ORIGINAL ARTICLE

COMPARISON OF CAUDAL BLOCK AND DEEP PENILE NERVE BLOCK FOR POSTOPERATIVE PAIN RELIEF IN PAEDIATRIC DAY-CASE CIRCUMCISION.

ADAMU SA[1,2], PANDA US[1], SAMBO YT[1], SANI A[3].

ABSTRACT

Background: To compare the postoperative analgesia and complications of caudal block and dorsal penile nerve block in children aged 1- 5 years for day case circumcision.

Method: This was a prospective randomized double blind study of paediatric patients aged 1-5 years, who had day-case circumcision at Federal Teaching Hospital, Gombe. Group A had caudal block with 0.5% plain bupivacaine and group B who had dorsal penile nerve block (DPNB) with 0.5% plain bupivacaine. Post-operative pain was assessed using the Children's Hospital of Eastern Ontario Pain Scale (CHEOPS). Patient's age and complications, average pain score, time for the first postoperative analgesia demand and total analgesics consumed in 24 hours were recorded and analyzed.

Results: A total of two hundred and nine (209) patients completed the study, made up of 107 and 102 in group A and B respectively. There was no significant difference in block success rate between the two groups (p = 0.34). Group A had significantly lower average CHEOPS pain score in the immediate postoperative period than the Group B p = 0.02. **Group A consumed** significantly lower **number of** paracetamol doses than group B **(p = 0.05).**

There was no significant difference in the incidence of postoperative vomiting between the two groups. The caudal block group had fewer complications than dorsal penile nerve block.

Conclusion: It has shown that caudal block has a higher success rate, better postoperative analgesia and fewer complications than dorsal penile nerve block in children aged 1- 5 years for day case circumcision.

KEYWORDS: Caudal Block, Deep Penile Nerve Block, Postoperative Pain Relief

INTRODUCTION

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. Adudu et al,[1] reported a lagging behind trend in intraoperative pain relief for paediatric surgical patients. They found that the use of old modalities of pain relief with opioid drugs was up to 87.9% in their study while caudal block was only 7.1%. Day-case analgesia needs to be devoid of sedation, nausea and vomiting and this can be achieved by nerve blocks and neuroaxial blocks like caudal block which are safer but unfortunately are not often used in our sub- region.[2]

Charlton,[2] explained that pain causes an increase in the sympathetic response of the body with subsequent rise in the heart rate and blood pressure. It can also lead to widespread effects on gastrointestinal and urinary tracts motility which may lead to postoperative ileus, nausea, vomiting and urinary retention. These problems may prolong hospital stay and delay

Department of [1]Anaesthesia, Federal Teaching Hospital, Gombe, Gombe state, Nigeria.
[2]Anaesthesia and Intensive Care, University of Maiduguri Teaching Hospital, Maiduguri,, Borno State, Nigeria.
[3]Surgery, Federal Teaching Hospital, Gombe, Gombe state, Nigeria.

Correspondence to:
DR ADAMU SADIQ ABUBAKAR,
Department of Anaesthesia and Intensive Care, University of Maiduguri Teaching Hospital, Maiduguri, Borno State, Nigeria.
eMail:- adamusadiq48@gmail.com

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discharge from day care units, or may lead to unplanned admission which causes unnecessary stress to parents and increase the cost of Medicare.

In a study on postoperative analgesia for circumcision in children by Martin,[3] he divided the study group into three groups. The first group had parenteral diamorphine, the second group had caudal analgesia with 0.5% plain bupivacaine and the third group had caudal analgesia with 0.5% plain bupivacaine plus morphine sulphate. In all the patients general anaesthesia was administered. He found that pain relief was satisfactory in all the three groups. The group that had only caudal block with plain bupivacaine recovered faster from the general anaesthesia. He concluded that caudal analgesia, with or without the addition of morphine, did not confer any advantage over parenteral diamorphine, and did not justify the extra time, possible complications and expense.

