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Original article:

A randomized controlled trial comparing pudendal block with dorsal penile nerve block for circumcision in children

[1]Kapil Prajapati, [2]Pradyumna Kakodiya, [3]Sanjay Kumar, [4]Pranchil Pandey, [5]Brijesh Tiwari

[1]Senior resident, Department of anesthesiology
Shyam Shah medical college Rewa
[2]Assistant professor, Department of Anesthesiology
NSCB medical college Rewa
[3]Assistant professor, Department of Anesthesiology
United Institute of medical sciences Prayagraj
[4]Senior resident, Department of Anesthesiology
Shyam Shah medical college Rewa
[5]Associate Professor, Department of urology
Shyam Shah medical college Rewa

Corresponding author:
Dr. Pranchil Pandey
Email: tbrijesh38@gmail.com

Abstract:

Introduction:

Topical analgesics, caudal block, and ring block of the penis are a few examples of regional anesthesia that have been utilized during circumcision and have varying degrees of effectiveness. Transient motor block has been linked to caudal block. The dorsal penile nerve block is a successful anesthetic technique, with extended postoperative analgesia, according to earlier investigations [4]. However, it has a 4-6.7% failure rate that has been documented [6].

To compare the analgesic and anesthetic efficacy of bilateral nerve stimulator-guided pudendal nerve block with that of dorsal nerve block for perioperative and postoperative analgesia in children undergoing circumcision, we conducted a prospective randomized controlled clinical trial based on this background

Methods:

A prospective, single-blinded, randomized investigation was carried out from March 2020 to February 2023 with the approval of the institutional review board and the signed agreement of the parents. 50 ASA-1 male children between the ages of 3 and 5 who were scheduled for elective circumcision were included in the study. A pre-existing coagulopathy, an infection at the injection site, and a known allergy to local anesthetic were among the exclusion criteria. One group received a pudendal nerve block, while the other group received a dorsal nerve block. For the first day, pain ratings were taken at various intervals (0, 6 and 12 h, and once per day for the next 5 days). It was measured using the Objective Pain Scale as modified by Hannallah et al. [9].

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Result:

Age, hemodynamic stability, and duration of surgery were comparable across the two groups (Table 1). In the group of patients who had their pudendal nerves blocked, every patient underwent circumcision as planned without requiring any analgesics. 3 patients (12%) in the dorsal nerve block group experienced an incomplete block, necessitating further local infiltration. In the dorsal nerve block group, one patient (4%) had total block failure and underwent general anesthesia (Table 2).

In conclusion, as compared to the dorsal nerve block, the guided pudendal nerve block method has been shown to be more precise and successful in circumcising children.

Keywords: circumscision; pudendal nerve block; dorsal nerve block

Introduction:

The most frequent surgical treatment performed on young male patients worldwide is circumcision [1, 2]. It is a surgery that has sparked a great deal of research, and several anesthetic and analgesic procedures have been studied to reduce complications and pain [3]. Male circumcision has been performed using a variety of anesthetic procedures, all with varying degrees of success. Postoperative nausea and vomiting, discomfort, and agitation have all been linked to general anesthetic issues [4]. Additionally, compared to neonates and babies, older children had a higher prevalence of circumcision-related problems, according to earlier research [5].

Topical analgesics, caudal block, and ring block of the penis are a few examples of regional anesthesia that have been utilized during circumcision and have varying degrees of effectiveness. The transient motor block has been linked to the caudal block [7]. Bruising, bleeding, and hemorrhage are the most typical side effects of a ring block for circumcision surgery [8]. The dorsal penile nerve block is a successful anesthetic technique, with extended postoperative analgesia, according to earlier investigations [4]. However, it has a 4-6.7% failure rate that has been documented [6].

To compare the analgesic and anesthetic efficacy of bilateral nerve stimulator-guided pudendal nerve block with that of dorsal nerve block for perioperative and postoperative analgesia in children undergoing circumcision, we conducted a prospective randomized controlled clinical trial based on this background. Postoperative analgesic use, postoperative pain ratings, and parental satisfaction were the secondary outcomes.

Methods:

A prospective, single-blinded, randomized investigation was carried out from March 2020 to February 2023 with the approval of the institutional review board and the signed agreement of the parents. 50 ASA-1 male children between the ages of 3 and 5 who were scheduled for elective circumcision were included in the study. A pre-existing coagulopathy, an infection at the injection site, and a known allergy to local anesthetic were among the exclusion criteria.

