Original Article

Comparison between circumferential local anesthesia and dorsal penile nerve block in circumcision procedure

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Abstract

Objectives: To compare circumferential local anesthesia and dorsal penile nerve block with regard to pain control during adult circumcision.

Materials and Methods: A randomized, controlled clinical trial was conducted and 30 men were randomly assigned into one of the following groups: circumferential local anesthesia (LA) and dorsal penile nerve block (DNB). Patients in both groups were injected with 0.2 ml/kg of 2% lidocaine without epinephrine before circumcision using the different techniques. During the operation, pain score was evaluated in accordance with the Numerical Rating Scale (NRS) and the data were compared using the Mann-Whitney test.

Results: The patients in the LA group felt more pain than those in the DNB group during anesthetic injection (4.73 vs 3.7, $p<0.05$) but the pain scores were lower than in the DNB group during the outer prepuce incision (0.47 vs 3.93, $p<0.05$), inner prepuce incision (0.33 vs 1.47, $p<0.05$) and incision near/at Frenulum (0.33 vs 4.47, $p<0.05$). Overall pain score was higher in the dorsal penile nerve block group (1.53 vs 2.6, $p<0.05$). The circumferential local anesthesia is equally effective through all stages of the circumcision whereas the dorsal penile nerve block was not effective at the ventral surface of penis.

Conclusion: For pain control in circumcision, circumferential local anesthesia is more effective than dorsal penile nerve block.

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Introduction

Male circumcision (MC) is the surgical removal of skin covering the tip of penis. This operation can improve penile hygiene, reduce incidence of penile cancer and has the potential to decrease the risk of sexual transmitted diseases such as human papilloma virus and human immune deficiency virus[1-3]. It is considered a treatment option for recurrent urinary tract infection, phimosis, paraphimosis and recurrent balanitis or for social, cultural, personal or religious purposes[4,5].

Although considerable controversy exists regarding the medical value of circumcision, the evidence is overwhelming that it is acknowledged to be a painful procedure. The dorsal penile block (DPNB) is an effective technique for regional anesthesia of the penis[6,7]. It is done by injecting anesthetic solution deep into Buck's fascia where the nerves emerge from under the pubic bone. Two injection sites are identified over the inferior edge of the pubic bone at approximately 10 o'clock and 2 o' clock relative to the base of the penis. The needle is inserted and directed ventrally until contact is made with the pubic bone. It is then withdrawn slightly and redirected to pass below the pubic symphysis, slightly laterally and approximately 3 to 5 mm deeper to enter the appropriate space.

Several studies have documented the effectiveness of dorsal penile nerve block but as circumcision only involves the skin that covers the glans penis it is not necessary to control pain in the entire penis with dorsal penile nerve block and there is the possibility that circumferential local anesthesia would be equally if not more appropriate. This study was undertaken to compare the efficacy of circumferential LA with DNB.

Materials and Methods

Patient selection

This clinical trial was approved by the Ministry of Public Health and the patients provided written informed consent before undergoing the procedures. All enrolled patients were adult men of 18 to 70 years of age who came for circumcision due to phimosis or for religious reasons.

The exclusion criteria included patients who might have sensory deficit such as peripheral neuropathy or paralysis, patients who were allergic to lidocaine, and patients who preferred general anesthesia. Other exclusion criteria were acute infection of the genitalia (acute posthitis or balanitis), a thickened prepuce secondary to chronic inflammation, severe foreskin adhesion, or other contraindications to MC such as anomalies of the penis (e.g. chordee, or curvature of the penis), hypospadias, epispadias, concealed or buried penis, micropenis, webbed penis, and ambiguous genitalia.

In total, 30 patients were prospectively enrolled onto the study and randomized by drawing lots. The anesthetic techniques were written on 30 pieces of paper, LA group (n = 15) and DNB group (n = 15). The papers were put in a box and patients selected one blindly before the operation. All anesthesia and circumcision procedures were performed by the same surgeon.

Surgical technique

The patient was placed in the supine position. After preparation of the skin the anesthetic injection was given.

For the regional anesthesia, the dorsal penile nerve block was administered as described by Kirya and Werthmann[6]. Using a 24-gauge syringe, 0.2 ml/kg of 2% lidocaine without epinephrine[8,9] was divided into 2 and injected into both sides at the 10- and 2-o'clock positions at the base of the

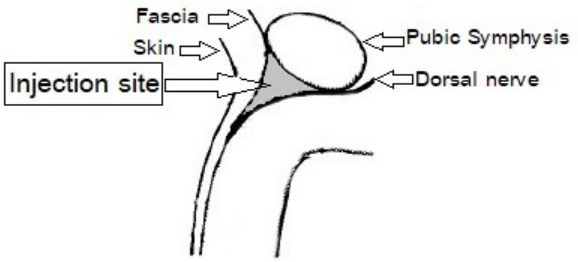

Figure 1. Lateral view of dorsal penile nerve block.