In a study by Howard et al, [4] they conducted a prospective randomized double blind placebo controlled clinical trial of acetaminophen analgesia in 44 full term neonates undergoing circumcision. Two hours before Gomco circumcision, neonates received either acetaminophen 15 mg/kg per dose (0.15 ml/kg) per dose or placebo 0.15 ml/kg per dose or every 6 hours for 24 hours. Neonates were monitored intraoperatively for changes in heart rate, respiratory rate, and crying time. Postoperative pain was assessed at 30, 60, 90, 120, 360 minutes, and 24 hours using a standardized postoperative comfort scoring system. Feeding behaviour was also assessed before and after circumcision by nursing observation. They found that neonates in both groups showed significant increases in heart rate, respiratory rate, and crying during circumcision with no clinically significant differences observed between the groups. Therefore, acetaminophen was not adequate analgesia for the surgery. Postoperative comfort scores showed no significant differences between the groups until the 360th minute postoperative assessment, at which time the acetaminophen group had significantly improved pain scores ($P < 0.05$). These results confirm pain perception by the neonate. Feeding behaviour deteriorated in both groups, and acetaminophen did not seem to influence this deterioration.

In a study by Gowan et al,[5] they randomized sixty one (61) children to receive one of the three methods of analgesia for day-case circumcision. Group 1 received dorsal penile nerve block only, group 2 received penile block plus diclofenac suppository and group 3 received diclofenac suppository only. Pain assessment with the CHEOPS score was recorded in the recovery area, one hour and two hours after awakening. It showed that both group 1 and 2 had adequate analgesia while group 3 with higher pain scores had inadequate analgesia.

In a prospective randomized study by Patel et al [6] on 50 patients with ASA I, ages 3–12 years scheduled for elective circumcision, patients were divided into two groups: DPNB (group I) and caudal block (group II) using 1 ml/kg of 0.25% bupivacaine. The postoperative analgesia was evaluated for 6 hours with the FLACC Pain scale. When the FLACC pain score was 5 or above, 2 mg/kg of diclofenac sodium suppository as a supplemental analgesic was administered. The time to the first analgesic demand, total amount of supplementary analgesic, number of doses given and probable local or systemic complications were recorded. There were no significant differences found in both groups and there were no major complications such as arrhythmia, hypotension, shock, or seizures found when either of the techniques was used.

In the previous studies,[7, 8] in similar studies also found that both caudal block and penile block are equal in efficacy; that is good analgesia was achieved for circumcision. They found in their independent studies that both

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techniques had no serious side effects or complications. Ashrey et al,[9] however, recorded a higher incidence of lower limb motor blockade in the caudal block group and the time for ambulation was significantly longer in the caudal group (6.95 ± 3.22 hours) than in the penile block group (5.28 ± 1.99 hours) which was significant ($p < 0.01$). They also had one technical failure in the penile block group. They concluded that a penile block was a satisfactory alternative to caudal blockade with regard to postoperative analgesia.

Kazak et al, [10] they found that when compared to caudal block with DPNB in 60 boys aged of 2-10 years using 0.1ml/kg of 0.25% levobupivacaine that the number of postoperative analgesic demand in 24 hours was similar in the two groups; with 2.1 ± 0.6 doses for caudal block group and 2.4 ± 0.7 doses for the penile group which was not significant ($p = 0.10$). In a study by Caudal and penile blocks are safe and effective as analgesic techniques for paediatric day-case. Effective pain relief means smoother post-operative course with early discharge from the hospital. This study will suggest how the use of local anaesthetics can achieve effective relief of post-operative pain after day-case circumcision in the paediatric patients. Regional anaesthesia undertaken when the child is under general anaesthesia can give prolonged control of pain and avoid the use of opioids. These two techniques have minimal complications.

The aimed of the study was to compare the postoperative analgesic efficacy, success rates and complications of the use of caudal block and dorsal nerve of penis block for paediatric day-case circumcision.

