Regional anaesthesia for circumcision in adults: a comparative study

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Penile block (PB) in adults is not a well-recognized technique. The aim of this study was to compare, in a randomized prospective manner, five different techniques of PB in 250 adults undergoing circumcision with regard to anaesthetic quality, complications and postoperative analgesia. Patients were divided into five groups (50 per group) according to the technique used: Group A – "10, 30–13, 30" approach; Group B – the subpubic approach; Group C – subcutaneous ring block; Group D – a combination of frenulum infiltration and the "10, 30–13, 30" approach; Group E – a combination of frenulum infiltration and the subpubic approach. The number of failed blocks in Groups A and B (41 and 43 respectively) was greater than in Groups C, D and E (2, 3 and 5 respectively) ($P < 0.001$). The five groups did not differ with regard to adverse effects or time until the onset of postoperative pain when the blocks were successful. It is concluded that good surgical anaesthesia, a low rate of adverse effects and prolonged postoperative analgesia can be achieved by the use of either subcutaneous ring block or a combination of dorsal nerve block (using the "10, 30–13, 30" or the subpubic approach) and infiltration of the frenulum. These approaches to the PB are effective anaesthetic techniques for circumcision in adults.

Chez l'adulte, le bloc du pénis (PB) ne constitue pas une technique généralement acceptée. Cette étude prospective et randomisée vise à comparer cinq différentes techniques de BP chez 250 adultes soumis à une circoncision, au regard de la qualité de l'anesthésie, des complications et de l'analgésie postopératoire. Les patients sont divisés en cinq groupes (50 par groupe) selon la technique utilisée: le groupe A – l'approche « 10:30–13:30 »; le groupe B – l'approche sus-pubienne; le groupe C – l'infiltration sous-cutanée en bague, le groupe D – une combinaison d'infiltration du frein avec approche « 10:30 – 13:30 »; le groupe E – une combinaison d'infiltration du frein avec approche sus-pubienne. Le nombre des échecs dans les groupes A et B (41 et 43 respectivement) est plus grand que dans les groupes C, D, et E (2,3 et 5 respectivement, $P <$ 0,001). Lorsque le bloc est réussi, les cinq groupes sont identiques entre eux au regard des effets secondaires ou du délai de l'apparition de la douleur. En conclusion, avec une infiltration sous-cutanée en bague ou une combinaison du bloc du nerf dorsal (approche 10,30–13,30 ou sus-pubienne), on peut obtenir une bonne anesthésie chirurgicale, un faible pourcentage d'effets secondaires et une analgésie postopératoire prolongée. Ces approches du bloc pénien sont des techniques anesthésiques efficaces pour la circoncision de l'adulte.

Key words
ANAESTHETIC TECHNIQUES: regional – penile block;
SURGERY: circumcision.

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Circumcision is performed for either medical reasons or ritual purposes. Most of the studies on anaesthesia for circumcision relate to paediatric patients.[1,2] In children, it is normally performed under general anaesthesia and penile block,[2] caudal[3] or topical analgesia[4] or opioids[5] are used for postoperative pain relief. According to these studies, penile block induces better postoperative analgesia and fewer adverse side effects than the other methods employed.

The literature contains very few reports of anaesthesia or postoperative management in cases of circumcision in adults.[6] In this prospective study we compared five different techniques of penile block for circumcision in adults.

Methods

Between January 1 and February 28, 1991, patients were scheduled for circumcision in our outpatient clinic and were enrolled in this study after written informed consent and institutional ethics approval had been obtained. Pa-

tients were admitted early on the morning of surgery, when a preoperative assessment was performed. No food or fluids were allowed for at least six hours before surgery. The patients were assigned randomly to one of five groups (A to E), each group consisting of 50 patients. No premedication was given. All 250 blocks were performed by the same anaesthetist. Following insertion of an *iv* cannula, a mixture consisting of equal quantities of lidocaine 1% and bupivacaine 0.5% (total volume 10 ml) was injected through a 23-gauge 3 cm needle using one of five blocking techniques. Patients in Groups D and E received supplementary infiltration of 2 ml into the frenulum.

A second "blinded" anaesthetist, using the pinprick technique, assessed the quality of analgesia 15 min after completion of the block and decided whether general anaesthesia was necessary or not. The criteria for proceeding to general anaesthesia were incomplete or inadequate anaesthesia of the penis. When needed, GA was induced with methohexitone 1 $mg \cdot kg^{-1}$ *iv* (with supplemental boluses of 10–20 mg as required), fentanyl 1–2 $\mu g \cdot kg^{-1}$ and a 1:1 mixture of nitrous oxide and oxygen by mask. During regional anaesthesia, no supplementary sedation was given and vital signs were monitored by a V_5 ECG lead, pulse oximetry and noninvasive blood pressure measurement. Patients who underwent GA were monitored also by capnography and measurement of rectal temperature.

