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An Overview of Peripheral Artery Disease in the Elderly: A Study in a Tertiary Hospital Southern Nigeria

Ibora Samuel Akpan, Osahon Enabulele, Afolabi Joseph Adewole

1-5

Near Miss and Maternal Mortality at the Jos University Teaching Hospital

Ephraim Samuels, Amaka Ngozi Ocheke

6-10

A Comparison of Pain Scores in Neonatal Circumcision with or without Local Anesthesia in Jos, Nigeria

Aminu Gango Fikin, Stephen Yohanna

11-15

Unilateral Sinonasal Masses: Review of Clinical Presentation and Outcome in Ahmadu Bello University Teaching Hospital, Zaria, Nigeria

Iliyasu Yunusa Shuaibu, Muhammed Aminu Usman, Abdulrazak Ajiya

16-21

Reported Adherence to Antihypertensive Treatment and Outcome at Postmortem in Southwestern Nigerians

Uchenna Simon Ezenkwa, Sebastian Anebuokhae Omenai,

John Olufemi Ogunbiyi

22-26

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A Comparison of Pain Scores in Neonatal Circumcision with or without Local Anesthesia in Jos, Nigeria

Aminu Gango Fikin¹, Stephen Yohanna²

¹Department of Family Medicine, Plateau State Specialist Hospital, Jos, Nigeria, ²Department of Family Medicine, Bingham University Teaching Hospital, Jos, Nigeria

Abstract

Introduction: Neonatal circumcisions are commonly performed in Nigeria, most often without anesthesia. The aim of this study was to determine whether anesthesia was required for neonatal circumcision. **Materials and Methods:** All new-born male neonates presenting for routine circumcision were considered for inclusion in the study. This was a randomized control study, comparing pain scores during circumcision with local anesthesia or without local anesthesia. A total of 72 neonates were randomly assigned to the two groups using computer-generated random numbers, with 36 in each group. The neonates were not matched for age or weight. All the anesthetic procedures and circumcisions were performed in identical manner by the principal investigators using the plastic bell technique. Approval for the study was obtained from the Research Ethics Committee of the hospital. Written voluntary informed consent was obtained from the parents of the neonates. **Results:** The mean age and weight of the neonates in the study were 17 ± 2 days and 3.2 ± 0.68 kg, respectively. The mean Neonatal/Infant pain score was 4.8 in the local anesthesia group and 6.0 in those without anesthesia. The mean transcutaneous PO_2 was 90.47 ± 7.53 in those with anesthesia compared to 85.83 ± 5.61 in those without anesthesia. The mean heart rate was 133.88 ± 35.00 beats/min in the anesthesia group compared to 152.11 ± 79.80 in those without anesthesia. Neonates circumcised without local anesthesia had higher respiratory rate compared to those circumcised with local anesthesia. **Conclusion:** Neonates circumcised without local anesthesia had higher mean pain scores, heart rate, lower oxygen saturation and increased mean respiratory rate than those that had local anesthesia. Local anesthesia should be routinely used during neonatal circumcision.

Keywords: Local anesthesia, neonatal circumcision, plateau specialist hospital

INTRODUCTION

Neonatal circumcision is common in Nigeria, most often without anesthesia because health-care providers believe that neonates do not feel pain or that the pain is not significant and has no long-lasting consequences, and that the procedure is of relatively short duration. However, new-borns feel pain and require the same level of pain assessment and management as adults.¹ Untreated pain in neonates may result in increased morbidity, pain memory with exaggerated responses to pain in later life and altered psychological development.²

Acute pain is one of the most common adverse stimuli experienced by infants as a result of injury, illness, or during medical procedures.³ It is associated with increased anxiety, avoidance, somatic symptoms, and increased parental distress.⁴ Pain assessment becomes necessary during circumcision. This is because pain can be prevented, reduced, and managed during neonatal circumcision to alleviate neonatal and parental

anxiety, somatic symptoms, and distress associated with the procedure. It will improve the quality of care for male newborns undergoing circumcision. Pain can be assessed using self-report, behavioral observation, or physiological measures.⁵ The aim of this study was to determine whether anesthesia was required for neonatal circumcision.

MATERIALS AND METHODS

The study was in Plateau State Specialist Hospital, a tertiary hospital in North-central Nigeria. It was a randomized control study, comparing pain scores during circumcision

Address for correspondence: Dr. Stephen Yohanna,
Bingham University Teaching Hospital, Jos, Nigeria.
E-mail: syohanna@hotmail.com

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under local anesthesia (experimental group) or without local anesthesia (control group). At 80% power and 95% confidence level ($\alpha = 0.05$), 72 neonates, 36 in each group participated in the study. Neonates presenting for circumcision and meeting the inclusion criteria were recruited after written informed consent was obtained from the parent(s). Inclusion criteria included full-term baby, defined as delivery at a gestational age ≥ 37 completed weeks of gestation and age 48 h–30 days, weight > 2.5 kg at birth or at presentation. Exclusion criteria were the evidence of bleeding diathesis, sedation, or pain medication within the previous 48 h, local infection around the prepuce, urethral, or penile shaft abnormality. Computer generated random numbers were prepared and sealed in opaque unmarked envelopes containing group assignments. Eligible participants were randomly assigned to either treatment arm. After a neonate was placed on the operating table, the envelope was opened to determine which group he belonged to. The neonates were not matched for age or weight.