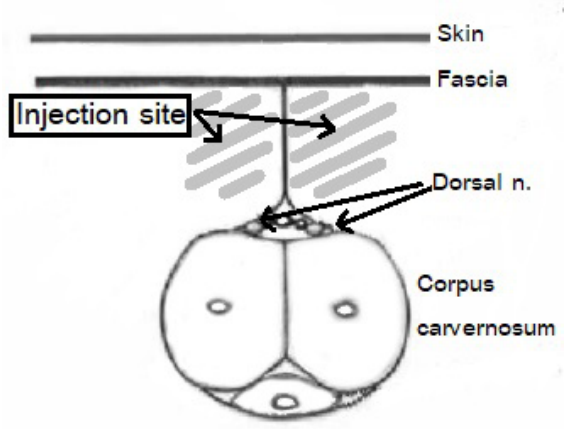

Figure 2. Transverse section of dorsal penile nerve block.

penis inferior to pubic symphysis (Figure 1 and 2).

In the LA group, circumferential local anesthesia was performed by injecting 0.2 ml/kg of 2% lidocaine without epinephrine[8,9] subcutaneously in the outer and inner surface at the level of the corona (Figure 3).

The sleeve technique circumcision was done with the following steps: circumferential outer foreskin incision, circumferential inner foreskin incision, frenulum incision, dorsal slit, foreskin excision and wound suture[10]. If the patients could not tolerate the level of pain, additional anesthetic solution would be injected directly at that area. Patient pain scores were evaluated again immediately and 5 minutes after the operation.

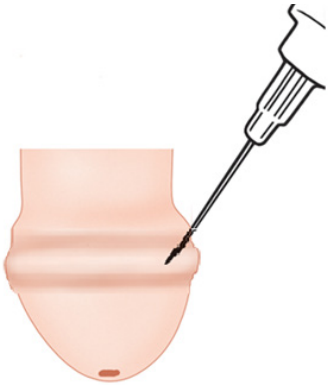

Figure 3. Circumferential local anesthesia (both outer and inner surface of prepuce).

Data collection

After anesthesia, patient sensation would be tested with forceps before starting the operation. Pain score was evaluated before, at each step and after the operation.

We used the internationally accepted Numerical Rating Scale (NRS) to evaluate pain[11]. To record the NRS, patients were asked to circle the number between 0 and 10 that best described their pain intensity. Zero usually represents "no pain at all" whereas the upper limit represents "the worst pain ever possible".

Statistical analysis

A T-test was used to compare age and BMI between two groups. We used the nonparametric Mann-Whitney test to compare pain scores[12]. Statistical significance was defined as a p-value of < 0.05.

Results

Patient characteristics were well balanced between the two groups. There were no statistically significant differences in age ($p = 0.9161$) and BMI ($p = 0.926$). Table 1 lists the characteristics of all patients in this study.

During anesthesia injection, LA was more painful than DNB (4.73 vs 3.7, $p < 0.05$). For each step of circumcision, in comparison with the dorsal penile nerve block group, the pain score was less in the LA group during the three procedural intervals: outer incision (0.47 vs 3.93, $p < 0.05$), inner incision (0.33 vs 1.47, $p < 0.05$) and incision near/at frenulum (0.33 vs 4.47,

Table 1. Comparison between local anesthesia (LA) group and dorsal penile nerve block (DNB) group.

	LA	DNB	P-value
Age (years)	43.53 +/- 20.97	42.73 +/- 20.23	0.9161
Body mass index (BMI) (kg/m^2)	22.59 +-/ 2.46	21.75 +/- 2.6	0.926
Circumcision steps	Pain score		
• Injection	4.73 +/- 1.22	3.7 +/- 0.96	0.04
• Outer incision	0.47 +/- 0.52	3.93 +/- 1.22	< .00001
• Inner incision	0.33 +/- 0.48	1.47 +/- 1.06	< .00001
• Frenulum incision	0.33 +/- 0.49	4.47 +/- 1.19	< .00001
• Dorsal slit	0.27 +/- 0.46	0.27 +/- 0.46	0.98
• Foreskin excision	0.27 +/- 0.46	1.33 +/- 0.35	0.59
• Suturing	0.73 +/- 0.70	1.00 +/- 0.76	0.37
• Post-op	0.267 +/- 0.46	0.2 +/- 0.41	0.77
• Post-op 5 minutes	0.13 +/- 0.35	0.13 +/- 0.35	0.98
• Overall pain score	1.53 +/- 0.64	2.6 +/- 1.24	.01278

Age and BMI are reported as mean ± SD. There were no significant differences between groups. The Numerical Rating Scale was used to evaluate pain. The Mann-Whitney test was used for statistical analyses.