Blocking techniques

GROUP A

The area at the base of the penis was prepared with povidone iodine solution and the needle was inserted in the 10,30 and 13,30 hours positions, as previously described.[7] Buck's fascia was pierced about 5 mm below the skin, when in most cases a click was felt. The local anaesthetic was injected deep into Buck's fascia following a negative test for aspiration of blood.

GROUP B

The inferior border of the symphysis pubis was palpated. At a point 1 cm from the midline the needle was inserted at an angle of 30° to the skin, slightly caudally and towards the midline, as previously described.[8] Following piercing of the fascia, the solution was injected.

GROUP C

A subcutaneous ring for infiltration of the local anaesthetic was prepared round the base of the penis, with no attempt made to pierce Buck's fascia. About two-thirds of the volume was injected dorsally until a visible wheal appeared around the proximal shaft of the penis.[9]

TABLE I Patient characteristics (mean ± SD)

	Age (yr)	*Height (cm)*	*Weight (kg)*
Group A	38.64 ± 1.73	174.74 ± 0.67	74.78 ± 0.88
Group B	38.64 ± 1.73	173.66 ± 0.60	73.36 ± 0.81
Group C	38.24 ± 1.69	173.24 ± 0.51	73.48 ± 0.96
Group D	38.58 ± 1.67	173.8 ± 0.51	73.36 ± 0.89
Group E	42.12 ± 1.98	174.92 ± 0.56	73.98 ± 0.82

GROUP D

In addition to injection at the 10,30 and 13,30 positions, as in Group A, 2 ml of anaesthetic solution was infiltrated into the frenulum.

GROUP E

These patients received a combination of the subpubic injection (as in Group B) and infiltration into the frenulum.

All patients were kept under close observation for six hours. Postoperatively, the need for analgesia was assessed by a third prenamed anaesthetist with the aid of a numeric analogue score with minima at 0 and maxima at 10. Pain was treated with paracetamol 0.5 g suppositories *pr* when the score was ≥3. The time taken from the end of the operation until pain onset and until the micturition was noted. Also recorded were adverse effects such as prolonged bleeding, haematoma and swelling at the operating site, vomiting, fainting, and signs of toxic reaction (dizziness, tremor, muscle twitching, convulsions, etc.).

One hour after surgery patients received fluids orally or, if they complained of nausea, intravenously.

Analysis of variance (ANOVA) was applied to continuous data in order to detect differences among groups. Differences among groups were further examined using Duncan's multiple t test. The ANOVA and Duncan's multiple t test were carried out using the SAS statistical package (SAS Institute Inc., Cary, NC, USA). Ratios were compared by means of the chi-square test.

Results

Patients' characteristics are presented in Table I. There were no differences between the groups with regard to age ($P = 0.51$), weight ($P = 0.64$) or height ($P = 0.18$). Of the 250 adults in this study, penile block was successful in 156 (62.4%). The rest (94/250, 37.6%) required GA because the block was ineffective. When the block was successful, the onset of surgical anaesthesia was quite similar among the five groups (Table II). Block failure (Table II) (indicated by pain when tested by pinprick) occurred in 41 patients from Group A. All 35 felt pain in the ventral part of the penis. In Group B, 35 patients felt pain on pinprick in the ventral aspect and eight also

TABLE II Incidence of failed penile blocks, time to first analgesic requirement and time to onset of surgical anaesthesia

Block group (n = 50)	*No. of failed blocks*	*TFAR*		*TOSA*
		U	*S*	
A	41	34 ± 45	250 ± 80	7.50 ± 1.8
B	43	32 ± 26	202 ± 86	7.05 ± 1.4
C	2*	38 ± 22	192 ± 52	6.50 ± 1.7
D	3*	42 ± 18	296 ± 105	5.60 ± 2.1
E	5*	40 ± 35	245 ± 96	6.20 ± 1.8

Total failed blocks: 94.
*Different from Groups A and B ($P < 0.001$).
TFAR = Time to first analgesic requirement; TOSA = Time of onset of surgical anaesthesia; U = Unsuccessful; S = Successful; The values for TFAR and TOSA are expressed in minutes (mean ± SD).

in the dorsal aspect of the penis. In Group C two patients felt both ventral and dorsal pain, in Group D three patients felt ventral pain and in Group E five patients felt both ventral and dorsal pain.

Block failure was lower in Groups C, D and E when compared to Groups A and B ($P < 0.001$) (Table II). The time to first analgesic requirement was not different among the five groups when each group was subdivided into successful and unsuccessful blocks (Table II).

Adverse effects encountered during or after surgery are listed in Table III.

