

A Hospital Based Prospective Study to Compare the Success Rate Haemodynamic Changes, Average Pain Score and the Time to First Analgesic Request in 24 Hours Postoperative Period Between Caudal Block and Dorsal Penile Nerve Block (DPNB) with Plain Bupivacaine in Paediatric Patients for Day-Case Circumcision

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Abstract

Background: Children often express pain post-circumcision by crying, restlessness and agitation which often lead to increase bleeding from surgical site and hesitation at micturition. NSAIDs are said to be associated with increased risk of post-operative bleeding and renal toxicity. The aim of this study to compare the efficacy of caudal block and dorsal penile nerve block (DPNB) with plain bupivacaine in paediatric patients for day-case circumcision. **Materials & Methods:** This was a prospective study in done on 100 paediatric patients' aged 1-5 years of American Society of Anaesthesiologists (ASA) classification I or II who underwent day-case circumcision at the K.D. Medical College, U.P. India. On arrival in the anaesthetic room, each patient was randomly allocated by balloting using sealed envelope into either group A (caudal block with 0.5% plain bupivacaine) or group B (dorsal penile nerve block with 0.5% plain bupivacaine). The times the first Paracetamol dose was needed and the time it was given were noted and recorded. Categorical variables were compared using the Chi-square or Fisher's exact test as appropriate. Continuous variables were analyzed with independent student t-test. **Results:** The caudal block group consumed significantly less doses of paracetamol (2.12 ± 0.36) compared to 3.02 ± 0.58 consumed by the DPNB group ($P < 0.05^*$). It also compared the mean dose of Paracetamol (mg) consumed by the two groups in the postoperative period. Group A consumed 372.58 ± 70.22 mg while group B consumed 575.12 ± 94.67 mg of Paracetamol in 24 hours ($p < 0.05^*$). The time to the first analgesic demand was significantly longer in the caudal block group (334.66 ± 16.18 minutes) compared to 92.30 ± 13.98 minutes in the DPNB ($p < 0.05^*$). **Conclusion:** We concluded that caudal block has a higher success rate, better postoperative analgesia, less postoperative haemodynamic changes and less incidence of vomiting. However, delayed micturition was more in the caudal block group compared to dorsal penile nerve block for children aged 1-5 years for day case circumcision.

Key Words: Circumcision, Paediatric patients, Day care, DPNB, Caudal block, pain

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Introduction

Children often express pain post-circumcision by crying, restlessness and agitation which often lead to increase bleeding from surgical site and hesitation at micturition. It is therefore essential to provide effective pain relief. Regional blocks used for circumcision include dorsal penile nerve block (DPNB) and caudal block[1]. These anaesthetic techniques are safe and provide effective postoperative pain relief. They provide dense intra-operative analgesia that often continue into the postoperative period with opioid-sparing effect[2]. Broadman,[3] stated that painful experiences such as circumcision in infants and children without anaesthesia may lead to life-long behavioural changes. He advocated the use of caudal block or other forms of local anaesthesia, such as penile, ilioinguinal, iliohypogastric nerve blocks to be performed for surgery below the umbilicus to reduce postoperative discomfort in paediatric patients.

Similarly, Brown,[4] also recommended that anaesthesia for circumcision should include local anaesthetic block as parenteral analgesics like paracetamol and non-steroidal anti-inflammatory drugs are often inadequate and stronger analgesics such as opioids can cause respiratory depression, nausea and vomiting.

Dorsal penile nerve block (DPNB) is a simple technique and easy to perform for postoperative analgesia in circumcision. Caudal epidural block is a popular regional anaesthetic technique used in children and in combination with general anaesthesia or alone it provides a safe, reliable and efficient analgesia/anaesthesia for surgeries below the umbilicus[5].

There is poor post-operative pain management for paediatric surgical patients undergoing circumcision in our sub-region, therefore, more effort should be made to anticipate and treat pain in the paediatric patients. Pharmacological agents employed in post-operative pain management include simple analgesics such as paracetamol and non-steroidal anti-inflammatory drugs (NSAIDs), which are not adequate when used alone for moderate to severe pain. NSAIDs are said to be associated with increased risk of post-operative bleeding and renal toxicity. Opioids are associated with the risk of sedation, respiratory depression, and nausea and vomiting. Regional techniques and nerve blocks provide better alternatives for effective analgesia with minimal side effects in the postoperative period. The aim of this study to compare the success rate haemodynamic changes, average pain score and the time to first analgesic request in 24 hours postoperative period

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between caudal block and dorsal penile nerve block (DPNB) with plain bupivacaine in paediatric patients for day-case circumcision.

