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Post-circumcision Analgesia—A Prospective Evaluation of Subcutaneous Ring Block of the Penis

LYNN M. BROADMAN, M.D.,* RAAFAT S. HANNALLAH, M.D.,† A. BARRY BELMAN, M.D.,‡
PAUL T. ELDER, M.D.,§ URS RUTTIMANN, PH.D.,¶ BURTON S. EPSTEIN, M.D.‡

Pain is the most common and, often, a very disturbing immediate sequela of circumcision in children and in adults. Kay¹ described the use of caudal anesthesia, and Soliman and Tremblay² the dorsal nerve block of the penis to control this postoperative pain. These blocks have not gained widespread popularity, possibly due to the misconception that they are difficult to perform, time-consuming, and may expose patients to additional risks and complications. The purpose of this study was to determine if a simple subcutaneous ring block at the base of the penis could provide effective postoperative analgesia in children following circumcision without additional risks or delay in recovery and hospital discharge.

METHODS

Fifty ASA Class I or II children who were undergoing circumcision, and who were at least 18 months of age, were subjects for this prospective, randomized, double-blind study. The protocol was approved by our Institu-

tional Review Board, and informed consent was obtained from all parents. The children were randomized to either the experimental or the control group by the sealed envelope method. None of the children received any form of premedication. Anesthesia was induced either by inhalation of nitrous oxide and halothane, or by the iv injection of thiopental if selected by an older child, or if younger children refused to accept an inhalation induction. Anesthesia was maintained with nitrous oxide and halothane. Dextrose 5% in saline 0.3% was infused iv. No analgesic drugs were administered intraoperatively.

Circumcision was carried out under the supervision of the same surgeon using the same technique in all patients.³ Electrocautery was used to excise the foreskin and to coagulate blood vessels. All skin edges were approximated with 5-0 Vicryl[®] suture. At the termination of surgery, but prior to emergence from general anesthesia, the ring block was performed by the surgeon under sterile conditions with a solution which was obtained from a numbered vial. The exact contents of the vial was known only to the research pharmacist. Bupivacaine 0.25% without epinephrine (group I) or normal saline (group II), was injected around the shaft of the penis near the base with a 25 ga × 1.0-inch needle (fig. 1). No attempt was made to identify Buck's fascia or the dorsal nerves of the penis; however, a greater volume of solution was injected dorsally in the midline than in other areas of the ring. Since no member of the operating room team was aware of the nature of the material injected at the base of the penis, a maximum "safe" volume was calculated for each child. This "safe" volume limited the potential dosage of bupivacaine to no more than 2.0 mg/kg. The actual volume injected during the performance of each block was determined by

* Assistant Professor.

† Associate Professor.

‡ Professor.

§ Fellow.

¶ Associate Research Professor.

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Address reprint requests to Dr. Broadman: Department of Anesthesiology, Children's Hospital National Medical Center, 111 Michigan Avenue, NW, Washington, DC 20010.

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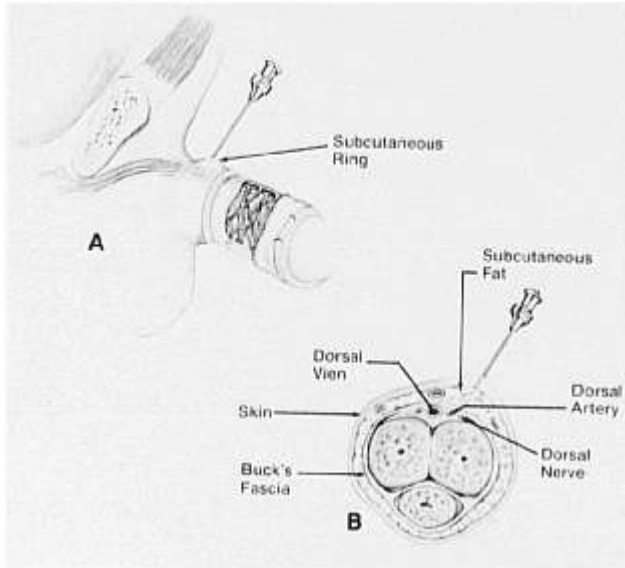


