

Pediatric Pain Letter

Abstracts and Commentaries on Pain in Infants, Children, and Adolescents

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Table of Contents

Introduction	25
Abstracts	
Sucrose Analgesia	26
Pain Control for Circumcision	29
Recent Articles	
Book Review	35
Announcements	35

Introduction

Evidence-based health care in pain

The Pediatric Pain Letter abstracts data-based research papers. Our goal in the Pediatric Pain Letter is to bring the research literature to health care providers so that evidence can be used to guide care. The PEDIATRIC-PAIN¹ electronic mail list on the Internet, our sibling publication, focuses on case-based wisdom or clinical judgement. We believe these to be complementary strategies.

It is generally agreed that the best evidence for the efficacy of a treatment comes from blinded, randomized trials, especially if there have been multiple trials from different research groups. A single, well designed trial is the next best source of evidence. Evidence from non-randomized trials, series of N=1 experiments, and other quasi-analytic studies is a third level of evidence. Much less satisfactory is evidence from a clinical series and the least satisfactory level of evidence is based on the pronouncements of authorities or what is standard practice, "just because it is". Because each patient is unique, evidence must always be combined with good clinical judgement. There are not always well

¹To subscribe to the PEDIATRIC-PAIN electronic mail list, see note on page 36.

designed studies that apply to the patient in front of us and our clinical actions may depend on weaker or indirect evidence. In particular, when treating complex and unusual problems, we must use the evidence available to us, but must also go beyond evidence. Our patients deserve the best care there is. Both evidence and good clinical judgement are important tools in providing that care.

In the United States, there has been an unfortunate conjunction between evidence-based medicine and managed care, at times, to the detriment of clinical judgement. There is no endorsement of managed care in our promotion of evidence-based care. Some excellent references on the use of evidence in clinical practice are listed below.

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Abstracts

Sucrose Analgesia

Blass, E. M. & Hoffmeyer, L. B. (1991). Sucrose as an analgesic for newborn infants. *Pediatrics*, 87(2), 215-218.

Objective. To determine the effect of sucrose and sucking behaviour on crying during heel lance and circumcision

Design. Randomized, blind, placebo-controlled trial.

Setting. Two community hospitals.

Participants. *Blood Collection:* 24 full-term male and female infants, 2-3 days old, undergoing heel lance. *Circumcision:* 30 full-term infants, 1-3 days old.

Interventions. *Blood Collection:* 12 infants were given 2 mL of sucrose (12% wt/vol) and 12 were given sterile water via syringe 2 minutes prior to heel lance. *Circumcision:* 10 infants received no intervention, 10 received a nipple with gauze saturated by 1.5 mL of sterile water inside, and 10 received a nipple with gauze saturated by 1.5 mL of a sucrose solution (24% solution) inside. The nipples were given to infants 3 minutes prior to the procedure and for the following 3 minutes during the procedure.

Main Outcome Measures. Percent of time spent crying

during and after the procedure.

Results. Blood Collection: Infants who received sucrose cried for 42% of the procedure and returned to baseline within 30 seconds, whereas infants given water cried for 80% of the procedure and returned to baseline within 150 seconds. Repeated measures ANOVA showed that these differences were significant, $F(1,20)=7.22$, $p<.01$; $F(6,20) =8.99$, $p<.001$, respectively. **Circumcision:** Infants who sucked a nipple cried for significantly less time during the procedure than infants who received no intervention, $F(2,20)=8.79$, $p<.001$. Infants who sucked a nipple with the sucrose solution cried significantly less than infants who had a nipple with water, no F specified, $p<.05$.

Conclusions. Sucrose and sucking are easily instituted and noninvasive means to reduce crying in infants undergoing painful procedures. Because the infants were given sucrose prior to the heel lance, the analgesic effect was not caused solely by the observed sucking and swallowing behaviour. It appears that the sucrose added to the antinociception associated with sucking a nipple.

Ramenghi, L. A., Wood, C. M., Griffith, G. C., & Levene, M. I. (1996). Reduction of pain response in premature infants using intraoral sucrose. *Archives of Disease in Childhood*, 74, F126-F128.

Objective. To determine whether intraoral sucrose reduces pain perception in healthy, preterm infants during painful procedures.

Design. Blind crossover trial.

Setting. University hospital.

Participants. 15 healthy premature infants, between 32 and 34 weeks postconceptional age, at least 24 hours old, who required 2 heel lances for blood collection within a 48 hour period.

Interventions. Infants received 1 mL of 25% sucrose solution or 1 mL of sterile water via syringe for 1 minute, 2 minutes prior to heel lance. Order of administration was random. Procedural variables (e.g., nurse) for each infant were kept constant.