METHODOLOGY: This was a prospective study in Nigerian paediatric patients' aged 1-5 years of ASA classification I or II who underwent day-case circumcision at the Federal Teaching Hospital, Gombe, Gombe State, Nigeria. Approval was obtained from the Ethical Committee of the hospital and an informed written consent was also taken from the parents/guardian of each of the patients.
Patients whose parents/ guardian refused to consent to this study and all those that satisfied the exclusion criteria (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 however, excluded from the study.

Parents and care givers were equally educated about the assessment in their native languages for better understanding and information leaflets were given for better clarity. They were reached through their phones for pain assessment.

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 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.
The anaesthetic machine, drugs for general and regional anaesthesia; and other equipment for resuscitation were made available. The anaesthetic apparatus were prepared prior to induction.

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).

Each patient was monitored using of

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precordial stethoscope, pulse-oximetry for pulse rate and peripheral oxygen saturation (SpO2), noninvasive blood pressure (NIBP), peripheral (axillary) temperature (T) and electrocardiography (ECG) using an Andromeda nova 3M multi-parameter monitor. The baseline vital signs were recorded.

In both groups, each patient was induced with gradual increase of halothane (maximum of 4%) 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 with the maintenance for each hour. The on-going loss was also replaced accordingly.

The caudal blocks and the DPNB were performed by the principal researcher under aseptic condition. The blocks were instituted with Duracaine^{R} Plain bupivacaine hydrochloride. The patients in group A were positioned laterally, with their hips flexed to 90°. Skin disinfection performed carefully at the site for the procedure with povidone iodine and it was draped.

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. The puncture was performed between the two sacral cornuae. A 24 gauge intravenous canula was introduced through the skin and sacrococcygeal ligament in a cephalic direction at 45^{0} 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^{o} 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. During the injection there was no subcutaneous swelling or resistance to injection. 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. The marker for injection was the symphysis pubis. 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 T_b (time of block) in both groups. Each patient was positioned supine. Skin incision was performed after adequate block in each group. Systemic analgesics (pethedine 1 mg/kg and paracetamol 10 mg/kg) were given if there were signs of inadequate block like tachycardia, hypertension, tachypnoea, lacrimation during the surgery. These patients

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were subsequently excluded from the study. 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.

At the end of the surgery, each patient was taken to the post anaesthesia care unit and on arrival at time Tp pain was assessed using CHEOPS and recorded by a blinded observer PACU nurse trained for the study. Monitoring continued with pulse-oximetry for pulse rate and SpO2, NIBP, T and ECG using a multi-parameters monitor. Assessment of motor block using Bromage scoring and voiding were also monitored and oxygen supplementation continued until the patient was fit for discharge home from the day care unit using post anaesthesia discharge scoring system of 9 or 10.

Blinded observer PACU nurses trained for the study assessed each patient in the postoperative period. Postoperative pain was assessed using the CHEOPS scores hourly by the PACU nurses in the recovery room and four hourly at home by phone call to the Parent / Care giver. Paracetamol 15 mg/kg analgesia was given for any pain score more than 5 in the postoperative period. It was given intravenously by PACU nurses in the PACU and orally by trained Parent / Care giver at home. 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.

Parents/care givers were called on phone every four hours for pain assessment. The time patients were given the first postoperative analgesia and total analgesics consumed in 24 hours were recorded.

Patient's age, pulse rate, blood pressure, weight, success rate of each block, complications, average pain score, time for first rescue analgesia and total analgesic consumed in 24 hours were recorded and analyzed. The study ended at 24 hours post-operatively.

Data were analyzed using epi info statistical program version 3.3.2. The results were presented as numbers, means ± standard deviation and percentages in the form of tables, figures and graphs. All tests were 2-tailed, and a level of significance was set at $p \leq 0.05$.