FIG. 1. A. A subcutaneous ring of 0.25% Bupivacaine being injected about the shaft of the penis near the base. B. A cross section of the penis at the base showing the paired dorsal nerves lying just lateral to the dorsal arteries and deep to Buck's fascia.

the formation of a visually acceptable wheal around the proximal shaft of the penis near the root. It ranged from as little as 1.5 ml of solution in an 18-month-old infant up to 5 ml in children ages 5–10 yr. The likelihood of an accidental intravascular injection was minimized by avoiding obvious superficial vascular struc-

TABLE 1. Pain/discomfort Scale⁴

Observation	Criteria	Points
Arterial blood pressure	BP \pm 10% preop	0
	BP > 20% preop	1
	BP > 30% preop	2
Crying	Not crying	0
	Crying but responds to tender loving care (TLC)	1
	Crying and does not respond to TLC	2
Movement	None	0
	Restless	1
	Thrashing	2
Agitation	Patient asleep or calm	0
	Mild	1
	Hysterical	2
Posture	No special posture	0
	Flexing legs and thighs	1
	Holding penis or groin	2

TABLE 2. Percentage of Ring Blocks Requiring Fentanyl

Agent Utilized for Ring Block	Fentanyl Analgesia Required	No Fentanyl Analgesia Required
.25% bupivacaine (n = 25)	5 (20%)	20* (80%)
Normal saline (n = 25)	14 (56%)	11 (44%)
Total # pts. = 50	19 (38%)	31 (62%)

Fentanyl was administered to children scoring 7 or more points on the pain/discomfort scale.

* Chi-square analysis; $P < .025$.

tures and by performing frequent aspirations during infiltration.

Following completion of the ring block, each child was immediately transported to the Post-anesthesia Recovery Room (PARR). In the PARR, and, later, in the Short-Stay Recovery Unit (SSRU), a research assistant, who was also unaware of the nature of the material which was used to perform the ring block, observed the patients at 5, 10, 15, 20, 30, 45, 60, 90, and 120 min and then at 1/2-hr intervals until discharge. Pain and/or discomfort were objectively evaluated at 5-min intervals using the scoring system shown in table 1.⁴ Fentanyl (1–2 mcg/kg) was administered iv to any child who achieved a pain score of 7 or more on two successive observations.

Children were discharged from the hospital when they were alert and oriented, had stable vital signs, could walk with minimal assistance, and could tolerate the oral intake of clear liquids with minimal nausea and vomiting.

Differences in the incidence of fentanyl administration between the control and the treatment groups were analyzed with chi-square techniques. Differences in pain scores and in the time required to meet discharge criteria for the various treatment groups were compared by using Student's *t* test.

RESULTS

Twenty-five patients received a bupivacaine block, while 25 served as controls. The children in both groups were comparable for age, weight, and duration of surgery. Children who received a ring block with 0.25% bupivacaine (group 1) required significantly less fentanyl ($P < .025$) than did the normal saline controls (group 2) (table 2). In addition, the pain/discomfort scores were significantly lower at the 15-min observation period in the PARR in the group I children (fig. 2) than in the group II children ($P < .03$). The mean time required to meet discharge criteria from the hospital for all group I patients was 155 ± 9 min, which was

significantly shorter than that of the control group (193 ± 9 min) ($P < .005$). To more clearly examine the effects of iv fentanyl (1–2 mcg/kg) upon the time required to meet standard discharge criteria, data from children who required fentanyl were removed from group I and II and used to form group III. Children who required fentanyl analgesia (group III; $N = 19$) had a mean discharge time of 195.4 ± 9.5 min. Children who did not require fentanyl ($N = 31$) had a significantly shorter mean discharge time of 160 ± 8.4 min when compared to those who required fentanyl ($P < .009$). When fentanyl was administered, it was found to be effective in controlling pain and discomfort in all cases. No child who had a penile block with bupivacaine was alarmed or concerned by the lack of penile sensation. No complications related to a block or adverse drug reactions were observed.

