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# The Safety of Dorsal Penile Nerve Block for Neonatal Circumcision

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**Background.** Dorsal penile nerve block (DPNB) was first described for use in neonatal circumcision in 1978. Since then, many studies have documented its effectiveness in alleviating pain in newborns undergoing circumcision. In 1989, the American Academy of Pediatrics acknowledged that DPNB may relieve the pain and stress of circumcision but stopped short of endorsing its routine use in this procedure, citing lack of data on its safety.

**Methods.** To determine the types and rates of complications from DPNB used for neonatal circumcision, the authors conducted a retrospective review of hospital records of 1358 circumcised male infants delivered at an urban medical center during a 1-year period.

**Results.** Of the 1358 records reviewed, 1222 (90%) had sufficient documentation to be included in the study. DPNB was used in 1022 (84%) of the circumcisions.

Complications occurred in 12 cases (11 with small ecchymoses at injection sites and one with excessive bleeding from the needle stick), for a rate of 1.2%. No cases of lidocaine toxicity, voiding delay, or vascular compromise were noted. There was a trend toward increased incidence of injection-site hematomas with the Plastibell as compared with the Gomco technique ( $P=.07$ ). There were no significant differences in complication rates for DPNB performed by less experienced operators (eg, medical students and residents) compared with more experienced operators (staff physicians).

**Conclusions.** This study corroborates findings of smaller case studies, indicating that DPNB is associated with a low rate of minor complications.

**Key words.** Circumcision; infant, newborn; nerve block; anesthesia; postoperative complications. (*J Fam Pract* 1994; 39:243-248)

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In 1989, after careful review and debate, the American Academy of Pediatrics (AAP) issued an updated policy statement on neonatal circumcision.<sup>1</sup> In a succinct review of the medical literature, the AAP Task Force on Circumcision addressed emerging issues of infant pain and local anesthesia for circumcision. The Task Force acknowledged studies that have convincingly demonstrated behavioral, cardiovascular, and hormonal changes consistent with pain responses in neonates undergoing circumcision.<sup>2-9</sup> Several of these studies also substantiated the effectiveness of dorsal penile nerve block (DPNB) with 1% lidocaine in alleviating adverse physiological and

behavioral responses to circumcision.<sup>5-9</sup> In the final analysis, the Task Force agreed that dorsal penile nerve block "may reduce the pain and stress of newborn circumcision," but added that "reported experience with local anesthesia is limited," and concluded, "it would be prudent to obtain more data from large, controlled series before advocating local anesthesia as an integral part of newborn circumcision."<sup>1</sup>

The need for additional data on the safety of DPNB is clear. Since neonatal circumcision without anesthesia is widely considered a safe surgical procedure, any method added to relieve pain must not disrupt the procedure's favorable risk-to-benefit ratio.<sup>10</sup> Indeed, it is preferable for any procedural innovation to be thoroughly studied before being implemented. With respect to DPNB, surveys of both resident and practicing physicians indicate a high level of interest in learning the technique.<sup>11-13</sup> These studies indicate that 55% of family practice residents in a

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large Minnesota training program have used DPNB,<sup>12</sup> as have 36% of a sample of active members of the Oregon Academy of Family Physicians.<sup>13</sup> Pediatric reference texts have already begun to include step-by-step instructions for performing DPNB along with circumcision.<sup>14,15</sup> Given these indications of clinical acceptance, it is likely that DPNB is already being incorporated into circumcision procedures in many parts of the United States.

Clinicians using DPNB and those deciding whether to adopt the technique need specific information on frequency and severity of complications. Currently available information has been somewhat limited and subject to interpretation bias. The authors' literature review, for example, yielded case reports of rare significant complications, to be weighed against anecdotal reports from experienced clinicians who have had very low complication rates in large series of cases. Specifically, one series of 887 cases in which DPNB was used claims no hematomas or other complications<sup>16</sup> and another describes more than 2000 DPNBs "with no major complications."<sup>17</sup>

Well-recognized minor complications of DPNB include ecchymoses, hematoma, and excessive bleeding at the injection site.<sup>5-7</sup> Major complications of DPNB can be divided into two categories: those which are theoretical, and those which have actually been reported. Theoretically, lidocaine toxicity can cause central nervous system depression or excitation. At higher serum levels, generalized tonic-clonic convulsions may occur.<sup>18</sup> Extreme lidocaine overdoses may produce ventricular fibrillation and cardiac arrest.<sup>19</sup> In reality, however, such effects have not been seen with the subcutaneous injection of 2 to 4 mg/kg of 1% lidocaine, which is the recommended dose for DPNB in newborns.<sup>5-9,16,17</sup> Similarly, interference in urinary or erectile function, about which concerns were raised when DPNB was first adopted,<sup>6,7</sup> have not been observed.

