Neonatal Infant Pain Scale in assessing pain and pain relief for newborn male circumcision

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REVIEW ARTICLE

Neonatal Infant Pain Scale in assessing pain and pain relief for newborn male circumcision

Carlo V. Bellieni [1] ✉

Circumcision—partial or total removal of the penile prepuce—requires cutting nerve-laden, sensitive genital tissue and is therefore liable to be painful. The aim of this review is to evaluate the evidence concerning pain felt by newborns during circumcision and to determine whether current analgesic methods can eliminate such pain. I performed a search in medical databases, selecting the trials published in the last 20 years that assessed pain in neonatal circumcision. Twenty-three trials have been retrieved. To get reliable findings, those trials that used validated pain scales were selected; then it was investigated which trials had comparable data for using the same pain scale. The only pain scale that was used in more than two trials was the modified Neonatal Infant Pain Scale (mNIPS) that ranges 0–6. The results of these trials show that none of the analgesic strategies used obtained the absence of pain. Some differences between circumcision techniques can be noticed, but most assessments exceed the score of 3, chosen as the clinically significant pain.

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Circumcision of males refers to the cutting and partial or total removal of the penile foreskin, typically for sociocultural or religious reasons. Absolute medical indications for circumcision are rare [1]. Circumcision may be performed at any time of life, for example, in the peripubertal period as part of a rite of passage in various African ethnic groups, or during the newborn period, as in traditional Jewish practice or as commonly done in the United States. By convention, a child is considered a newborn from birth until the 28th day of life, after which the child is considered an infant, until the first year of life [2]. Based on all available evidence, including behavior, hormone expression, and neural activity, there is scientific consensus that newborns feel pain, at least as acutely as adults when given a comparable stimulus [3, 4]. Within pain science, a common way to measure pain is to use validated pain scales. Because newborns cannot self-report pain, most validated pain assessment tools use some combination of pain behavior assessment. The aim of this review is to evaluate the evidence concerning pain felt by newborns during circumcision and to determine whether current analgesic methods can eliminate such pain. More than 40 such scales for procedural pain exist in neonatology, and it is not possible to draw meaningful outcome comparisons between studies that use different pain assessment tools [5]. To allow for meaningful comparisons we, therefore, performed a search of medical databases to identify all clinical trials of analgesic methods for newborn circumcision published in the last 20 years that used validated pain scales; we then further narrowed the set of included trials to those using the same scale across the largest number of studies; we then compared the results of those studies.

CIRCUMCISION AND PAIN

Pain during circumcision can be felt at four main steps: administration of analgesia via needle-prick (where applicable), separation of the prepuce from the penile glans, cutting of the prepuce, recovery period. I have considered the final three steps in this review, as these are the steps for which comparisons of analgesic effectiveness can be made.

To fully understand the first of these steps, separation of the penile prepuce from the glans, it is necessary to briefly describe the anatomy of the prepuce and its presence in different species. The foreskin (prepuce) is a shared anatomical feature of all primates, both human and non-human, including endosex males, endosex females, and in some cases, individuals with intersex traits [6]. In endosex females, the prepuce is sometimes called the clitoral hood and in some cultures, for example in parts of South and Southeast Asia, this structure is also partially or totally removed for ritual or cultural reasons [7]. The foreskin (prepuce) is continuous with the shaft skin of the penis, forming a sort of sheath that typically covers the glans [8]. It is a primary sensory part of the penis, containing a dense concentration of nerve endings, and appears to be the most sensitive part of the penis to light-touch sensation based on quantitative testing [9]. The epithelium of the inner surface of the foreskin is continuous with the epithelium that covers the glans. At the time of birth, the natural process of foreskin separation from the glans is incomplete in most newborns and the foreskin is not retractable; a complete separation of the foreskin occurs in most boys only at the time of puberty [8]. Therefore, to perform a circumcision in the newborn period the prepuce must be separated mechanically. The detachment of the foreskin from the glans is achieved by stretching the skin of the foreskin upwards and inserting a hemostat or other probe between the inner surface of the foreskin and the glans to detach the adhesions between the two structures.