DISCUSSION

Circumcision in infants and children is often associated with severe postoperative pain. Such pain may cause restlessness, agitation, and postoperative bleeding. Currently, the techniques most commonly used to control the pain associated with circumcision include parenterally administered narcotics, caudal blocks,¹ and dorsal nerve blocks.²

Soliman and Tremblay² reported satisfactory results in 48 out of 50 children who received a dorsal nerve block using 0.54 mg/kg bupivacaine 0.25% solution. Two patients were agitated in spite of the block; however, their postoperative behavior was not changed by meperidine administration. Patients with successful blocks required no other form of postoperative analgesia for a minimum of 6 h.

A recent study by Vater and Wandless⁵ showed that dorsal nerve blocks of the penis provided postoperative analgesia for circumcision that was just as effective as that produced by caudal blocks. Furthermore, the dorsal nerve block group had a lower incidence of vomiting, micturated sooner, and stood earlier than did the caudal group. Performing a dorsal nerve block, however, requires special skills. Without proper precaution, a hematoma can result from accidentally puncturing the dorsal artery or vein of the penis while attempting to infiltrate the dorsal nerves, which lie deep to Buck's fascia.

Sara and Lowry⁶ have recently reported two cases of gangrene of the skin of the glans penis following circumcisions which were performed in conjunction with dorsal nerve blocks. These authors postulate that these two serious complications were more than likely caused by compression of the dorsal arteries, which resulted in inadequate perfusion of the glans, apparently caused by

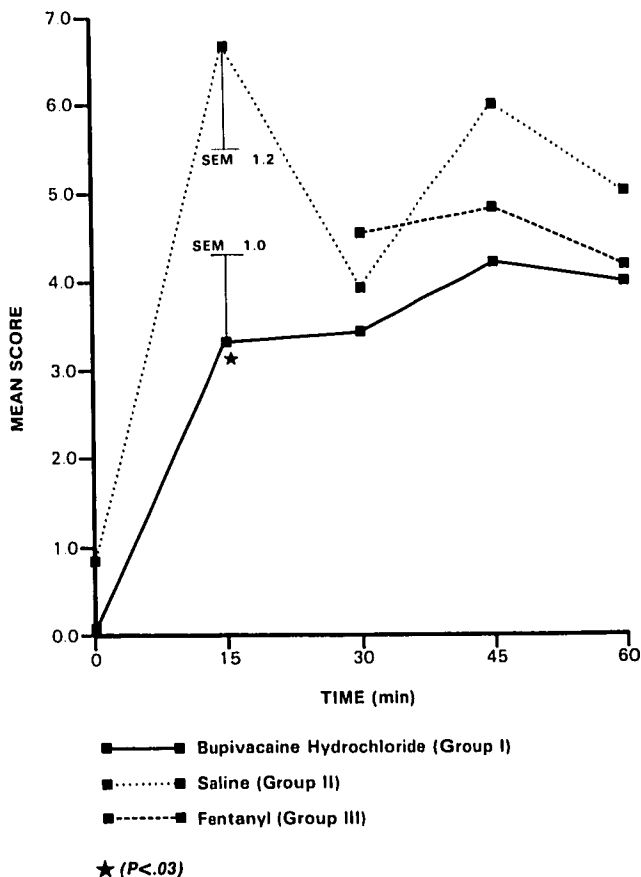


FIG. 2. Pain/discomfort scores in the recovery room following bupivacaine hydrochloride (group I) or normal saline ring blocks (group II). Group III is composed of 19 group I and group II patients who required intravenous fentanyl for postoperative pain.