Main Outcome Measures. Measures were taken during and 5 minutes after the procedure. Duration of the first cry elicited by the heel lance was defined as length from first cry to beginning of a quiet time of at least 5 seconds. Time spent crying, facial actions, and heart rate were also recorded.

Results. Infants spent significantly less time crying during and after the procedure and had a significantly shorter first cry when they received sucrose prior to the heel lance. Infants who received water prior to the heel lance had a significantly higher pain score at 1 and 3 minutes after the procedure.

Conclusions. Intraoral sucrose is an effective short term analgesic which also influences a number of behaviours including sucking, hand to mouth activity, and heart rate in healthy, preterm infants. Further research should examine the mechanisms underlying the effects of sucrose on pain.

Barr, R. G., Young, S. N., Wright, J. H., Cassidy, K. L., Hendricks, L., Bedard, Y., Yaremko, J., Leduc, J., & Treherne, S. (1995). "Sucrose analgesia" and diphtheria-tetanus-pertussis immunizations at 2 and 4 months. *Developmental and Behavioral Pediatrics, 16*(4), 220-225.

Objective. To examine the effectiveness of sucrose as an analgesic in reducing infants' pain following diphtheria-tetanus-pertussis immunizations at 2 and 4 months.

Design. Longitudinal, randomized controlled trial.

Setting. A general pediatric practice in Montreal, Canada.

Participants. Eligibility criteria included: normal postnatal health histories; no present illness or fever; a normal physician examination; and signed, informed consent from a parent. 66 infants were enrolled in the study and randomly assigned to receive either sucrose or water prior to the immunization injection. The parents of 8 infants withdrew from the study by the 4 month follow-up.

Interventions. Following a 20 second baseline, 3 0.250-mL administrations of 50% sucrose (g/100 mL) in sterile water were applied to the anterior tongue by pipette at 30-second intervals by a blinded research assistant. The injection was given immediately following the third administration of sucrose or water.

Main Outcome Measures. The percentage of time spent crying was assessed during the baseline, injection, and postinjection periods.

Main Results. Infants who received sucrose cried less than infants who received water in the postinjection period (69% vs. 83%). Younger infants cried more than older infants across all three periods, regardless of type of liquid received.

Conclusions. Sucrose was associated with decreased crying in response to a painful stimulus; the reduction, although statistically significant, was quite small. The extent to which these findings represent a clinically significant decrease in pain is not known.

Allen, K. D., White, D. D., & Walburn, J. N. (1996). Sucrose as an analgesic agent for infants during immunization injections. *Archives of Pediatric and Adolescent Medicine, 150*, 270-274.

Objective. To assess the effectiveness of sucrose on reducing pain from immunization injections in infants, and to determine whether its effectiveness changes with age and with multiple injections.

Design. Blind, randomized controlled trial.

Setting. Ambulatory pediatric clinic of a tertiary hospital.

Participants. 285 infants, 2 weeks to 18 months old, presenting for immunizations, who were of normal gestational age, and free of any chronic disease.

Intervention. Infants were randomly assigned to 1 of 3 groups: 2 minutes prior to administration of the immunization, participants were given orally either 2 mL sterile water, 2 mL of a 12% sucrose solution, or nothing.

Main Outcome Measures. Percentage of time spent crying, defined as an audible distress vocalization, was coded from videotape.

Results. 4-month-olds were excluded from analyses because they spent more time crying prior to the injection than other infants. Using repeated measures ANOVA and subsequent pairwise comparisons, 2-week-olds (n=50) who received either sucrose ($p<.01$) or sterile water ($p<.01$) cried significantly less than 2-week-old infants who received nothing. Infants who received sucrose or water cried significantly less if they had 1 injection; no differences were observed among infants who had 2 injections ($p<.05$).

Conclusions. The administration of more than 1 injection appeared to eliminate the possible analgesic effect of the sterile water or sucrose solution. These results question whether sucrose, in the absence of sucking, provides clinically meaningful analgesic effects.

Miller, A., Barr, R. G., & Young, S. M. (1994). The cold pressor test in children: methodological aspects and the analgesic effect of intraoral sucrose. *Pain, 56*, 175-183.

Objective. To determine the effects of sweet taste on pain responses to the cold pressor test in children.

Design. Randomized, controlled, crossover trial.

Setting. Participants were recruited from a Montreal private school. Testing was carried out in a vacant classroom.

Participants. 44 children (23 male) between 8 and 11 years who consented and also returned a completed parental consent form participated. 42 subjects had complete data. Exclusion criteria included the presence of chronic, potentially neuropathic illness or conditions associated with chronic pain.

Interventions. Children were asked to participate in 2 cold-pressor tasks (maximum duration of 4 minutes with water at 10°C) 2 days apart while holding either 20 mL of a 24% sucrose solution intraorally or holding water intraorally. Children were randomly assigned to one of 4 orders: sucrose-water, water-sucrose, water-water, and sucrose-sucrose.

