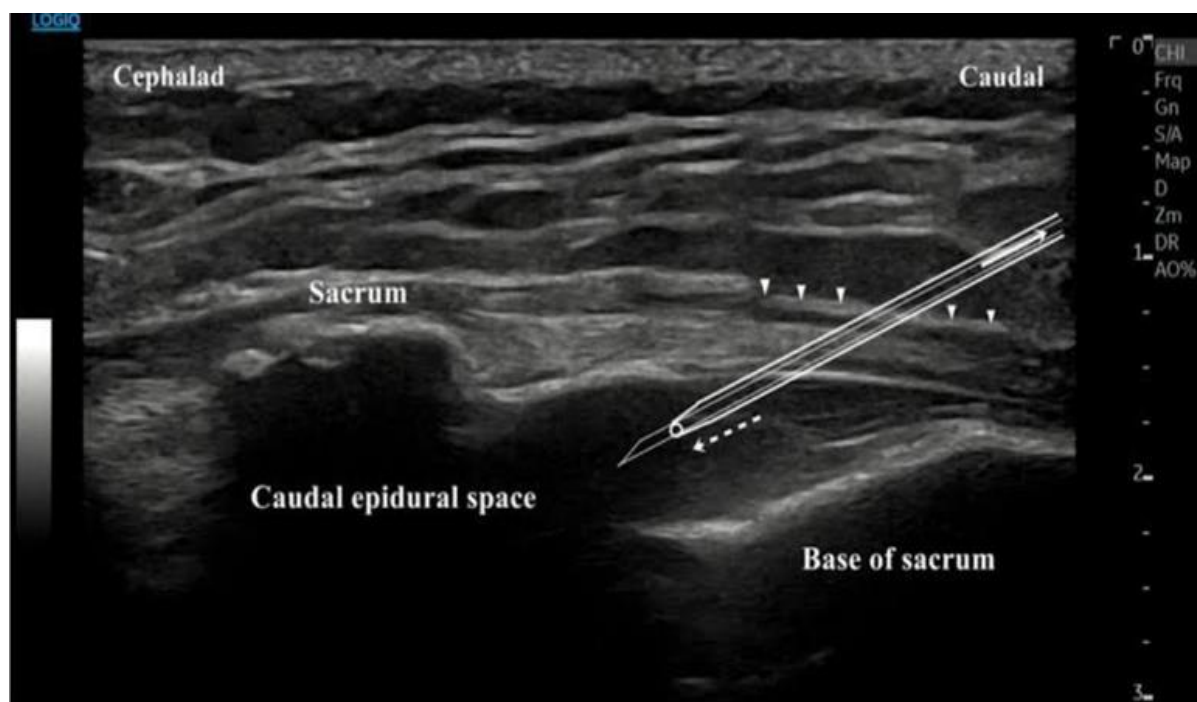
### Study Procedure

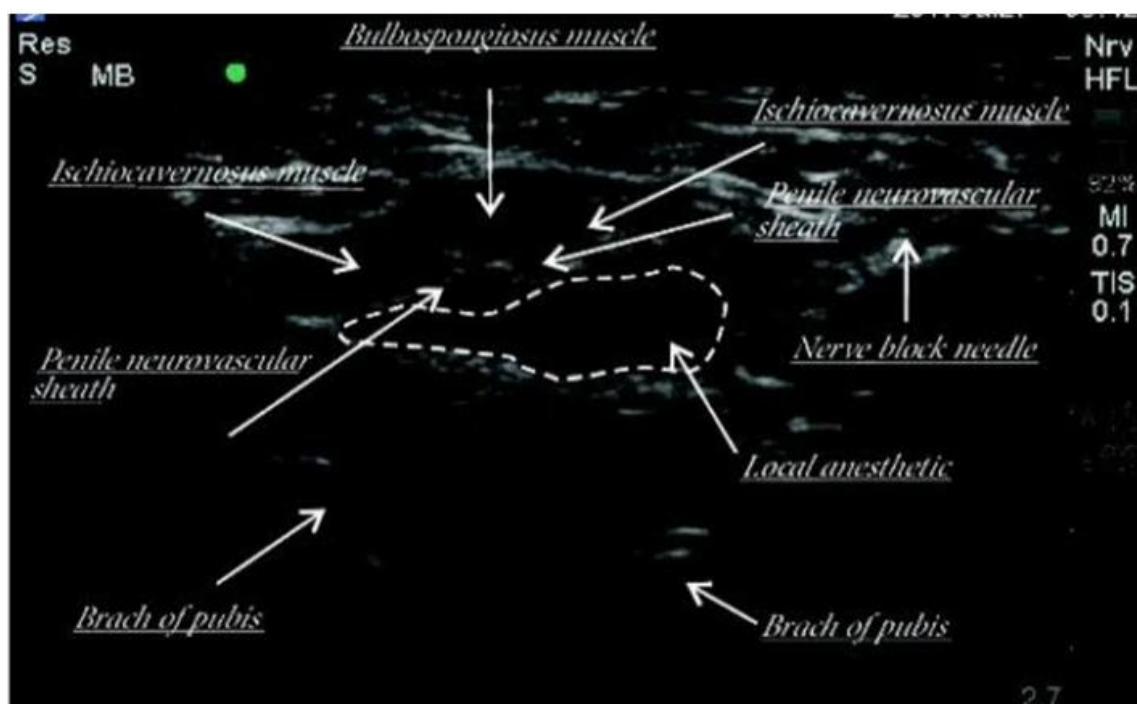
After receiving approval from the institutional ethical committee and informed consent, 24 patients were randomly allocated into two groups. The patients and the anaesthetist assessing the outcomes were blinded to group allocations. Intravenous access was secured, and oxygen was administered via bag and mask to all patients. Both groups received injections of glycopyrrolate 0.04 mg/kg, ondansetron 0.15 mg/kg, ketamine 2 mg/kg, and propofol 2 mg/kg with bag and mask ventilation. Group A was given a USG-guided caudal block, while Group B received a USG-guided penile block in dose of 0.25% bupivacaine 0.8-1ml/kg. Parameters observed during the study included intraoperative heart rate, saturation, blood pressure, and temperature, as well as postoperative heart rate, saturation, blood pressure, temperature, the time taken to achieve maximum sensory block, and postoperative analgesic effects evaluated using the