All the anesthetic procedures and the circumcisions were performed in identical manner by the principal investigators. For the anesthesia group, local anesthesia was performed using 0.4 ml of 1% lidocaine without epinephrine. This was injected subcutaneously into the foreskin at both 10-o'clock and 2-o'clock positions at the level of the corona using a 26G tuberculin syringe. Circumcision was performed after 5 min to allow anesthesia to take effect.

For the group without anesthesia, circumcision was performed without prior administration of local anesthesia. The neonate was restrained in the supine position on the operating table at the level of the thighs by straps allowing access to the surgical field. The penis and the perineum were cleaned with diluted chlorhexidine. The foreskin was grasped by two artery forceps

at the lateral edges and pulled forward. An artery forceps were passed through the preputial orifice under the foreskin to lyse the adhesion between the glans and the skin.

The forceps were removed, and a mark was made by crushing on the dorsal aspect of the foreskin. A dorsal slit was made between the glans and the foreskin. The bell of the plastibell was placed between the glans and foreskin. The foreskin was pulled slightly forward and clamped with artery forceps. Suture material was then looped around in the groove and a surgical knot was tied firmly. The excess skin was excised with scissors. A probe was passed between the glans and the bell to remove clots of blood. The neonate was cleaned and handed to the parents. The suture material cutoff the blood supply to the foreskin, which withered and dropped off in 7–10 days, taking the plastibell with it.

Recording of data was done by trained assistants using Neonatal/Infant pain scores (NIPS), and pulse oximeter which was attached to the right big toe. Data were recorded during the following phases: lateral clamping of the foreskin, lyses of adhesions, dorsal cutting, retracting the foreskin for further lysis of adhesions, tying the surgical knot, and removal of the excess skin. Heart rate and oxygen saturation were continuously recorded throughout the procedure using pulse oximeter at 60 s interval.

The pain scale consists of six behavioral components with composite scores of 0–6 (as shown in Table 1 below). Five out of the six components were used in this study. These included facial expression, crying, breathing pattern, arm, and leg movements, and state of arousal. Leg movement was omitted because the infant was restrained on the theater bed.

Data analysis was conducted using EPI-INFO version 3.3, Centers for Disease Control, Atlanta. (March 2008). Student's *t*-tests were performed comparing the two groups. Mean

Table 1: Neonatal/Infant Pain Scale⁵ (modified)

Pain assessment		Score
Facial expression		
0 - Relaxed	Restful face, neutral expression	
1 - Grimace	Tight facial muscles; furrowed brow, chin, jaw, (negative facial expression - nose, mouth and brow)	
Cry		
0 - No cry	Quiet, not crying	
1 - Whimper	Mild moaning, intermittent	
2 - Vigorous cry	Loud scream; rising, shrill, continuous (Note: Silent cry may be scored if baby is intubated as evidenced by obvious mouth and facial movement)	
Breathing patterns		
0 - Relaxed	Usual pattern for this infant	
1 - Change in breathing	In drawing, irregular, faster than usual; gagging; breath holding	
Arms		
0 - Relaxed/restrained	No muscular rigidity; occasional random movements of arms	
1 - Flexed/extended	Tense, straight legs; rigid and/or rapid extension, flexion	
Legs		
0 - Relaxed/restrained	No muscular rigidity; occasional random leg movement	
1 - Flexed/extended	Tense, straight legs; rigid and/or rapid extension, flexion	
State of arousal		
0 - Sleeping/awake	Quiet, peaceful sleeping or alert random leg movement	
1 - Fussy	Alert, restless, and thrashing	

values for NIPS, heart rate, oxygen saturation, respiratory rate and duration of the circumcision were analyzed separately. A secondary analysis was performed comparing mean values of NIPS, heart rate, oxygen saturation, and respiratory rate in the neonates who received local anesthesia with those who did not receive anesthesia before the circumcision. Statistical significance was assigned if $P < 0.05$.

Approval for the study was obtained from the Research Ethics Committee of the Plateau State Specialist Hospital, Jos, Nigeria. Written voluntary informed consent was obtained from the parents of the neonates.