Main Outcome Measures. During the cold pressor task, measures of threshold (time to first pain sensations), tolerance (time to removal), and VAS ratings of sensation intensity every 10 seconds during the first minute and every 20 seconds for the following 3 minutes were obtained.

Results. Holding sucrose intraorally resulted in a prolonged threshold compared to water ($F(1,17)=5.82, p=.03$) among children who received both water and sucrose. Sucrose did not affect tolerance. VAS intensity ratings showed a significant increase with longer immersion times, $F(3,45)=10.97, p<.001$.

Conclusions. A slight analgesic effect of intraoral sucrose on pain threshold may be present in pre-pubertal children. Further study is required to determine whether, and under what conditions, this effect can be replicated.

Ramenghi, L. A., Griffith, G. C., Wood, C. M., & Levene, M. I. (1996). Effect of non-sucrose sweet tasting solution on neonatal heel prick responses. *Archives of Disease in Childhood*, 74, F129-F131.

Objective. To evaluate the effectiveness of a sugar-free, commercially prepared sweetener (Calpol vehicle) in reducing the reaction to heel pricks in neonates compared to 25% sucrose solution, 50% sucrose solution, and placebo.

Design. Randomized, blind, placebo-controlled trial.

Setting. University hospital.

Participants. 60 healthy, full-term newborn infants, with birthweights above 2500 g and 5-minute Apgar scores ≥ 7 , who required heel prick for bilirubin sampling.

Interventions. Infants were randomly assigned to 1 of 4 conditions: 2 mL of 25% sucrose solution, 50% sucrose solution, Calpol vehicle or sterile water given orally by syringe approximately 2 minutes prior to procedure.

Main Outcome Measures. Changes in 4 facial expressions (brow bulge, eye squeeze, nasolabial furrow and open mouth), presence and length of crying, and heart rate were rated prior to, during, and following the procedure. Crying during the procedure and for 3 minutes following was recorded on a tape recorder.

Results. There were no significant differences between groups in sex, gestational age, postnatal age, mode of delivery, behavioral state at rest, and time spent squeezing the heel. The pain score from the facial action measures before the heel

prick, but after the solution was given, was lower in all three treatment groups, as were the pain score and heart rate 3 minutes after the procedure. In addition, the duration of first cry and the percentage of time spent crying was reduced in the treatment groups.

Conclusions. The non-sucrose sweet solution (Calpol vehicle) was equally effective to the 25% and 50% sucrose solutions in reducing pain-related facial action and cry.

Commentary

Throughout history, caregivers have used sweet solutions to calm and soothe their crying babies. In some countries, sweet-tasting remedies are also used as a home remedy for colic. However, scientific evidence for the effectiveness of sweet as an analgesic is recent. In 1987, Blass and colleagues, using a rat model, found pain and distress responses to be markedly attenuated by intraoral sucrose. These changes were reversed when the opioid antagonist naltrexone was administered, suggesting an endogenous opioid mediation of the analgesia (Blass et al., 1987).

These results have led to the speculation that the ingestion or tasting of sucrose before or during a painful procedure could significantly reduce or eliminate pain, not only in rats, but also in human infants. The ingestion of 0.2 mL of 12% sucrose was observed to quiet babies and keep them quiet for at least 5 minutes afterwards (Blass et al., 1989). These observations have inspired researchers to seek parameters of the effect. A number of studies have since been conducted testing the effectiveness of sucrose as an analgesic in newborn infants (Smith et al., 1990; Blass et al., 1991; Ramenghi et al., 1996), in premature infants (Ramenghi et al., 1996), in infants (Barr et al., 1995; Allen et al., 1996), and in older children (Miller et al., 1994).

Smith et al. (1990) found that sucrose alone and sucrose ingested through a pacifier were found to reduce crying in 1- to 3-day-old neonates compared to water ingestion alone. These results were also confirmed by Blass et al. (1991) who found that sucrose ingested through a pacifier reduced crying during heel lance and circumcision. In this study, sucking a standard non-flavored pacifier was also found to have an analgesic effect. These results are in accordance with findings obtained in other studies on the effectiveness of non-nutritive sucking in reducing pain in infants (e.g., Gunnar et al., 1984); this analgesic effect was found to be further enhanced by sucrose. In the study by Ramenghi et al. (1996), the analgesic effect of sucrose in premature infants was also confirmed. Premature infants undergoing heel lance were observed to cry less and to have less pain when given 25% sucrose compared to controls.