FLACC score at 2, 4, 6, 8, 10, 12, 18, and 24-hour intervals. The demographic profiles were compared using mean and standard deviation, while discrete data were assessed by numbers and percentages.

For the USG-guided caudal block in Group A, a linear transducer of 10 – 13 MHz was used with sterile gel and a sterile plastic cover. The transducer was applied perpendicular to the caudal canal to scan, with depth settings adjusted to each patient's size. The sacral hiatus was visualized using an in-plane technique at the level of the sacral cornua. At this level, the transducer was rotated 90° to obtain the longitudinal view of the sacrococcygeal ligament and sacral hiatus, then placed between the two cornua. A 22-gauge hypodermic needle 1 inch was advanced toward the upper third of the sacrococcygeal ligament, terminating after penetration. Upon confirming no blood or cerebrospinal fluid in aspiration and a negative test dose, 0.25% bupivacaine was administered in dose of 0.8 -1ml/kg while observing the USG-guided image.

In Group B, using a US-guided technique, a linear ultrasound probe with 5 to 10 MHz was placed transversely along the base of the penis. Real-time ultrasound with an in-plane method was used to identify the corpora cavernosa, dorsal artery and vein, and superficial and deep Buck's fascia. The needle was advanced through Buck's fascia laterally to the dorsal artery, and after negative aspiration, a 0.25% bupivacaine solution was injected at 0.8-1 ml/kg under direct vision, taking care to prevent neurovascular injury or intravascular injection. Post-injection, the spread of the local anesthetic solution was observed as a black hypoechoic area.





The postoperative analgesic effects were compared between the two groups undergoing circumcision according to the FLACC Behavioral Scale. Analgesic effects in children were observed at 2, 4, 6, 8, 10, 12, 18, and 24-hour intervals over the next 24 hours.

### FLACC Behavioral Scale

Categories	Scoring		
	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant frown, clenched jaw, quivering chin
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid, or jerking
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or being talked to, distractable	Difficult to console or comfort
Each of the five categories (F) Face; (L) Legs; (A) Activity; (C) Cry; (C) Consolability is scored from 0-2, which results in a total score between zero and ten.			

### Statistical Analysis

The recorded data was compiled and entered into a spreadsheet program (Microsoft Excel 2019) before being exported to the data editor page of SPSS version 19 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were described using means and standard deviations or medians and interquartile ranges, depending on their distribution. Qualitative variables were presented as counts and percentages. The confidence level and level of significance for all tests were set at 95% and 5%, respectively.

### RESULTS

Twenty-four patients were recruited, and all completed the study. Both groups were comparable regarding their demographic profiles and the duration of surgery (Table 1). The mean time to first rescue

analgesia was significantly longer in Group A ( $P < 0.005$ ) (Table 2). The mean heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were similar between the two groups at various time points. The mean FLACC score for Group A was significantly lower ( $P < 0.05$ ) (Table 2). In contrast, the FLACC score was significantly higher ( $P < 0.05$ ) postoperatively at 8, 10, 12, and 18 hours in Group B. The mean postoperative analgesic consumption in Group A was significantly reduced (Table 2). In Group A, 2 patients did not require any analgesics, and 10 patients needed only one dose of analgesic postoperatively. Where the flacc score was 4 out of 10. In Group B, 11 patients required two doses of analgesic. Where flacc score was 6 and 1 patient needed three doses postoperatively at flacc score of 8 ( $P < 0.01$ ) (Table 2).