RESULTS: A total of 218 ASA I and II children booked for day case circumcision at Federal Teaching Hospital, Gombe were recruited in this study, made up of 109 children in each group (A and B). Failed blocks were obtained which were 2(1.84 %) and 5(4.59%) for group A and B respectively, which were not statistically significant (p=0.34).

However, during the follow up, two patients in group B were dropped out of the study due to incomplete data because their parents could not ascertain the time they administered the paracetamol syrup. Hence, the total of 209 patients were collected and analysed made up of 107 and 102 in Group A and B respectively.
Table I shows the **comparison** of the demographic data and **block status in** the 2 groups. The mean age of the children in group A was 3.14 ± 0.96 years and that of group B was 3.21 ± 1.12 years with no significant difference between the two groups (p = 0.65). The mean weight of the children was 13.45 ± 1.96 kg and 13.56 ± 1.93 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 = 0.79). There was no significant difference in block success rate between the two groups (p = 0.34).

Table II shows that caudal block group consumed significantly less doses of paracetamol compared to DPNB group (P = 0.03). In table III shows that the caudal group had fwer complications compared to the DPNB.

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

Variables	Group A	Group B	P-value
Age mean ± SD (years)	3.14 ± 0.96	3.21 ± 1.12	0.65
Weight mean ± SD(kg)	13.45 ± 1.96	13.56 ± 1.93	0.79
Adequate (successful) blocks (%)	98.17	95.41	0.34
Inadequate (unsuccessful) blocks n (%)	2 (1.84)	5 (4.59)	0.34

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

	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Paracetamol doses (mg)	371.59 ± 70.27	586.07 ± 95.31	**0.04**
Number of doses	2.10 ± 0.31	3.04 ± 0.52	**0.03**

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

Complications	Group A	Group B	p-value
Postoperative Vomiting	5 (4.67)	8 (6.67)	0.46
Delayed micturition (> 6 hours)	17 (15.89)	11 (10.28)	0.16
Pain in the PACU (CHEOPS > 5)	47 (43.92)	89(87.25)	0.01

DISCUSSION: Total pain relief following circumcision with minimal or no complications should be paramount. Hence, this study compared the caudal block with the dorsal penile nerve block for the pain relief during circumcision.

In the present study, the dorsal penile nerve block was relatively ineffective for postoperative analgesia in day care circumcision. This was because up to 87.25% of patients in DPNB group had CHEOPS pain score $\geq$ 5 in the post anaesthetic care unit. This was probably due to inadequate penile block by the DPNB. In the study by Weksler et al, [7] they found that penile block was achieved by injecting bupivacaine into the two compartments of the sub-pubic space, with an additional ventral infiltration of a small volume of bupivacaine along the raphe of the penis, and they were able to conclude that DPNB was equally effective to caudal block for postoperative pain relief for circumcision.

In the present study however, the caudal group had more frequency of delayed micturition 17 (15.89%) compared to 11 (10.28%) in the DPNB group but it was not statistically significant (p = 0.16). This agrees with the study by Metzelder et al, [11] in which they reported higher number of patients who had delayed micturition 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

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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, 4.67% of children in the caudal block group had postoperative vomiting which was lower than (15%) found in a study by Nafi'u et al, [12] 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 8(6.67%) 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, [7] 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 emitogenic agent was not used.

The results in this study showed that up to 43.92% of patients in the caudal block group had pain in the PACU, but, in the study conducted by Nafiu et al, [12] none of the paediatric patients who had caudal block with bupivacaine for lower abdominal surgeries had postoperative pain in the PACU.

CONCLUSION

The results of this study, has shown that caudal block has a higher success rate, better postoperative analgesia, 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.

LIMITATIONS

1. Pain assessment at home was by parent/care givers and therefore lack standard.
2. The finding in this study may not apply to neonates and infants. The new trend is changing toward early neonatal and infant circumcision while this study was limited to children ages 1-5 years.
3. The length of the surgery which invariably determines the extent of tissue damage and a intensity of pain was not assessed in this study.

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