Of particular interest is the extension of these results to older infants. Barr et al. (1995) studied the analgesic effectiveness of sucrose in 2- to 4-month-old infants undergoing immunization. Their results showed that sucrose was effective in reducing cry only in the postinjection period. Pain is thought to involve both an immediate behavioral response or the sensory component and the behavioral recovery from the stimulus or the motivational-affective component. The authors suggested that the use of sucrose in infants will not modify the sensory aspects of pain, but that it will have an effect on the affective pain experience. This conclusion warrants further research. Allen et al. (1996) found that 2-week-old infants receiving sterile water or sucrose during immunization cried less than infants receiving nothing. This finding was the first to question the analgesic effects of sucrose in the absence of a sucking response. The authors suggested that the sucking response may be needed to strengthen the analgesic properties of sucrose in infants. Further research is thus needed before definitive conclusions can be drawn.

Miller et al. (1994) studied holding sucrose in the mouth while undergoing a cold pressor test in school age children. Holding sucrose intraorally increased the pain threshold but had no effect on the tolerance or intensity ratings of pain. These results partially substantiate other results commonly seen in neonates and infants and raise, at the same time, a number of questions regarding the mechanism of this effect and its persistence throughout life. Sweet taste rather than ingestion of sugar was suggested as the mechanism. In a more recent study (Ramenghi et al., 1996), the effectiveness of a non-sucrose sweet tasting solution was compared to 25% and 50% sucrose solution and sterile water. A significant reduction in crying time and pain score was found in all three sweet groups compared to the sterile water group. This finding substantiates the analgesic effects of a sweet tasting solution.

These well designed studies have answered a great number of questions and have raised many more. The analgesic effect of sucrose in older children, its mediating factors, as well as its long-lasting effects remain unanswered questions deserving more attention in future research. The potential use of sucrose analgesia as a method of alleviating pain in neonates and older children is attractive because of its inherent simplicity and feasibility for use in the clinical setting. However, more research is needed before sweet taste is recommended for widespread clinical use.

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Pain Control for Circumcision

Howard, C. R., Howard, F. M., & Weitzman, M. L. (1994). Acetaminophen analgesia in neonatal circumcision: The effect on pain. *Pediatrics*, 93(4), 641-646.

Objective. To determine the effectiveness of acetaminophen in alleviating intraoperative and postoperative circumcision pain in newborns.

Design. Randomized, double-blind, placebo-controlled trial.

Setting. University medical centre.

Participants. 44 newborns scheduled for circumcision at least 24 hours after birth (gestational age = 37-42 weeks; 1- and 5-min. Apgar scores ≥ 7 ; absence of chronic illness; no maternal drug or alcohol use during pregnancy).

Interventions. Infants were randomly assigned to 1 of 2 groups: starting 2 hours prior to procedure, infants received 15 mg/kg per dose (0.15 mL/kg per dose) of acetaminophen or 0.15 mL/kg per dose of placebo every 6 hours for 24 hours.

Main Outcome Measures. Time spent crying during the stages of the procedure was determined by monitoring and timing cry vocalizations. A nurse counted heart rate based on cardiac auscultation and a second nurse determined respiratory rate through visual observation. The Postoperative Comfort Score, which assesses 10 behaviors scored on a 0-2 rating scale, was used to evaluate pain immediately prior to circumcision and postoperatively at 30, 60, 90, 120 minutes, and 6 and 24 hours following the procedure.

Results. No differences were observed between groups in heart rate or respiratory rate during the circumcision. Using ANCOVA, and the previous comfort score as a covariate, infants who received acetaminophen were more comfortable 6 hours following the procedure than infants who received placebo, but no differences were observed at any other

postoperative time.

Conclusions. Acetaminophen does not appear to provide adequate analgesia during the first hours following circumcision, but may provide some relief following the immediate postoperative period (i.e., 6 hours following circumcision). Further research is necessary to evaluate the effectiveness of acetaminophen for pain 6-24 hours following circumcision.

Weatherstone, K. B., Rasmussen, L. B., Erenberg, A., Jackson, E. M., Claffin, K. S., & Leff, R. D. (1993). Safety and efficacy of a topical anesthetic for neonatal circumcision. *Pediatrics*, 92(5), 710-714

Objective. To evaluate the safety and efficacy of topical anesthetic for neonatal circumcision.

Design. Randomized, double-blind, placebo-controlled trial.

Setting. University medical centre.

Participants. 30 healthy newborns scheduled for circumcision (birth weight \geq 2500 g, gestational age = 37-42 weeks; 1- and 5-min. Apgar scores \geq 7; age = 6-72 hours).

Interventions. Infants were randomly assigned to 1 of 2 groups: 15 received 0.5 g of topical 30% lidocaine in acid mantle cream applied to penis 20 minutes prior to circumcision and 15 received 0.5 g acid mantle cream alone.