Cutting of the prepuce is performed after stretching the detached skin from the glans: the foreskin is cut, sometimes after having covered the glans with a kind of plastic or metal bell to

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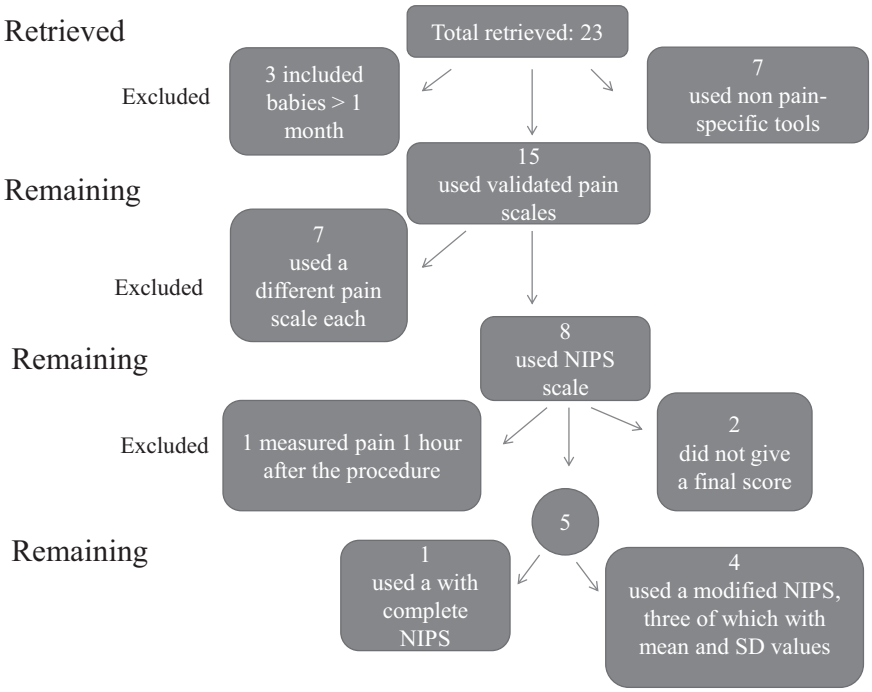

Fig. 1 The PRISMA selection of trials. NIPS Neonatal Infant Pain Score, SD standard deviation.

afford some measure of protection. Some operators attempt not to cut the frenulum of the foreskin, given its high vascularity and the risk of bleeding; however, in some methods of circumcision, the frenulum is cut or destroyed. The most used techniques are the Gomco, Plastibell, and Mogen techniques [10–12].

Finally, the remaining skin is compressed by the devices used for circumcision, or by sutures, to attempt hemostasis; and in the following few days, the child must receive analgesics and should be looked over for possible complications.

Eutectic Mixture of Lidocaine and other Analgesics (EMLA) cream, dorsal penile ring block (DPNB), and ring block (RB) can be used as anesthetics.

- EMLA is a cream with a eutectic mixture of anesthetics, to be applied at least 45 minutes before the intervention.
- DPNB is a maneuver that injects lidocaine in the penis nerve on the dorsal face of the penis. It requires skill to find the nerve.
- RB is injecting lidocaine on the prepuce all around the glans. It is a technique usually used to anesthetize fingers.

MATERIAL AND METODS

I performed a search among the clinical trials published in the last 20 years, from 1997 up to October 2021, to retrieve those papers that report pain assessment during neonatal circumcision. I used the databases of PubMed and Index Medicus. The key-words I used were: newborn, pain, circumcision. Exclusion criteria concerned reviews, editorials, or commentaries dealing with babies beyond the neonatal age. Among these papers, I have selected those performed with the same assessment method, whose number is the highest. Here I will report the results of this research.