Patients who underwent GA did not differ from patients with successful blocks with regard to postoperative bleeding, haematoma, swelling, inability to urinate within six hours of the operation, fainting or signs of toxic reactions (shivering, muscle twitching starting 20–25 min after achievement of penile block and lasting for 15–20 min). There were no differences among the five groups with regard to vomiting. Swelling at the site of operation occurred most frequently in patients in Group C. All patients with successful block were able to walk by the end of the surgery. No cases of necrosis of the skin of the penis or postoperative wound infection were noted. All vital signs were within normal limits throughout surgery and postoperatively.

Discussion

Blocking of the dorsal nerves of the penis is a simple and effective technique to provide post-circumcision analgesia in children.[10] This study was undertaken in order to determine the most effective approach to penile block for circumcision in adults.

The paired dorsal nerves of the penis are branches of the pudendal nerves, and are mainly responsible for the sensory innervation of the skin of the penis, sending terminal fibres to both its dorsal and ventral aspects.

Additional sensory innervation comes from the ilioinguinal and genito-femoral nerves, as well as from posterior scrotal branches of the perineal nerves that run paraurethrally to the ventral surface of the frenulum.[11,12]

Various techniques of penile block have been described, mainly in children. These include the "10.30–13.30" and subpubic approaches to the dorsal nerves[7,8] and the subcutaneous ring block of the penis.[9] The "10.30–13.30" approach[7] used here in Group A patients appears to have two main disadvantages. First, the anaesthetic might be injected into the dorsal penile vessels and/or corpora cavernosa, with the risk of failed anaesthesia and even ischaemia and necrosis of the skin of the penis.[13] Secondly, some areas of the ventral part of the penis may remain unanaesthetized, because of the numerous sources of innervation as described above.

The subpubic approach, which may be either central or lateral,[8,14] also has certain disadvantages. Since the subpubic space is divided by the suspensory ligaments of the penis into two non-communicating compartments, two injections are needed in order to achieve satisfactory anaesthesia.[15,16] In addition, as in the case of the "10.30–13.30" technique, analgesia of the ventral part of the skin of the penis (frenulum) tends to be patchy. It would therefore seem logical that infiltration of the frenulum is necessary in order to achieve effective anaesthesia of the penis.[6] Subcutaneous ring block has been shown to be effective in alleviating post-circumcision pain in children,[9] possibly by blocking the subcutaneous nerve fibres of the skin of the penis shaft.

When the frenulum was infiltrated (Groups D,E) the ventral aspect was adequately anaesthetized in most cases, suggesting that infiltration of the frenulum should be performed routinely in order to ascertain satisfactory penile block.[12] The causes of failure in ten patients from Groups C,D and E are not clear. Successful blocking in Groups A and B, which was achieved in only 16/100 patients, was probably the result of preferential innervation of both the dorsal and the ventral skin of the penis by branches of the dorsal nerves of the penis.

The volume of injected local anaesthetic required in adults may vary between 7 ml[17] and as much as 50 ml.[18] We used 10 ml, with a supplement of 2 ml for infiltration of the frenulum in Groups D and E, and this seemed to be sufficient. The mixture of anaesthetic drugs used here resulted in rapid onset (5–10 min) due to lidocaine[18] and prolonged duration of action (up to 5–6 hours) due to bupivacaine.[1,12,19] The aetiology of the signs of toxic reactions might be inadvertent injection of a part of the local anaesthetic directly into the penile vessels.

There were no differences between the groups with regard to the duration of pain relief in successful blocks except for a shorter duration with ring block (Group C)

TABLE III Adverse postoperative effects

	No. of patients									
	Group A		*Group B*		*Group C*		*Group D*		*Group E*	
Adverse effects	*GA*	*PB*	*GA*	*PB*	*GA*	*PB*	*GA*	*PB*	*GA*	*PB*
Bleeding	1	0	0	0	2	0	0	0	1	1
Haematoma	0	2	0	1	0	0	2	0	0	1
Swelling	2	2	1	2	6	10	2	4	2	3
Inability to urinate	0	1	1	0	0	0	0	0	1	1
Vomiting	10	2	10	3	2	0	1	2	2	3
Fainting (vago-vagal reflex)	0	2	1	0	0	2	0	0	1	1
Toxic reactions	0	2	0	0	0	1	0	2	0	0

GA = General anaesthesia.
PB = Penile block.

(Table II) which might be attributable to wider dispersion of the anaesthetic and hence its more rapid absorption.

In summary, good intraoperative and postoperative analgesia of the skin of the penis can be achieved by the use of either subcutaneous ring block or a combination of dorsal nerve block (using the "10.30–13.30" or the subpubic approach) and infiltration of the frenulum. These approaches to the penile block are effective anaesthetic techniques for circumcision in adults.

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