Main Outcome Measures. Serum β -endorphin and lidocaine levels were assessed from a blood sample. Pulse, respiratory rate, temperature, blood pressure, and oxygen saturation were monitored at 5 minute intervals for 20 minutes prior to procedure, during the procedure, and for 15 minutes following the procedure. From videotape, behavioral state, leg movement, arm movement, facial expression, torso movement, respiratory pattern, soothability, response to distress by caregivers and tactile stimulation were coded using the Newborn Pain Behavior Scale, the Yarrow Environmental Assessment Scale, and the Infant Pain Behavior Rating Scale. The tapes were viewed in 30-second intervals by blinded observers. Behavioral observations were expressed as the increase in mean percent of time each behavior was observed, comparing preprocedure to postprocedure intervals.

Results. 10 of 15 infants who received lidocaine had decreased or unchanged serum β -endorphin levels, whereas 11 of 15 infants receiving placebo had increased serum β -endorphin levels (χ^2 , $p < .05$). Infants receiving placebo experienced a greater increase in pain behaviors than those receiving lidocaine, however no statistics are reported.

Conclusions. The study demonstrated that topical 30% lidocaine cream applied prior to circumcision of the term newborn may reduce the stress response and pain behaviors

associated with circumcision.

Marchette, L., Main, R., Redick, E., Bagg, A., & Leatherland, J. (1991). Pain reduction interventions during neonatal circumcision. *Nursing Research*, 40(4), 241-244.

Objective. To determine the effect of different noninvasive interventions during neonatal circumcision on pain.

Design. Randomized controlled trial.

Setting. Tertiary care hospital.

Participants. A convenience sample of 121 full-term neonates (mean age = 3.1 days; range = 2-9 days) scheduled for circumcision. All had Apgar scores of at least 6 at 1 and 5 minutes after delivery. Participants were excluded if the circumcision took longer than 15 minutes, excessive swelling or bleeding occurred, or if they had too much missing data.

Interventions. Neonates were randomly assigned to 1 of 6 groups: The 5 treatment groups consisted of playing relaxing classical music, intrauterine sounds, encouraged pacifier sucking, classical music with pacifier, and intrauterine sounds with pacifier. Treatment groups received interventions from the time they were placed on the restraint board until they were removed. The control group received standard care: no nurses present and no pain reduction interventions.

Main Outcome Measures. Variables measured during each of the 14 steps of the procedure included: heart rate, heart rhythm, blood pressure, transcutaneous oxygen saturation, behavioral state (with the alertness section of the Brazelton Neonatal Behavioral Assessment Scale), and crying.

Results. Although some significant differences were noted between groups for some of the procedure steps, the pain reducing interventions did not greatly reduce the overall pain associated with the procedure.

Conclusions. Stronger pain interventions such as anesthesia or analgesia appear to be required for reducing the pain during circumcision in newborns.

Fontaine, P., Dittberner, D., & Scheltema, K. E. (1994). The safety of dorsal penile nerve block for neonatal circumcision. *The Journal of Family Practice*, 39(3), 243-248.

Objective. To describe the types and rates of complications associated with dorsal penile nerve block for circumcision in newborns, as well as to determine whether complications are related to infant characteristics, circumcision method, and operator experience.

Design. Retrospective survey (i.e., chart review)

Setting. Urban medical centre.

Participants. 1395 males infants born during 1989 who were circumcised were eligible for the study. Of these, 37 charts could not be located, and an additional 136 infants were excluded because they were transferred from the study setting prior to circumcision leaving 1222 infants (mean age=2.0 days, range 0-17 days; mean birthweight=3589 g)

Main Outcome Measures. Information was obtained on where the circumcision took place, whether dorsal penile nerve block was used, whether Gomco clamp, Plastibell, or another method of circumcision was used, and whether the operator was a medical student, resident, or staff physician. Potential complications included: ecchymosis or hematoma; excessive bleeding at injection site; methemoglobinemia; transient penile ischemia; lidocaine toxicity; lidocaine effect; delay in voiding; and interference with erectile functioning.

Results. Dorsal penile nerve block was used in 83.6% (n=1022) of infants. Complications were identified in 12 infants giving a complication rate of 1.2%. Eleven of the complications were ecchymoses \leq 1 cm in length which did not require treatment and 1 was excessive bleeding successfully treated with a silver nitrate stick. No differences were noted in birthweight, chronological age, or method of circumcision among those identified with and without complications. Complication rates did not differ significantly by level of training.

Conclusions. Dorsal penile nerve block appears to be a safe way of reducing the pain and distress associated with circumcision, with a minor complication rate of 1% to 3%.

Snellman, L. W. & Stang, H. J. (1995). Prospective evaluation of complications of dorsal penile nerve block for neonatal circumcision. *Pediatrics*, 95(5), 705-708.