**Table 1: Demographic variables and duration of surgery of the participants**

Variable	Group A (n=12) (Mean±SD)	Group B (n=12) (Mean±SD)
Age (years)	4.50±1.22	4.68±1.70
Weight (kg)	19.79±3.90	19.10±5.23
Duration of surgery (min)	58.02±4.47	56.15±4.67

**Table 2: Comparison of postoperative parameters between the two groups**

Variable	Group A (n=12) (Mean±SD)	Group B (n=12) (Mean±SD)	P value
FLACC score	0.68±0.14	1.05±0.47	0.32
Time to first rescue analgesia	20.48±4.12	8.98±3.20	0.05*
Postoperative analgesic (paracetamol) consumption in 24 h (mg)	315.51±54.12	598.47±49.46	0.02*
Number of doses of rescue analgesia – 0/1/2/3, n	2/10/0/0	0/0/11/1	0.001*

\* Indicate statistically significance at  $p \leq 0.05$

### DISCUSSION

Circumcision is commonly performed on children for various religious or cultural purposes. Caudal anaesthesia, topical anaesthesia, and dorsal penile nerve block represent the most frequently utilized techniques for achieving pain relief.<sup>8</sup> The dorsal penile nerve block (DPNB) is a procedure that involves the injection of local anaesthetic agents near the dorsal nerves of the penis. This technique was first introduced in the 1970s.<sup>9</sup> The rates of complications associated with the penile block are minimal. Complications reported encompass swelling, hematoma, or edema; bruising at the injection site; and issues related to the medication.<sup>10</sup> Ultrasound-guided nerve block has been documented in medical literature since 1978.<sup>11</sup> The integration of ultrasound technology in regional anaesthesia has led to notable advancements in the field of pediatric regional anesthesia. Rubin and colleagues demonstrated through their clinical studies that ultrasound-guided blocks offer certain benefits compared to traditional methods in pediatric patients.<sup>12</sup> Ultrasound-guided DPNB offers a detailed two-dimensional assessment of the subpubic region and penile anatomy.

This technique enables the precise advancement of the needle into the subpubic area in real-time, facilitating

visualization of the local anaesthetic solution's effective distribution.

This study compares the US-guided method with the Caudal Block. The FLACC score was employed to assess pain levels and determine the necessity for rescue analgesics. O'Sullivan and colleagues conducted a comparison between the anatomical landmark technique for DPNB and the ultrasound-guided approach.<sup>13</sup> The results of this study indicate that the routine application of ultrasound for performing DPNB in male pediatric circumcision is not justified when compared to the anatomical landmark method. Research indicates that there is no notable difference in fentanyl usage or initial pain scores when comparing the "anatomical landmark" group to the "ultrasound" group.

The findings of this study indicate that the interval before the initial rescue analgesia was extended, while both the FLACC score and the consumption of postoperative analgesics, specifically paracetamol, were reduced with the use of sacral ESPB.<sup>14,15</sup> Research has demonstrated the effectiveness of ESPB at both thoracic and lumbar levels across multiple studies. Bansal et al. evaluated the use of ultrasound-guided sacral erector spinae plane block for postoperative pain management in pediatric patients

undergoing hypospadias repair.<sup>16</sup> Postoperative analgesic consumption was notably reduced in the sacral ESPB group compared to the control group. A recent study conducted by Mermer et al.<sup>17</sup> examined the analgesic impact of sacral ESPB on pain following hemorrhoidectomy in adult patients. Significantly low pain scores and a reduction in tramadol consumption were noted in patients receiving sacral ESPB for up to 24 hours.

In recent years, ultrasound has gained traction as a valuable tool in regional anesthesia, with numerous studies highlighting its advantages over traditional landmark techniques, particularly in pediatric anesthesia. Research indicates that ultrasound can be beneficial not only in pediatric circumcision procedures but also in surgeries involving adult penises. Gurkan's study highlights the pain-relieving benefits of ultrasound-guided dorsal penile nerve block in adult penile surgery.<sup>18</sup> The findings indicated that a US-guided penile block enhanced postoperative pain relief and reduced the need for morphine in adults, aligning with the results of our study. Newborns hold significant relevance in the context of pediatric patients who have undergone circumcision. This patient population presents unique challenges, characterized by their fragility, underdeveloped systems, and varied pain responses. In these patients, the assessment of postoperative and intraoperative pain relies solely on subjective evaluation. The long-term effects of pain on newborns remain unclear. Understanding that the application of ultrasound in children circumcision enhances both postoperative and intraoperative analgesia is crucial for integrating ultrasound into the standard practice of children penile blocks.

The sacral ESPB group and caudal group exhibited no signs of bradycardia or hypotension, with patients maintaining hemodynamic stability throughout the intraoperative period. The study presents certain limitations, including its single-centre design, a relatively small sample size, and the absence of long-term follow-up to evaluate outcomes beyond 24 hours after surgery. The existing body of literature on the application of sacral ESPB in pediatric populations is notably sparse. Consequently, additional trials involving a larger patient population are essential moving forward in this area.

## CONCLUSION

Analgesic effect of children going Circumcision through USG guided caudal block is longer lasting then of children going for Circumcision through USG guided penile block.

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