RESULTS

All the neonates were comparable with regard to their physical characteristics. The mean age and birth weight for the neonates were 13 ± 7 days and 3.66 ± 0.51 kg. The head circumference was 36.34 ± 2 cm, and length 51.3 ± 3.6 cm. Table 2 shows the physical characteristics of the study participants.

The results indicated that local anesthesia usage during circumcision was associated with an average NIPS score of 4.8 and 6.0 in those without anesthesia. The NIPS scores were lower in those circumcised with local anesthesia compared to those circumcised without local anesthesia. Table 3 shows the mean pain scores among the two groups of participants.

In general, the neonates who did not receive local anesthesia demonstrated a greater pain response than those circumcised using local anesthesia. All neonates who were circumcised without anesthesia had the maximum NIPS score of six

throughout the entire procedure. In both groups, NIPS scores were higher during lysis of adhesion and tying of the plastibell than during clamping, dorsal incision, or cutting of the foreskin.

The group given local anesthesia had smaller increases in heart rate compared with the unanesthetized group during circumcision (mean 133.86 ± 35.00 vs. 152.11 ± 79.80 ; $P < 0.0001$).

A significant difference in the heart rates between the two groups was observed during the dissection and following the

Table 3: Mean pain scores (Neonatal/Infant Pain Scale) during circumcision among the study participants

Parameters	Treatment allocation	
	Anaesthesia	No anaesthesia
Facial expression		
Skin clamping	6	6
Lyses of adhesions	6	6
Dorsal cutting	6	6
Retraction	6	6
Knot tying	6	6
Removal of excess skin	6	6
Total	36	36
Cry		
Skin clamping	6	12
Lyses of adhesions	5	12
Dorsal cutting	6	12
Retraction	6	12
Knot tying	6	12
Removal of excess skin	6	12
Total	35	72
Breathing pattern		
Skin clamping	6	6
Lyses of adhesions	6	6
Dorsal cutting	6	6
Retraction	6	6
Knot tying	6	6
Removal of excess skin	6	6
Total	36	36
Arms movement		
Skin clamping	5	6
Lyses of adhesions	6	6
Dorsal cutting	6	6
Retraction	6	6
Knot tying	6	6
Removal of excess skin	6	6
Total	35	36
State of arousal		
Skin clamping	6	6
Lyses of adhesions	6	6
Dorsal cutting	6	6
Retraction	6	6
Knot tying	6	6
Removal of excess skin	6	6
Total	36	36
Overall scores	178	216

Table 2: Physical characteristics of the study participants

Characteristics	Treatment allocation	
	Anesthesia (n=36), n (%)	No anaesthesia (n=36), n (%)
Age (days)		
2-8	5 (13.9)	4 (11.1)
9-15	18 (50)	24 (66.7)
16-22	7 (19.4)	4 (11.1)
23-29	6 (16.7)	4 (11.1)
Weight (kg)		
2.5-3.0	6 (16.6)	10 (27.8)
3.01-3.50	5 (13.9)	11 (30.5)
3.51-4.50	15 (41.7)	10 (27.8)
>4.50	10 (27.8)	5 (13.9)
Head circumference (cm)		
30-35	8 (22.2)	10 (27.8)
36-40	27 (75)	26 (72.2)
>40	1 (2.8)	0
Length (cm)		
40-45	0	4 (11.1)
46-50	11 (30.5)	13 (36.1)
51-55	20 (55.6)	17 (47.2)
56-60	2 (5.6)	2 (5.6)
>60	3 (8.3)	0

application of the plastibell clamp. Both groups demonstrated heart rates higher than baseline while resting undisturbed toward the end of the procedure. Handling of the penis produced a statistically significantly higher elevation in heart rate in the unanesthetized group compared with the changes in the anesthetized group ($P < 0.05$). The heart rate in both groups had returned to near preoperative baseline values by the end of 1 h postoperative monitoring period. In both groups, heart rates were higher during lysis of adhesion and tying of the plastibell than during clamping, dorsal incision, or cutting of the foreskin.

The mean respiratory rate was increased in those circumcised without local anesthesia compared with those circumcised with local anesthesia (51.52 ± 6.77 vs. 49.69 ± 2.95) However, the difference was not statistically significant.

The mean oxygen saturation decreased among those circumcised without local anesthesia compared to those circumcised with local anesthesia ($85.83\% \pm 5.61\%$ vs. $90.47\% \pm 7.53\%$) (Normal reference range 75%–100%). The difference in the oxygen saturation in the two groups was not statistically significant. The transcutaneous PO_2 for both groups decreased when the neonates were strapped onto the circumcision table and during the antiseptic scrub. Injection of the lidocaine in the anesthetized group delayed the time for return of the transcutaneous PO_2 toward the baseline, compared with the almost immediate post handling recovery for the neonates who did not receive injections. Usually, a decrease in transcutaneous PO_2 level is followed by a rebound above baseline level. Both groups of neonates in this study displayed this response. After dissection of the prepuce-glans plane began, the anesthetized group demonstrated a drop of transcutaneous PO_2 from the elevated transcutaneous PO_2 rebound level back toward the baseline. The unanesthetized group had a lower value above the baseline transcutaneous PO_2 during the dissection period. The transcutaneous PO_2 values in both groups rebounded after tying of the surgical knot around the plastibell groove and remained above the baseline levels until the neonate was cleaned. In both groups, oxygen saturation was lower during lysis of adhesions and tying of the plastibell than during clamping, dorsal incision, or cutting of the foreskin. Table 4 presents the physiological changes in the neonates during the circumcision.