Objective. To evaluate the complications associated with dorsal penile nerve block when used for circumcision in newborns.

Design. Prospective survey.

Setting. General hospital.

Participants. Parents of 491 out of 576 (85%) eligible newborn males, whose medical care was administered by the same health maintenance organization, completed the necessary study questionnaires.

Interventions. All newborns received dorsal penile nerve block prior to circumcision, which was the standard anesthetic regime of the study setting.

Main Outcome Measures. Presence of bruising or hematoma at injection site, complications of circumcision unrelated to anesthesia, and illness unrelated to circumcision were noted at time of discharge by pediatrician or nurse practitioner, and 2 weeks post-procedure by parents.

Results. At the time of discharge, 11% (n=54) of newborns had bruising at the injection site of the dorsal penile nerve block. The large majority (n=40) of these bruises were \leq 1 cm in diameter, and only 1 infant had a hematoma. All bruising had resolved during the 2-week follow-up period. No other complications were noted.

Conclusions. Dorsal penile nerve block appears to be a safe and effective way of reducing the pain and distress associated with circumcision.

Commentary

Circumcision is performed routinely and worldwide on normal healthy children and infants, usually within 10 days of birth. While it is widely acknowledged that circumcision is associated with degrees of pain that, if untreated in the neonate, may affect pain responses several months after the event (Taddio et al., 1995), it is frequently performed on newborns without anesthesia or analgesia (Weatherstone et al., 1993). This occurs despite official recommendations by at least some medical and pediatric societies that attention should be given to appropriate pain relief (see Table 1). For circumcisions performed in childhood and infancy, pain management decisions should be based on the same ethically motivated risk-benefit analyses that are applied to older patients. Two phases in circumcision demand consideration for pain relief: the procedure (incision and removal of foreskin) and the recovery period (especially the first 6 hours). A primary concern is the safe and optimal management of pain in the pre-verbal child, specifically newborns.

While the effectiveness of various pain relief options has been investigated singly, few studies have compared the relative efficacy of different interventions or their combination. Thus, questions relating to choice of pain relief and method of application (or the influence of other factors such as method of circumcision) have not been resolved. Orally administered acetaminophen is relatively ineffective for

the intra-operative and immediate post-operative periods, but may provide some benefit after the first 6 hours of recovery (Howard et al., 1994). The two most widely studied and applied forms of pain relief that are useful for both the intra-operative and immediate recovery period are administration of local anaesthesia (Dorsal Penile Nerve Block, DPNB; Kurya & Werthmann, 1978) and application of topical analgesic preparations (e.g., EMLA; Benini et al., 1993; see Vol. 1, No. 2 for abstract of this paper).

DPNB (with lidocaine) has been shown to be safe (Fontaine et al., 1994; Snellman & Stang, 1995). Yet there remains a concern regarding rare but possible complications including lidocaine toxicity, voiding delay, and vascular compromise (Fontaine et al., 1994), plus the added pain and potential bruising associated with anaesthetic injection. Topical anesthetics have been investigated as potentially providing a less invasive form of pain relief in both the intra- and post-operative phases. For older children, these preparations are simple, safe, readily accepted by surgeons, patients, and parents. Despite these advantages, however, topical anesthetics are not generally recommended for infants under the age of 6 months (under 1 month in USA) - especially those containing prilocaine (e.g., EMLA cream), due to the risk of methaemoglobinaemia (e.g., Engberg et al., 1985). Topical anesthetics provide complete relief from circumcision pain and they require longer pre-procedural application times (e.g., 1 hour; Benini et al., 1993) than a local anaesthetic (e.g., 1 minute; Snellman & Stang, 1995). For older children, the efficacy of a mixed regimen incorporating DPNB for intra-operative and immediate post-operative pain, a topical anesthetics after the DPNB has subsided, then oral analgesia if needed for the later post-operative period has not been tested.

For neonatal circumcision, the issue of pain relief has not been resolved. Benign, soothing interventions such as pacifiers and music have minimal value when used as single interventions (e.g., Marchette et al., 1991). However, the administration of a sucrose solution prior to circumcision has been associated with clinically significant reductions in behavioural distress, such as decreased duration of crying (e.g., Blass & Hoffmeyer, 1991; see "Sucrose Analgesia" for abstract of this paper), and may be recommended as a safe, non-invasive, and easily administered method for helping to alleviate circumcision pain for neonates. However, the most certain way to prevent pain from circumcision is to say no to circumcision.