Materials & methods

This was a prospective study in done on 100 paediatric patients' aged 1-5 years of American Society of Anaesthesiologists (ASA) classification I or II who underwent day-case circumcision at the K.D. Medical College, U.P. India. Patients with known or suspected sensitivity to local anaesthetic drugs, the clinical features of bleeding diathesis, haemoglobinopathy, neurological diseases like cerebral palsy or epilepsy, infection at the site of injection, failure of the block to fix in 30 minutes, congenital abnormality of the limbs/ spinal bifida and patients with cardio-respiratory problems were excluded from study.

Anaesthetic Technique

Pre-operative evaluation of each patient was done by taking a brief history, general physical examination, systemic examination and evaluation of investigations. The airway was examined for ease of airway management like intubation. The physical status of each patient was determined based on American Society of Anaesthesiologists (ASA) classification. Each of the patient's weight was taken and documented for clinical use and each patient was fasted for 6 hours, 4 hours, and 2 hours for solid, liquid and clear fluid respectively.

On arrival in the anaesthetic room, each patient was randomly allocated by balloting using sealed envelope into either group A (caudal block with 0.5% plain bupivacaine) or group B (dorsal penile nerve block with 0.5% plain bupivacaine).

In both groups, each patient was induced with gradual increase of sevoflurane (maximum of 8%) in oxygen inhalation using facemask and they were maintained with 1.5% isoflurane in 50 % oxygen and air, while size 1 or 2 oropharyngeal airway was used to maintain airway patency. A 24 or 22gauge intravenous cannula was inserted for intravenous access and 4.3% dextrose in 0.18% saline was given at 4ml/kg/hr for the first ten kilogram body weight, 2ml/kg/hr for the second ten kilogram body weight and 1ml/kg/hr for each subsequent kilogram body weight above 20kg for the maintenance fluid management. Each patient was given intravenous atropine 0.02mg/kg body weight. The fluid deficits were calculated based on the maintenance for duration of fasting. It was replaced over three hour duration with half of it given in the first hour the remaining half was divided into two and each quarter was replaced over an hour together

Results

The mean age of the children in group A was 3.10 ± 0.82 years and that of group B was 3.15 ± 0.98 years with no significant difference between the two groups ($p > 0.05$). The mean weight of the children was 12.98 ± 1.76 kg and 13.22 ± 1.95 kg in group A and B respectively. There was no significant difference between the children of the two groups with respect to their weight ($p > 0.05$). Group A had 98%, while group B had 96% successful blocks. There was no significant difference in block success rate between the two groups ($p > 0.05$) (table 1).

Table 1: The Demographic data and block success in the two groups.

Variables	Group A (N=50)	Group B (N=50)	P-value
Age (Mean±SD) (yrs)	3.10±0.82	3.15±0.98	>0.05
Weight (Mean±SD) (Kg)	12.98±1.76	13.22±1.95	>0.05
Adequate (Successful) block (%)	98%	96%	>0.05
Inadequate (Unsuccessful) block	1 (2%)	2 (4%)	>0.05

There were no significant differences in the mean preoperative pulse rate (PR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) among the two study groups in table no. 2. There were significant differences in the mean increase in the postoperative PR, SBP, DBP and MAP for the two groups.

Table 2: The Preoperative haemodynamic variables for the study groups

Parameters	Group A	Group B	P-value
PR (beats/min.)	112.36±2.48	113.24±4.20	>0.05
SBP (mmHg)	93.58±2.87	92.10±4.51	>0.05
DBP (mmHg)	42.23±3.56	44.38±4.62	>0.05
MAP (mmHg)	58.92±2.68	57.30±3.48	>0.05

with the maintenance for each hour. The on-going loss was also replaced accordingly.