DISCUSSION

Circumcision is the commonest procedure performed in the neonatal population.^{4,5} The common age for neonatal

circumcision is between 2 and 30 days.⁶ There is an assumption that neonates do not experience pain with the same intensity as adults.⁷ Physicians still may be reluctant to use anesthesia for neonatal circumcision because of concern regarding efficacy and safety. No study has described the benefits of local anesthesia for neonatal circumcision in our environment. This study hypothesized that if local anesthesia could demonstrate the efficacy in providing pain relief, then more health-care workers would use local anesthesia when performing circumcisions. This study evaluated pain in neonates during circumcision using local anesthesia.

Several studies have addressed pain-reducing interventions during neonatal circumcision including use of pacifiers, swaddling and medication.^{2,8-10} Taddio *et al.* in the United States of America demonstrated that anesthesia decreases the pain of circumcision.⁶ Razmus *et al.* demonstrated that local anesthesia was extremely effective in reducing the pain of circumcision as indicated by a low mean NIPS score at forceps application, dorsal incision, application of clamp and foreskin cutting. In contrast, the unanesthetized neonates demonstrated marked increase in NIPS score during all phases of the circumcision.⁶ Another study by Razmus *et al.* reported that newborns circumcised with dorsal nerve block and ring block (local anesthesia) had the lowest NIPS scores.¹¹

In this study, the NIPS scores were recorded during lateral clamping of the skin, lyses of adhesions, dorsal cutting, retraction for further lyses of adhesions, tying of the surgical knot, and removal of excess skin. The NIPS scores were lower in those circumcised with local anesthesia compared to those circumcised without local anesthesia. The neonates that were circumcised without local anesthesia demonstrated marked pain scores. The use of local anesthesia modified these changes. The usage of local anesthesia during circumcision was associated with an average NIPS score of 4.96 compared to an average NIPS score of 6 in those circumcised without anesthesia. The NIPS scores in this study were similar to scores found in the study by Taddio *et al.* in the USA.

It is likely that the popularity of circumcision will increase based on prevailing medical opinions as to its benefits. It is, therefore, imperative that it should be performed in a manner that causes the neonate as little pain as possible.

A study by Taddio showed that infants are affected by the pain of circumcision.¹² The researchers found clinical and biochemical evidence that indicates that new-born infants exhibit physiological, autonomic, and behavioral responses to noxious stimuli. Acute responses of neonates to pain stimuli include large increases in heart rate, decreased transcutaneous PO_2 and behavioral changes in those who were not anesthetized.¹³ The use of local anesthesia effectively reduces the physiological and behavioral indicators to pain caused by circumcision.¹⁴ Results of several double-blind, placebo-controlled studies confirm that local anesthesia decreases excursion from baseline values for tissue oxygenation, heart rate, and behavioral changes during circumcision.^{2,8-10,15} There is also evidence

Table 4: Physiological changes due to pain in neonates during circumcision

Parameters	Treatment allocation, mean \pm SD		P
	Anaesthesia	No anaesthesia	
Heart rate	133.86 \pm 35.00	152.11 \pm 79.80	<0.0001
Respiratory rate	49.69 \pm 2.9	51.52 \pm 6.77	<0.0001
Oxygen saturation	90.47 \pm 7.53	85.83 \pm 5.61	<0.0860

SD – Standard deviation

that unanesthetized neonatal circumcision is associated with an increased pain response to vaccination at four to 6 months of age.¹⁶ The results from this study indicated similar results with other studies done previously by Smith *et al.*,¹⁷ Sharek *et al.*,¹⁸ and Taddio.¹²

CONCLUSION

This study indicated that those who were circumcised without local anesthesia had higher mean pain scores, heart rate, lower oxygen saturation, and increased mean respiratory rate than those that had local anesthesia. This study demonstrated that local anesthesia was extremely effective in reducing the physiological variables of circumcision.

This study has shown that the pain of circumcision can be minimized or eliminated by use of local anesthesia. The performance of circumcisions without anesthesia should no longer be condoned or considered acceptable in the clinical setting.

Limitations

The neonates in the study were not matched for age or weight, and the same dose of 1% lidocaine was used for all the neonates in the local anesthesia group.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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