Table 1. *Estimated infant circumcision rates and position statements of various colleges and societies**

Country (Rate†)	Organization	Recommendations
Australia (10%)	Australian College of Paediatrics	<ul style="list-style-type: none"> • routine male circumcision should not be performed prior to age of 6 months. • "...ensure that appropriate anaesthetic techniques are used."
Canada (<30%)	Canadian Paediatric Society	<ul style="list-style-type: none"> • circumcision of newborns should not be routinely performed. • "appropriate attention needs to be given to pain relief."
UK (<0.5%)	British Medical Association	<ul style="list-style-type: none"> • Circumcision not unlawful. Physicians should consider the situation of each case, and act according to their clinical judgement. • "Circumcision for medical purposes should be carried out in accordance with accepted good clinical practice."
USA (60%)	American Academy of Pediatrics	<ul style="list-style-type: none"> • Newborn circumcision has potential medical benefits and disadvantages as well as disadvantages and risks. • "Local anaesthesia may reduce observed physiologic [pain] response ... also has inherent risks"

* Full text available via <http://www.cirp.org/CIRP/library/statements>

† Source: National Organization of Circumcision Information Resource Centers (NOCIRC: <http://www.nocirp.org>)

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R Recent Articles

Ravilly, S., Robinson, W., Suresh, S., Wohl, M. E., & Berde, C. B. (1996). Chronic pain in cystic fibrosis. *Pediatrics*, 98(4), 741-747.

Objective. To determine the incidence of chronic pain in older children with cystic fibrosis (CF) and to describe approaches typically used for pain management.

Design. Retrospective case series (chart review).

Setting. Children's hospital.

Participants. Two groups were followed. Group 1 (posthumous) consisted of 55 children with CF (30 males; mean age=24 years) dying between September 1984 and September 1993. Group 2 (consultation) consisted of 23 children with CF (12 males; mean age=23 years) referred to the Pain Treatment Service between February 1986 and October 1993.

Main Outcome Measures. Demographics, functional status, frequency, location and (when possible) etiology of non-perioperative pain episode, dose, mode of administration, duration of treatment and efficacy of pharmacologic therapies.

Results. 84% reported some form of chronic pain. Pain was a frequent complaint in both groups and the most common types were chest pain, headache, limb pain, abdominal pain, and back pain. In the 6 months prior to death there was a dramatic increase in reports of chest pain and headache. The most common cause of chest pain was mixed muscular pain and the most common cause of headache was hypercarbia and/or hypoxia for group 1 and sinusitis for group 2. The patients had used a variety of nonpharmacologic (e.g., acupuncture, TENS, relaxation, biofeedback) and pharmacologic (nonsteroidal antiinflammatory medications, tricyclic antidepressants, thoracic epidural analgesia, and opioids) approaches to manage pain. Regional anesthesia and opioids were found to be effective.

Conclusions. Chronic pain is a common complication of cystic fibrosis. Regional anesthesia is useful for managing chronic pain in this population. Carefully administered opioids

provide effective chronic pain therapy and have few substantial complications.

Larsson, B., & Carlsson, J. (1996). A school-based, nurse-administered relaxation training for children with chronic tension-type headache. *Journal of Pediatric Psychology*, 21(5), 603-614.

Objective. To examine the efficacy of school-based relaxation training administered by the school nurse in reducing chronic tension-type headache in children, and to determine if treatment effects are maintained at a 6-month follow-up.

Design. Randomized trial.

Setting. 3 randomly selected schools in Goteborg, Sweden.

Participants. 30 children were eligible to participate; 1 refused, 1 moved, and 2 were noncompliant with baseline assessment. 26 children (1 male; age range = 10-15 years) remained. Eligibility criteria included reporting headaches "several times a week or daily" during a previous survey of headache, fulfilling International Headache Society criteria for chronic tension-type headache, and headache history for at least 6 months.

Interventions. Equal numbers of children were randomly assigned to 1 of 2 groups. The treatment group consisted of 2-3 hours of relaxation training prior to onset of treatment, 10 treatment sessions (3-4 pupils per session) over a 5-week period at the school nurses' offices using audiotapes and a treatment manual. The control group consisted of no treatment or contact with the school nurse.

Main Outcome Measures. Total headache activity (sum of ratings), number of headache-free days and headache frequency were computed from self-recordings of headache intensity (0=no headache; 5=incapacitating headache) made four times daily during a 3-week period immediately following treatment and another 6 months following treatment.

Results. The treatment group showed more improvement in overall headache activity, headache-free days, and headache frequency following treatment and at follow-up than the control group. 69% (n=9) of children in the treatment group showed an improvement of at least 50% in overall headache activity, whereas only 8% (n=1) in the control group showed similar improvement, $\chi^2 = 3.94, p < .05$.

Conclusions. The relaxation program described in this study was effective in reducing chronic tension-type headaches in school aged children. This study should be replicated with more boys and a placebo group to control for contact with professionals or therapists.