The caudal blocks were instituted with Duracaine R Plain bupivacaine hydrochloride. The patients in group A were positioned laterally, the sacral hiatus was identified by placing the thumb and the ring fingers on the right and left posterior superior iliac spines (indicated by skin dimples) and the sacral hiatus palpated by the index finger. A 24 gauge intravenous canula was introduced through the skin and sacrococcygeal ligament in a cephalic direction at 45° to the skin. When the sacrococcygeal ligament was pierced, evident when a pop was felt, the canula was then advanced by 0.5 - 1cm in the sacral canal at 30° to the skin surface. Correct position was confirmed by the absence of spontaneous reflux of blood or cerebrospinal fluid when the hollow needle was removed. After a negative aspiration test, caudal block was instituted with 0.5 ml/kg of 0.5% plain bupivacaine. Each patient was positioned supine and drug was allowed to fix for period of twenty minutes. Loss of pain sensation was assessed using heart rate in response to a pinch with an artery forceps.

In the second group (group B), each patient was placed in a supine position. Dorsal penile nerve block was instituted under aseptic condition. The penis was retracted downward. A hypodermic needle size 23 gauge attached to a 5mls syringe containing 0.5% plain bupivacaine was inserted 1 cm lateral to the midline bilaterally; until a pop was felt as fascia scarpa was pierced. After a negative aspiration test, 0.1 ml/kg of 0.5% bupivacaine (maximum of 2.5 ml), was injected in each side to institute the block. The drug was allowed to fix for period of 20 minutes. Loss of pain sensation was assessed using heart rate in response to a pinch with an artery forceps.

The time of injection for each patient was noted as time Tb (time of block) in both groups. Monitoring was continued intraoperatively in both groups and recorded every five minutes for the first 15 minutes and then every 15 minutes till the end of the surgery. The times the first Paracetamol dose was needed and the time it was given were noted and recorded. However, no patient was allowed to walk until complete motor function had recovered with Bromage score of 4. The time patients were given the first postoperative analgesia and total analgesics consumed in 24 hours were recorded.

Data Analysis

Data were analyzed using epi info statistical program 22 version. Categorical variables were compared using the Chi-square or Fisher's exact test as appropriate. Continuous variables were analyzed with independent student t-test.

The caudal block group consumed significantly less doses of paracetamol (2.12 ± 0.36) compared to 3.02 ± 0.58 consumed by the DPNB group ($P < 0.05^*$). It also compared the mean dose of Paracetamol (mg) consumed by the two groups in the postoperative period. Group A consumed 372.58 ± 70.22 mg while group B consumed 575.12 ± 94.67 mg of Paracetamol in 24 hours ($p < 0.05^*$) (table 3).

Table 3: The mean paracetamol doses consumed by the two groups in 24 hours.

Parameters	Group A	Group B	P-value
Paracetamol doses	372.58 ± 70.22	575.12 ± 94.67	$< 0.05^*$
Number of doses	2.12 ± 0.36	3.02 ± 0.58	$< 0.05^*$

The caudal group had 2(4%) postoperative vomiting while in the DPNB group it was 3(6%) ($p > 0.05$) which was not significant. In the caudal group the incidence of delayed micturition was 8 (16%) compared to 5(10%) in the DPNB group which was not statistically significant ($P > 0.05$). There was statistically significant increase in the incidence of postoperative pain in the PACU in the DPNB group 44(88%) compared to 22 (44%) in the caudal block group ($p < 0.05^*$) (table 4).

Table 4: The frequency of complications in the two groups.

Complications	Group A (N=50)	Group B (N=50)	P-value
Postoperative vomiting	2	3	> 0.05
Delayed micturition (>6hrs.)	8	5	> 0.05
Pain in PACU	22	44	$< 0.05^*$

The time to the first analgesics demand was significantly longer in the caudal block group (334.66 ± 16.18 minutes) compared to 92.30 ± 13.98 minutes in the DPNB ($p < 0.05^*$).

Discussion

Painful experiences in circumcision of infants and children without the benefit of analgesia may lead to life-long behavioural changes. Total pain relief following circumcision should be paramount.

The present study found that the success rates of blocks in the study groups were 98% and 96% in the caudal block and dorsal penile nerve block groups respectively. There was no statistically significant difference between the two groups ($p > 0.05$). This finding was similar to that of the study conducted by Seyedhejazi et al,[6] in which they found the success rates of 97.7 % and 92.6% in caudal block and dorsal penile nerve block respectively ($p > 0.05$). The higher success rate of caudal block despite the absence of ultrasound guided block was due to the prominent anatomic landmarks of the sacral hiatus in children especially in children under the ages of 6 years.