Among reported major complications of DPNB, one of the most concerning is methemoglobinemia,<sup>20</sup> a condition that may be induced by a variety of local anesthetics and presents clinically with cyanosis and decreased oxygen saturation.<sup>21</sup> Other frequently quoted reports of significant complications from DPNB may not represent the technique as it is most commonly applied to newborns. For example, one report of penile ischemia following DPNB postulated interference with penile blood supply through inadvertent vascular injection or disruption of the dorsal penile veins or arteries.<sup>22</sup> That report, however, referred to cases in which DPNB was performed on two boys, ages 13 months and 3 years, who underwent circumcision with general anesthesia. In these cases, DPNB was administered for its postoperative analgesic effect, using bupivacaine (a longer acting anesthetic than lidocaine) and an injection technique in which anesthetic is

delivered more proximally (ie, closer to the site where the dorsal neurovascular bundles emerge from beneath the pubic symphysis and hence are more vulnerable to compression). The circumcisions themselves differed from newborn circumcision in that vascular ties and circumferential sutures were used, making it difficult to establish DPNB as the sole factor in the distal penile ischemia that developed and subsequently resolved. A second study of eight infants whose mothers received lidocaine through an epidural catheter prior to cesarean section indicated that lidocaine may slow newborn brain stem auditory-evoked responses.<sup>23</sup> Although comparisons between study and control infants reached statistical significance for some sound frequencies, all of the evoked potentials for all infants were within normal limits. This study's implications for postnatal adaptation are unknown.

Clinical trials specifically evaluating complications of DPNB with 1% lidocaine in neonates are few. The frequency and severity of DPNB complications in pertinent existing studies are listed in Table 1. This combined analysis of 150 infants circumcised with DPNB and 104 controls reveals no major complications and a minor complication rate of only 2.3%. Equally important, the nature of the bleeding and hematomas that occur would have been considered trivial for most medical procedures.

The purpose of this study was to report the types and rates of complications associated with dorsal penile nerve block from a large series of neonatal circumcisions in an urban community hospital. Associations between complications and infant characteristics, circumcision method, and operator experience level were investigated.

## Methods

### *Subjects and Setting*

Fairview Riverside Medical Center in Minneapolis, Minnesota, represents the combined facilities of St. Mary's Hospital and Fairview Riverside Hospital. The setting was chosen for its high volume of obstetric deliveries (4321 in 1989) and relatively high circumcision rate (69% in 1988).<sup>8</sup> In addition, the medical center is a training site for University of Minnesota family practice and obstetric residents and medical students. Circumcisions in the institution are thus performed by operators with different levels of training. Both Plastibell (Hollister Inc, Libertyville, Ill) and Gomco (Allied Healthcare Products Inc, St Louis, Mo) clamp techniques are used.

Two thousand one hundred forty-nine male infants born at Fairview Riverside Medical Center between January 1, 1989, and December 31, 1989, were considered eligible for the study. Cases were identified from comput-

Table 1. Studies Demonstrating the Frequency and Severity of Dorsal Penile Nerve Block (DPNB) Complications in Infant Circumcision

Author/Cite/Year	Subjects*	No. of Major Complications	No. (%) of Minor Complications	Comments
Kirya and Werthmann <sup>5</sup> 1978	52/0/0	0	1 (1.9)	Minor bleeding from right superficial dorsal vein puncture
Williamson and Williamson <sup>6</sup> 1983	20/0/10	0	0	No voiding delay, bleeding, infection or injection site hematomas during procedure or on physical exam 24 hours postcircumcision
Holve et al <sup>7</sup> 1983	15/8/8	0	1 (6.7)	Small unilateral hematoma due to superficial dorsal vein puncture. No abnormalities of urination or erections prior to discharge or at 1-2 months of age
Maxwell <sup>9</sup> 1987	20/0/10	0	0	No local or systematic complications of the technique
Stang et al <sup>8</sup> 1988	20/20/20	0	Not given†	Clinically insignificant superficial bruising "occasionally found" at the injection site
Arnett et al <sup>24</sup> 1990	23/21/7	0	1 (4.3)	Minor bleeding
Total	150/49/55	0	3 (3/130 = 2.3†)	

\*Number with DPNB/saline control injection/no anesthesia.