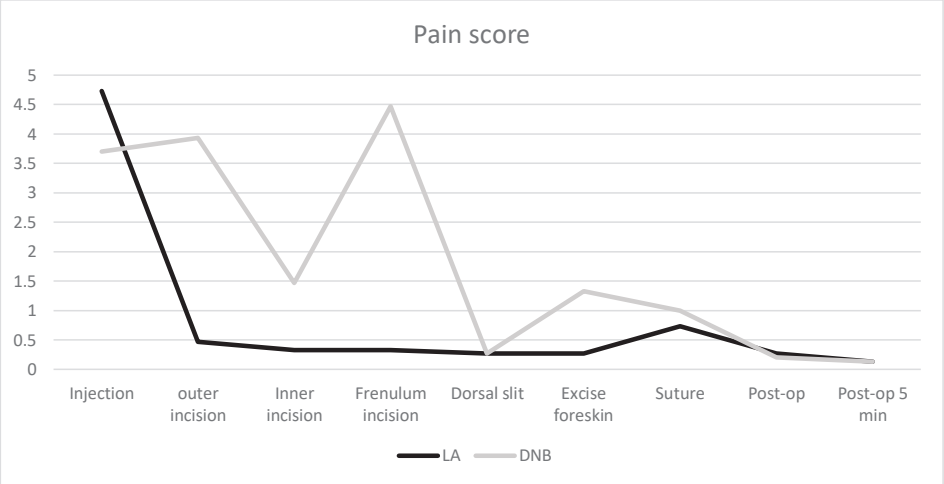

Figure 4. Pain score at each step of circumcision between the two groups.

$p < 0.05$). But there was no significant difference during dorsal slit, foreskin excision, suture, and post-operative pain. Overall pain score was higher in the dorsal penile nerve block group (1.53 vs 2.6, $p < 0.05$). Figure 4 shows the pain score at each step of circumcision between the groups.

Throughout the circumcision, the patients in the LA group had the highest pain score during anesthetic injection but showed little change in pain score compared with the DNB group during every step of circumcision and immediately afterwards. The DNB group had the highest pain score during frenulum incision, injection and outer foreskin incision.

Discussion

Our study has shown that circumferential LA is associated with higher pain score than DNB during anesthetic injection but lower scores during the operation. In the circumferential LA group there was a requirement of more injection sites than in the dorsal penile nerve block group to cover both outer and inner foreskin. This might be the cause of the pain score being higher in the circumferential LA during injection.

In the DNB group it appears that the dorsal penile nerve block was less effective at the three steps: outer incision, inner incision and incision near/at frenulum. However, during these steps, most of the patients did not feel pain at the dorsal side but began to feel pain and required additional anesthesia when the operation shifted to the ventral side especially near/at the frenulum. This might be the cause of the overall pain score being higher in the dorsal penile nerve block group.

Sensory innervation of the penis is through the dorsal nerve. The nerves richly supply the glans. The dorsal nerves travel alongside the dorsal arteries. In addition to receiving supply from the dorsal penile nerves the penis also receives innervation from small branches of the perineal nerve at the ventral side[13]. If DNB is used more anesthetic is needed in this area. The dorsal penile nerve block is technically more difficult than the local anesthesia as the depth and location of the dorsal nerve has to be estimated. The local anesthesia involves an injection of lidocaine directly at the surgical site so it can be performed more easily and accurately. In addition, in this study, we found that the duration for the anesthetics to take effect was shorter in the LA group. This might be due to the difference in technical difficulty as mentioned before.

There are a few limitations to our study, firstly there was no pain score threshold for additional anesthesia. We injected additional anesthesia only when the patients could not tolerate pain. Some patients requested additional anesthesia when NRS was 3 while others did not request it at the same pain score, so the real pain score might be higher. The variation in human tolerance of pain is difficult to control. The other principal weakness is that, statistically NRS does not have ratio qualities. Numerically equal intervals on the scale (e.g., the difference between 1 and 3 and the difference between 7 and 9) may not represent equivalent intervals in terms of scaling the intensity of pain.

In this study no complications were found in either group. But by reviewing the literature on dorsal penile nerve block, there are potentially two minor complications: bleeding and hematoma, both due to penetration of the superficial penile vein. Sara and Lowry have reported two cases of gangrene of the glans following circumcision using dorsal penile nerve block in a 13-month-old and a 3-year-old[14]. The authors postulated that trauma to the dorsal vessels caused bleeding into the restricted space between the Buck fascia and the corpora cavernosa, resulting in tamponade of the dorsal arteries and subsequent ischemia. Using the local anesthesia technique, the anesthetic is injected away from any major vessels and consequently would be less likely to result in bleeding or intravascular injection.

Conclusion

Circumferential local anesthesia is more effective in controlling pain during circumcision. Local anesthesia is also a simple technique and is theoretically less likely to result in serious complications. In the case of dorsal penile nerve block, it should be combined with ventral infiltration of local anesthesia at the site of incision.

Conflict of Interest

The author declares no conflict of interest.

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