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Using sealed opaque envelopes and computer-generated random numbers, the patients were divided into two groups of thirty at random. Both groups underwent circumcision under regional anesthesia. One group received a pudendal nerve block, while the other group received a dorsal nerve block. The child's group assignment was unknown to the anesthesiologist, surgeon, aiding staff, and parents as well. The patient was not managed intraoperatively or postoperatively by the anesthesiologist who administered the block. The intraoperative analgesia was supplemented by a different anesthetist who was not informed of the patient's allocated group. Data collection was carried out by skilled nurses who were unaware of the anesthetic method used in either group.

The physiological variables were measured non-invasively using pulse oximetry, electrocardiography monitoring, and blood pressure. During the execution of the regional block, 8% sevoflurane in 100% oxygen was administered to all patients. After administering the local anesthetic injections, the sevoflurane level was lowered to 0.4-0.8% and kept there until the procedure was finished. 4.5 ml of lidocaine 1% without adrenaline, 4.5 ml of bupivacaine 0.5%, 0.5 ml of fentanyl (50 lg.ml), and 0.5 ml of clonidine (75 lg.ml) were used in each 10 ml of the local anesthetic combination.

The lithotomy posture was used to administer the pudendal nerve block. At three and nine o'clock, two distinct injection locations were noted, spaced 1.5 to 2 cm apart from the anus's core. Aseptic skin preparation was followed by the advancement of a 25-G nerve stimulator needle perpendicular to the skin to a depth of 1-1.5 cm while utilizing a stimulation current of 2.5–5 mA and 2 Hz. After that, the needle was pushed laterally in a cephalad and external manner until the pudendal nerve was stimulated. The penis was seen moving up and down as a result of the contraction of the perineal muscles. While lowering the stimulation current to 0.5–0.6 mA, the needle tip positioning was improved to maintain the same muscle contractions. Following that, 0.3 ml.kg)1 of the local anesthetic mixture was administered, 0.15 ml.kg)1 at each of the points (3 and 9 o'clock positions). The pudendal nerve block took between three and five minutes to complete.

The dorsal penile nerve block was administered while the child was supine. The local anesthetic mixture was administered to the patients in 0.3 ml/kg/1 doses. The base of the penis was gently pulled down after skin preparation and palpation of the arch of the lower border of the symphysis pubis, and a 30-G needle was then inserted in the midline at a 75-degree angle to the plane of the skin, at the base of the penis, until bony contact was made with the symphysis pubis. The local anesthetic combination was then slightly withheld and reinserted towards the right side, where 1.5–3.5 ml was injected subcutaneously to distribute the infiltrate in a fan-like pattern. The left side was then treated using the same approach.

A heart rate rises during operation of more than 25% from baseline was considered to be insufficient analgesia. The surgical operation was subsequently stopped, and 0.2 ml of more anesthetic solution was given subcutaneously to the painful area. Following the transaction of the foreskin and electrocautery-induced hemostasis, one surgeon used the same surgical approach to accomplish all circumcisions. The skin margins were then sutured with 3-0 plain catgut. Along with the time the block began and how long it took to complete, patients' characteristics like age,

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height, and weight were also noted. In every instance, the length of the procedure was also noted. During surgery, any increase in sevoflurane levels and its duration were noted. In the recovery room, the mean arterial pressure, heart rate, and oxygen saturation were routinely monitored and recorded before to (baseline), during, and after surgery.

Following surgery, a nurse who was unaware of the anesthetic method watched the youngster in the recovery area. For the first day, pain ratings were taken at various intervals (0, 6 and 12 h, and once per day for the next 5 days). It was measured using the Objective Pain Scale as modified by Hannallah et al. [9]. This scale uses three degrees (0 = none; 1 = moderate; 2 = severe), based on objective criteria (crying, movement, behavior, verbal or physical expression), to provide a total score of 0 to 10. A qualified nurse gave the parents instructions on how to evaluate their child's level of discomfort using the pain scale. After that, the information was gathered by calling the parents five days after the operation.

Depending on the child's weight, paracetamol liquid or 100-mg suppositories were recommended up to three times per day if the child's overall pain score was 2-3. If the pain score was below 4, tramadol 1 mg.kg)1 was administered orally.

Following a period of monitoring (2–6 hours), all patients were released from the hospital on the same day depending on their degree of consciousness, hemodynamic stability, and lack of pain, bleeding, nausea, or vomiting.

In order to reach a power of 80% at a = 5%, a sample size of 25 patients in each research group was determined to be required to detect a difference of 0.45 in mean pain levels at 12 h between the two groups. Student's t-tests were used in statistical analysis to find significant differences in the mean values of age, height, weight, hemodynamic stability, time required to accomplish the block, and length of operation across the study groups. For pain ratings, the Mann-Whitney test was used. Chi-squared tests were employed to evaluate the satisfaction of the parents, the surgeon, the presence of hemorrhages, and the need for analgesics. P values below 0.05 were regarded as significant.