Furthermore, the present study observed the failure rate of 4% in the dorsal penile nerve block group was lower than 7.4% found by Seyedhejazi et al[6]. This may likely be associated with variation in the anatomy of the dorsal penile nerve. However, this may be improved by the use of ultrasound guided block or with the aid of nerve stimulator. The failure rate in the caudal block in this study was 2% but Kazak et al,[7] had 0% failure rate. The 0% failure rate may be due to the use of large volume of local anaesthetics (1 ml/kg of levobupivacaine) while in this present study 0.5ml/kg of bupivacaine was used.

The significant differences in the trend of the postoperative haemodynamic changes between the caudal block and the DPNB groups found in this study may be as a result of inadequate analgesia by the DPNB group in the immediate postoperative period as the effect of general anaesthesia wore off. This finding was similar to that of Seyedhejazi et al,[6] in which there were significant increase in the BP and HR after 45 minutes, in penile group compared to the caudal block group.

The time to the first analgesics demand was significantly longer in the caudal block group (334.66 ± 16.18 minutes) compared to 92.30 ± 13.98 minutes in the DPNB ($p < 0.05^*$). In a study by Beyaz,[8] the analgesia lasted for 354 ± 15 and 352 ± 18 minutes for caudal block and DPNB groups respectively ($p > 0.05$). The difference between the two groups in his study which was not significant was most likely because he used larger volume of 0.5 ml/kg of 0.25% levobupivacaine compared to 0.1ml/kg of 0.5% bupivacaine used in the present study for the DPNB.

There was a significant difference in the average number of paracetamol (PCM) doses consumed in 24 hours postoperatively between the two groups in the present study. The caudal block group consumed significantly less doses of paracetamol of 2.12 ± 0.36 compared to the 3.02 ± 0.58 by the DPNB group ($P < 0.05^*$). This finding differs from that by Kazak et al,[7] in their study where they used levobupivacaine for both caudal block and DPNB for postoperative pain in circumcision. They found that the total postoperative

analgesic demands in 24 hours to be similar in the two groups. The postoperative number of paracetamol doses demanded in 24 hours were 2.1 ± 0.6 in the caudal block group and 2.4 ± 0.7 in the dorsal penile nerve block group with $p = 0.10$. The lower number in PCM doses consumed by the penile block group in their study may be because they used large volume of 1 ml/kg of 0.25% levobupivacaine with extensive infiltration as against 0.1 ml/kg used in this study.

In the present study however, the caudal group had more frequency of delayed micturition 8 (16%) compared to 5 (10%) in the DPNB group but it was not statistically significant ($p > 0.05$). This agrees with the study by Metzelder et al,[9] in which they reported higher number of patients who had delayed micturition (defined here as > 6 hours) post-operatively with 15 out of 27 children that had caudal analgesia compared to 5 out of 33 children that had penile block. The delayed micturition among the caudal block group in this study can be attributed to the blockage with 0.5% bupivacaine of the afferent and efferent nerves to the bladder which prevent the bladder to contract by voluntary facilitation of the spinal voiding reflex. The delayed micturition among the DPNB group in this study can be due to pain as they had higher pain score.

In this study, 4% of children in the caudal block group had postoperative vomiting which was lower than (15%) found in a study by Nafi'u et al,[10] This may be due to the fact that ketamine was added to the bupivacaine for the caudal block in their study.

The present study found that 3(6%) of dorsal penile nerve block group children had postoperative vomiting which was more than 5(4.67%) in the caudal block group. This finding differs with that of Weksler et al,[11] that had one patient (2%) in penile block group and nine patients (18%) in caudal block group that experienced postoperative vomiting. The higher vomiting experienced can be attributed to the use of inhalation anaesthesia with oxygen in nitrous oxide (1:2) and halothane while, in the present study nitrous oxide which is a known emetogenic agent was not used.

The results in this study showed that up to 44% of patients in the caudal block group had pain in the PACU, but, in the study conducted by Nafi'u et al,[10] none of the paediatric patients who had caudal block with bupivacaine for lower abdominal surgeries had postoperative pain in the PACU.

Conclusion

We concluded that caudal block has a higher success rate, better postoperative analgesia, less postoperative haemodynamic changes and less incidence of vomiting. However, delayed micturition was more in the caudal block group compared to dorsal penile nerve block for children aged 1- 5 years for day case circumcision.

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