†Cases from the study by Stang et al<sup>8</sup> are not included in calculation of percentage since minor bruising did occur but was not recorded as a complication.

er-generated lists of all 1989 hospital discharges with the diagnosis of newborn hospital birth, subselected for circumcised male infants. Thus, 1395 medical records were identified, indicating an in-hospital circumcision rate of 65%. Thirty-seven (2.7%) charts could not be located during the study period. All 1358 available charts were reviewed by one of the authors. Circumcision status was verified from physicians' circumcision procedure notes, physicians' orders, and nurses' progress notes. If no circumcision procedure note could be found and there was no reference to circumcision or circumcision complications elsewhere in the medical record, the case was excluded from the study. Infants were also excluded if they had been transferred from Fairview Riverside Medical Center to another facility (usually a level III nursery) prior to being circumcised. After exclusions, 1222 (90%) of the 1358 medical records were eligible for further review.

### Design

Data were abstracted from the charts using a standard form developed by the authors. Two infant characteristics, birthweight and age at the time of circumcision, were recorded. Information was also obtained on where the circumcision was performed, whether DPNB was used, which circumcision method was used (Gomco, Plastibell, or other), and whether the operator was a medical student, resident, or staff physician. A checklist of potential complications from DPNB had been constructed by the authors following a MEDLINE search for appropriate

review articles, clinical studies, and case reports. Although only the most common complications were included on the chart review form, the authors actively sought evidence for any of the potential complications listed in Table 2. When ecchymosis was described, the location and size were recorded. If bleeding from DPNB injection site required any treatment other than simple compression, it was considered "excessive" and the type of treatment was noted.

### Data Analysis

Frequencies of infant characteristics, procedure characteristics, and complications of DPNB were calculated and compared using chi-square and nonparametric tests. Continuous variables were compared with Student's *t*

Table 2. Reported and Theoretical Complications of Dorsal Penile Nerve Block (DPNB) for Infant Circumcision

Complications Cited in Clinical Studies and Case Reports	
1.	Ecchymosis or hematoma at injection site <sup>5,6,7</sup>
2.	Excessive bleeding at injection site <sup>5,6,7</sup>
3.	Methemoglobinemia <sup>20,21</sup>
4.	Transient penile ischemia <sup>22</sup>
Theoretical Complications	
1.	Lidocaine toxicity, ie, cardiac arrhythmias, seizures <sup>18,19</sup>
2.	Lidocaine effect: prolongation of brain stem auditory-evoked response in newborns whose mothers received epidural lidocaine for cesarean section <sup>23</sup>
3.	Delay in voiding <sup>6,7</sup>
4.	Interference with erectile function <sup>7</sup>

Table 3. Characteristics of Infants with and without Complications from Dorsal Penile Nerve Block (DPNB)

	All Infants (N=1022)	Infants with Complications (n=12)	Infants without Complications (n=1010)	P Value*
Mean birthweight (g±SD)	3586±503	3700±579	3585±505	.44†
Median age at circumcision (d)	2.0	2.0	2.0	.46‡
No. (%) of procedures performed by medical student/resident	166 (16.2)	0 (0)	166 (16.4)	
No. (%) of procedures performed by staff physician	856 (83.8)	12 (100)	844 (83.6)	.23§
No. (%) of procedures performed using Gomco method	633 (61.9)	4 (33.3)	629 (62.2)	
No. (%) of procedures performed using Plastibell method	389 (38.1)	8 (67.7)	381 (37.7)	.07§

\*Infants with complications vs infants without complications.

†Student's *t* test.

‡Chi-square independence test.

§Fisher's exact test (2-tailed).

test. Because there were no a priori directional hypotheses (ie, the investigators did not expect one technique or location to produce more complications than another), two-tailed *P* values were used in all statistical tests.

## Results

The median age at the time of circumcision for the 1222 infants studied was 2.0 days, with a range from the first day of life to 17 days. Age in hours was not routinely recorded in circumcision procedure notes, making more precise determination impossible. The mean birthweight of circumcised male infants was 3589 g, with a standard deviation of 503 g. Staff physicians performed 1046 circumcisions; residents, 150; and medical students, 26, representing 85.6%, 12.3%, and 2.1% of the total, respectively.