RESULTS

Twenty-three papers [4, 13–34] have been retrieved, according to the inclusion and exclusion criteria (Fig. 1). Seven studies did not use pain-specific assessment such as crying time or heart rate variations [20–22, 24, 25, 33, 34], and three included babies older than one month [23, 25, 28]. Five trials [4, 13, 14, 31, 32] used validated pain scores but with different assessment methods. Banieghbar et al. [16] used the integral NIPS. Bilgen et al. [17] used the NIPS score but only one hour after the procedure; Malrony et al. and Olson et al. used the NIPS score, but they did not give a final score and compared just the single items [26, 29]. Four used the NIPS scale but modifying it (excluding the score of leg movements) [18, 19, 27, 30], but one [19] did not give results as mean and standard deviation. After a preliminary evaluation, it became evident that the greater group of trials using a unique pain scale to evaluate pain during the neonatal period is that which uses the Newborn Infant Pain Score (NIPS). This scale (see Table 1) ranges from 0 (no pain) to 7 (maximum pain): it was developed and validated by Lawrence et al. [35]. It gives a final score obtained from the sum of six items: facial expression, cry, breathing, arm movements, leg movements, alertness; to each item a score of 0 or 1 is given according to the presence or absence of the item; only the cry intensity receives a different score, raging 0–2 according to the cry intensity. Only three studies were comparable to each other [18, 27, 30], as they were the only ones using the modified Neonatal Infant Pain Score (NIPS, see Table 1). Unlike the original NIPS, the one adopted in these trials did not consider the arm movements, so its maximum score is 6

Table 1. The NIPS scale.

	0 point	1 point	2 points
Facial expression	Relaxed	Contracted	-
Cry	Absent	Mumbling	Vigorous
Breathing	Relaxed	Different than basal	-
Arms	Relaxed	Flexed/stretched	-
Alertness	Sleep/calm	Uncomfortable	-

Every item receives a score, and the total mNIPS score is given by the sum of the single items' scores.
The sign "-" means that 2 points score cannot be given to that item.

and not 7. The study by Garry et al. [19] was excluded because it enrolled only 6 babies for each experimental group and it gave results not as mean and SD, but as median and confidence interval. The data of the three selected studies are reported in Table 2. The grand mean of the eight groups used in the three studies was 3.01. This score is considered to indicate the presence of clinically significant pain according to standard interpretations of either NIPS or mNIPS.

DISCUSSION

The data given in this review (Fig. 2 and Table 2) show that pain is not being eliminated by the techniques used in the trials. Some differences between the different techniques can be noticed, but none gives a score of zero; on the contrary, most assessments exceed the score of 3, chosen as the clinically significant pain threshold by several authors. The results of one study [27] show values lower than the other two [18, 30]; this only means that the absence of pain is not confirmed, even considering that in the description of the results the authors of that study write that more than 1/3 of the babies enrolled in each group cried constantly across the procedure. The studies considered in our review use a modified NIPS scale; this raises one concern: given that the maximum score for mNIPS is 6 as opposed to 7 (for NIPS), the standard pain threshold of 3 is not valid here. Rather, a comparable threshold (given a total of 6) would be ~2.5. The results of the present study should be interpreted with this in mind. Please note that in studies using other scales, for instance the "Face, Legs, Activity, Cry, Consolability" (FLACC) scale, results similar to those obtained here are also found: that is, indications of clinically significant pain for newborn circumcision even following analgesia are regularly observed across different ways of measuring pain behaviors [4].

Some evidence suggests that pain is felt more by newborns than older children [36]. A large body of evidence suggests that early-life experiences of pain—at least above a threshold of 3 as measured by NIPS, but also potentially below this threshold—can have long-term adverse consequences for the developing child [37]. In addition, various studies have shown a "memory" of pain: babies who had undergone circumcision when they were infants, when vaccinated after three months were shown to have more pain than noncircumcised children or those who had been circumcised but were given a local analgesic [33, 38]. Even when different surgical methods are compared, pain is still present [22]. A previous review highlighted encouraging results with the use of both pharmacological and nonpharmacological analgesia [39]; nonetheless, that review only reported the results of the retrieved trials in terms of which method was relatively less painful than others, without analyzing if the methods were painless.