damage to either the dorsal arteries or vein during performance of the block. These damaged vessels then bled into the restricted space formed by Buck's fascia and the corpora cavernosa (fig. 1), and led to arterial compression. This compression may have been compounded by post-analgesia erections.⁶ Such serious complications might be avoided by performing a simple ring block of the penis. While it is still possible to accidentally puncture superficial arteries and veins while performing a superficial ring block, bleeding from such vessels should not form a hematoma in a confined space. Unlike the dorsal nerve block, no attempt is made to infiltrate deep to Buck's fascia when performing a ring block; hence, there should not be any compression of the dorsal arteries. We have shown that excellent analgesia can be obtained following circumcision by simply injecting a subcutaneous ring around the base of the penis with 0.25% bupivacaine. This procedure, in contrast to specifically blocking the dorsal nerves, requires no special training. Although our study did not include infants undergoing neonatal circumcision, one of the

authors (ABB) has employed the technique in more than 50 newborns with very good results.

Another novel technique, the use of topical lidocaine, has recently been reported by Tree-Trakarn *et al.*⁷ to provide effective postoperative pain relief in children following circumcisions which were performed under general anesthesia. When compared to our ring block technique, topical lidocaine does have the advantage of being easy to perform, and could be used by parents to provide postoperative analgesia following discharge. On the other hand, topical lidocaine cannot be used to provide adjunct operative anesthesia, because lidocaine will not penetrate intact skin. It will only penetrate the intact mucous membrane undersurface of the foreskin, and the exposed nerve endings and skin edges which remain following surgery.

It was our intention, in designing the study, to have both controls and ring block children emerge from their general anesthetic at the same rate in order to properly blind the observer stationed in the recovery room. Therefore, the ring blocks were placed at the completion of surgery. In clinical practice, however, we routinely place all of our blocks following the induction of anesthesia, but prior to the onset of surgery, to provide both adjunct operative anesthesia and postoperative analgesia. This will help us to determine if the block is functioning properly by decreasing the inspired concentration of volatile anesthetic agents and evaluating the patient's response to surgical stimulation. If the block does not appear to be functioning properly, it can be repeated. Moreover, the adjunct anesthesia provided by the ring block allows the anesthesiologist to reduce the inspired concentration of volatile anesthetics during surgery. This, in turn, leads to more rapid recovery. Perhaps the most optimal analgesic combination would be to perform a ring block prior to the onset of surgery to provide both adjunct operative anesthesia and postoperative analgesia, and then apply lidocaine spray just prior to discharge from the hospital in order to provide an additional 4 h of analgesia.

We found that intravenous fentanyl in a dosage of 1–2 mcg/kg iv provided acceptable postoperative pain relief for both ring block (group I) and control (group II) patients who had significant postoperative pain. However, the administration of this low-dose fentanyl did delay discharge from the hospital by 35 min. In another recently published study,⁴ the use of low-dose fentanyl did not delay discharge following orchidopexy surgery, because many of the children tended to have

protracted discharge times due to postoperative nausea and vomiting. In the orchidopexy patients, the incidence of postoperative nausea and vomiting was not altered by either the administration of low-dose fentanyl or caudal block analgesia. On the other hand, patients in the present study were not troubled by postoperative nausea and vomiting; when fentanyl was administered to this group, it had a tendency to produce somnolence and delay discharge. Although longer-acting narcotics, *e.g.*, morphine, were found by other investigators to produce longer duration of analgesia than can be obtained with fentanyl, they result in more drowsiness and a high incidence of vomiting.⁷

In summary, a subcutaneous ring block of the penis with 0.25% bupivacaine hydrochloride was found to be a simple and effective method of providing post-circumcision analgesia without complications or delays in discharge. No special skill or equipment was required to perform the block. The children who received ring blocks required significantly less fentanyl in the postoperative period, and met discharge requirements significantly earlier than did children in the control group. While iv fentanyl (1–2 mcg/kg) provided effective analgesia during recovery for the control group and those children in whom bupivacaine hydrochloride was ineffective, hospital discharge and return home were delayed by an average of 35 min when compared to those who did not require fentanyl.

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