DPNB was used in 1022 (83.6%) of the 1222 cases. Twelve instances of apparent complications from DPNB were identified, for a complication rate of 1.2%. Eleven of the complications were injection-site ecchymoses that were less than 1 cm in diameter and noted before the infants were discharged from the hospital. No specific treatment was required for care of these minor ecchymoses. One additional complication, excessive bleeding at the injection site, was successfully treated by application of a silver nitrate stick.

Infants who experienced complications of DPNB and those who did not are compared in Table 3. There were no significant differences between the two groups in birthweight or age at time of circumcision. Although all 12 complications of DPNB occurred in staff physicians'

cases, the complication rates by level of training were not statistically significant. Likewise, there was no significant difference between complication rates in the two nurseries within the medical center. There was a trend toward increased incidence of post-DPNB ecchymoses in infants circumcised with the Plastibell clamp, compared with those who were circumcised with the Gomco technique; however, the difference did not reach statistical significance (*P*=.07).

## Discussion

Over 1 million neonatal circumcisions are performed annually in the United States, with a reported complication rate of 0.2% to 0.6%.<sup>1</sup> When physicians consider adding DPNB to a procedure as common and relatively safe as neonatal circumcision, it is appropriate to evaluate the added risks as well as the benefits. In addition, physicians who perform circumcision must have detailed knowledge of the benefits and potential complications so that they can counsel parents for informed consent.

Medical benefits of DPNB are clear. Multiple studies, including prospective controlled clinical trials, have demonstrated that DPNB lessens or eliminates adverse effects of circumcision, including changes in heart rate, oxygen saturation, serum cortisol levels, behavioral state, and amount of infant crying during the procedure.<sup>5-9,24</sup> The striking facts are that no published studies to date dispute the effectiveness of DPNB for local anesthesia or substantiate the widely held myth that the injection itself adds pain or stress sufficient to outweigh the benefits.

To our knowledge, this study represents the first

comprehensive review of short-term complications in a large series of newborn circumcisions with DPNB. The rate of minor complications (1.2% incidence of ecchymoses and bleeding) is consistent with the 2.3% combined rate in smaller clinical studies.

In the 1022 DPNB cases we reviewed, not one major complication occurred. There were no seizures or clinically apparent cardiac arrhythmias. No hospital discharge was delayed because the infant had not yet voided, and no evidence of penile swelling or necrosis was noted on any newborn's discharge examination form.

It is interesting that the Plastibell technique is noted to increase the risk for ecchymosis or hematoma formation following DPNB. Since circumcision is performed after DPNB is complete, the possible relationship between circumcision technique and DPNB complications is somewhat unexpected. It may be that increased venous pressure proximal to the Plastibell hemostatic tie promotes leakage from a vessel already punctured by DPNB needle stick. However, until studies examine larger numbers of circumcisions complicated by ecchymoses, our finding remains speculative.

Limitations of the data presented here include the retrospective study design, in which the only complications that could be discovered were those considered significant enough to be entered into the medical record by physicians and nurses. A prospective design, particularly one that identifies complications occurring after discharge as well as those occurring in the hospital, might reveal a higher rate of minor complications, such as ecchymoses.

Since this study dealt only with short-term complications, further research is needed to establish whether DPNB provides any late-developing side effects or long-term benefits. To better define the nature and frequency of rare complications, future studies also should investigate the incidence of short-term complications of DPNB in even larger series of cases. Prospective studies investigating the relationship between the occurrence of complications and serum levels of local anesthetics would be particularly valuable. Finally, future clinical trials should compare DPNB with newly proposed anesthetic techniques, such as direct local infiltration of the foreskin,<sup>25</sup> oral sucrose,<sup>26</sup> and topical anesthesia with newer preparations such as 30% lidocaine cream<sup>27</sup> or a eutectic mixture of the local anesthetics lidocaine and prilocaine (EMLA).<sup>28</sup> Until additional studies have been conducted, DPNB with lidocaine remains the most widely used and carefully studied anesthetic technique for neonatal circumcision.

Our retrospective study lends support to the contention that DPNB is safe. A minor complication rate in the 1% to 3% range may be reasonably quoted to parents when discussing risks and benefits of adding DPNB to the

circumcision procedure. Although complications more significant than those reported here may occur, it must be recognized that all surgical and anesthetic procedures carry finite risks. Physicians caring for newborns must decide with parents whether the rare complications of DPNB, which occur in less than 1 in 1000 cases, outweigh the ethical and medical advantages of this humane technique.

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