Table 2. Features of the three studies selected.

Reference number	Birht age	Postnatal age	Babies: number in each group	Analgesic treatment	mNIPS score (Standard deviation)	Nation
#27	At term	Less than 28 days	55	EMLA	1.95 (0.229)	Nigeria
			55	DPNB	1.53 (0.690)	
#31	At term	Less than 7 days	20	EMLA + sucrose	3.1 (1.33)	Lebanon
			20	EMLA + sucrose + DPNB	3 (1.33)	
			20	EMLA + sucrose + RB	2.45 (1.27)	
			10	EMLA	5.5 (0.53)	
#18	Term and preterm	Before 44 weeks of corrected age	25	DPNB	2.3 (1.8)	USA
			25	EMLA	4.8 (0.7)	
			20	Nihil	Not reported	

EMLA topic anesthetic cream, *DPNB* dorsal penile nerve block, *RB* ring block.

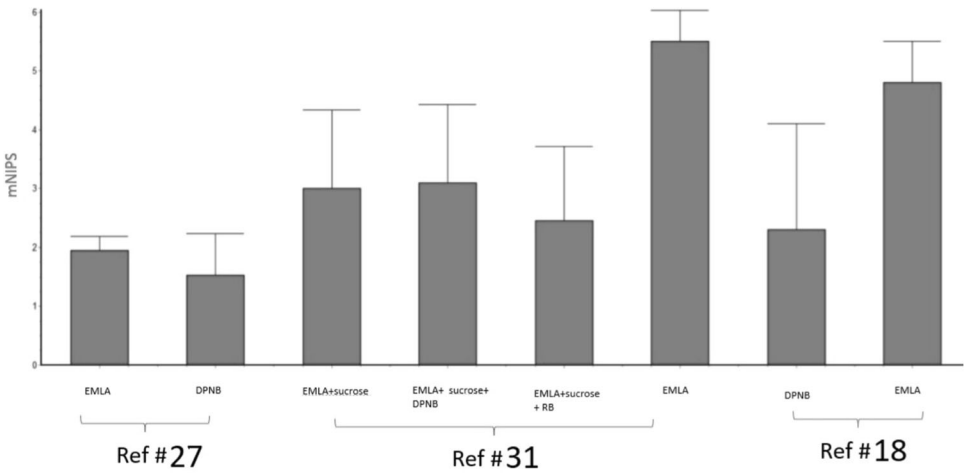

Fig. 2 Pain level during circumcision with different analgesic methods. Mean values and standard deviations of the mNIPS scores in the three retrieved trials. EMLA topic anesthetic cream; DPNB dorsal penile nerve block; RB ring block.

CONCLUSION

Data from this review show that pain can be a significant aspect of circumcision; current analgesic treatments cannot eliminate it completely. With the NIPS scale, the pain threshold is commonly considered a score of 3; but with the mNIPS which has a narrower range (0–6 instead than 0–7), the pain score is consequently lower, and most of the groups included in our review give a score beyond 2 or 3. Much of the baby's suffering can be ascribed to fear and stress, that might be avoided if babies are put in a warm and comfortable setting, using treatments such as facilitated tucking or sensorial saturation [40]; but these have not yet been included in the studies on circumcision pain.

Whether it is ethical for doctors to perform circumcisions on minors when the procedure is not medically indicated continues to be debated, with supporters of the practice arguing that it is ethical for doctors do so [41], and other scholars from a range of disciplines arguing, increasingly, that such a procedure is not ethical if the affected person cannot provide their own consent [42]. A serene discussion of such matters is required, including both theoretical and empirical considerations. Regarding the latter, the presence or absence of pain associated with circumcision is one relevant consideration.

DATA AVAILABILITY

Data of this review are available on demand.

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COMPETING INTERESTS

The author declares no competing interests.

ADDITIONAL INFORMATION

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