Results:

Age, hemodynamic stability, and duration of surgery were comparable across the two groups (Table 1). In the group of patients who had their pudendal nerves blocked, every patient underwent circumcision as planned without requiring any analgesics. 3 patients (12%) in the dorsal nerve block group experienced an incomplete block, necessitating further local infiltration. In the dorsal nerve block group, one patient (4%) had total block failure and underwent general anesthesia (Table 2). There were no issues observed in the group receiving a pudendal nerve block, however one mild hemorrhage was discovered in the group receiving a dorsal nerve block, with no statistically significant difference between the two groups (Table 2). When compared to the dorsal block group, the pudendal nerve block group had much less pain within the first 12 hours after surgery (table 3). In comparison to the pudendal nerve block group, the percentage of patients who used analgesics within the first six hours postoperatively was considerably greater in the dorsal nerve block group (table 3).

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Table 1- Pediatric pudendal and dorsal nerve block characteristics and clinical data.

Variables	Pudendal block (n = 25)	Dorsal nerve block (n=25)	P value
Age (years)	4.3± 0.4	4.1±0.9	0.213
Time of block onset; min	10.2±3.2	10.0±2.3	0.346
Mean arterial pressure Pre-operative Intra-operative Post-operative	 71.2±2.3 70.4±2.8 70.9±2.5	 70.6±2.1 71.7±1.9 70.8±2.3	0.543
Heart rate Pre-operative Intra-operative Post-operative	 103.2±7.6 107.9±6.9 103.8±8.1	 105.3±7.4 103.9±4.9 104.9±8.3	0.765
Time needed to perform block; min	**5.7**±1.1	**5.5**±0.9	**0**.128
Surgery duration; min	27.3±2.1	27.6±1.8	0.367

Table 2- Outcomes of pudendal nerve block or dorsal nerve block in children

Variables	Pudendal block (n = 25)	Dorsal nerve block (n=25)	P value
hematoma	0	1(4%)	0.213
Failure Partial total	 0 0	 3(12%) 1(4%)	 0.02 0.03

Table 3- Mean postoperative pain scores (modified Objective Pain Scale; OPS)

Variables	Pudendal block (n = 25)	Dorsal nerve block (n=25)	P value
Pain score (OPS) 0h	 1.2	 0.2	 0.03
6h	0.9	0.2	0.02
12h	0.6	0	0.02
24h	0.4		0.01
48h	0.2	0	0.01

Discussion:

The majority of the patients in the two groups underwent circumcision successfully, and all of them were discharged from the hospital the same day with reasonably low pain levels during the

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course of the follow-up. During the first several hours after surgery, the pudendal nerve block approach was linked to decreased analgesic intake and lower pain levels.

The infiltration of local anesthetic into the glans causes vascular injury, which results in a hematoma and mild local oedema, as well as bleeding [11]. There may sometimes be an infection, such as an ischemic glans [12]. Using the dorsal nerve block, previous investigations have revealed failure rates of around 4-6.7% [6]. The dorsal nerve block technique itself may be seen as a blind method since it depends on an approximation of the injection site's location and a subjective assessment of the dorsal nerve's anatomical placement, which is deep inside Buck's fascia [13]. Contrarily, pudendal block, utilizing a nerve stimulator, is a guided method that ensures close closeness to the pudendal nerve by visually verifying the movement of the penis (up or down) as a result of contraction of the muscles supplied by the perineal branch of the nerve. These results show that the nerve stimulator increases the precision of the injection location by delivering the anesthetic mixture close to the pudendal nerve. To address the dorsal nerve block's failure rate, published research advise combining it with ventral perineal nerve injections. It is advised to block the perineal nerves during circumcision since they are crucial for the penis' innervation [10]. A further benefit of the pudendal block over the dorsal block is its capacity to block both the dorsal and perineal nerves by inhibiting the pudendal nerve, since both the perineal nerve and the dorsal nerve are terminal branches of the pudendal nerve [13].

Although there was a statistical advantage for the pudendal block, the average pain score between the two groups was not that high. The inclusion of clonidine and fentanyl in the local anesthetic solution may be the cause of the extended pain alleviation. Fentanyl prolongs anesthesia time via a peripheral mechanism, improving postoperative analgesia in the process [14].

Conclusion:

There have been no documented complications with pudendal nerve block, which is used outside of the surgical incision site. Additionally, it's linked to positive surgery satisfaction. In comparison to the dorsal nerve block, the guided pudendal nerve block method has been shown to be more precise and successful in circumcising children. This was shown by the better postoperative results in terms of analgesic use, pain scores, and parental satisfaction.

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