Chambers, C. T., Reid, G. J., McGrath, P. J., Finley, G. A., & Ellerton, M. L. (1997). A randomized trial of a pain education booklet: Effects on parents' attitudes and postoperative pain management. *Children's Health Care, 26*(1), 1-13.

Objective. To evaluate parents' attitudes and management of postoperative pain in their children after reading an education booklet entitled *Pain, Pain Go Away: Helping Children With Pain*.

Design. Randomized placebo-controlled trial.

Setting. Children's hospital, Same Day Surgery Unit.

Participants. Of 107 eligible parents of children (age=2-12 years; no developmental disabilities; no other medical condition; the parent respondent provided at-home postoperative care during first 3 days following surgery) undergoing day surgery known to cause at least a moderate amount of post-operative pain, 6 declined, 13 surgeries were postponed/cancelled, 5 children were admitted overnight, and 1 child did not meet eligibility criteria. A final sample of 82 parents remained.

Interventions. Parents were randomly assigned to 1 of 3 groups: 27 parents received a pain education booklet which provided information on pain assessment and management, 28 received a control booklet which provided information on pain assessment, and 27 received a control booklet which provided information on preparing a child for a hospital visit.

Main Outcome Measures. Parents assessed their child's worst pain using a 100-mm visual analogue scale ranging from 0 (no pain) to 100 (very severe pain) 5 times during the day and noted any pain medications given for 3 days after surgery. Parents also completed a questionnaire which evaluated their attitudes toward using acetaminophen to treat pain in their child.

Results. There were no differences in parents' ratings of pain between groups. Parents in the pain education group had more positive attitudes toward medication use and gave medication more frequently than parents in either control group. However, the difference between medication use was only statistically significant on the third day after surgery and none of the parents administered as many doses as recommended on the package. Parents' attitudes about medication were not related to their pain ratings.

Conclusions. The parents who received the pain education booklet reported more positive attitudes about using medication to treat their child's pain, but their actual medicating behavior only differed significantly from the control groups' on the third day after surgery. A need for better education for parents in the effective use of medication is emphasized.

Parker, R. I., Mahan, R. A., Giugliano, D., & Parker, M. M. (1997). Efficacy and safety of intravenous midazolam and ketamine as sedation for therapeutic and diagnostic procedures in children. *Pediatrics, 99*(3), 427-431.

Objective. To evaluate the safety and efficacy of a combination of ketamine and midazolam administered by hematology/oncology and/or critical care staff (i.e., not anesthesiology) to provide sedation during procedures requiring sedation.

Design. Prospective survey.

Setting. University hospital.

Participants. 68 children (age range = 4 months - 17 years) who received a total of 350 procedures (74 lumbar punctures, 97 bone marrow aspirations and/or biopsies, 95 imaging studies, 84 radiotherapy studies).

Interventions. For all children, 0.05 mg/kg to 0.1 mg/kg of midazolam was given initially, with a maximum single dose of 2 mg and maximum total dose of 4 mg. 2 to 5 minutes later, 1.0 mg/kg to 2.0 mg/kg of ketamine was given, with subsequent doses of 0.5 mg/kg to 1.0 mg/kg given as needed, to a total dose of 6 mg/kg in most cases. Additional doses of midazolam or a single dose of ketamine >50 mg were rarely given. For longer procedures, and in children who developed tolerance to ketamine, this maximum dose was infrequently exceeded.

Main Outcome Measures. Oxygen saturation assessed by pulse oximetry and heart rate were monitored continuously throughout the sedation and during the recovery period. Blood pressure was assessed at least every 15 to 30 minutes, and in most cases, every 5 minutes. Sedation was rated by medical staff and parents as optimal, acceptable, or failed. Recovery from sedation from the completion of the procedure was measured by level of awareness, fluency of speech, ability to walk (if appropriate), and lack of double-vision at 15 minutes, 30 minutes, and 30-minute intervals thereafter.

Results. All children were described as "acceptably sedated", and 90% were considered "optimally sedated". No serious complications occurred. Oxygen saturation dropped below 85% during 4 procedures (1.1%), which required that the procedure be interrupted and/or mild stimulation. Oxygen saturation ranged from 88% to 94% during lumbar puncture (neck flexion) in 32.4% (24/74) of procedures. Flushing was noticed in 11.8% (8/68) of children and as agitation and sleep disturbance were noted in less than 3% of children. Recovery occurred within 30 minutes following a majority (74.3%) of procedures.

Conclusions. The combination of midazolam and ketamine provides effective sedation for painful and anxiety-provoking

procedures such as bone marrow aspiration and lumbar punctures, as well as for other procedures which require sedation, with few side effects noted in this sample.

Book review

Carter, B. (1994). *Child and infant pain: Principles of nursing care and management*, London: Chapman & Hall. ISBN 0-412-48720-9

This book is primarily directed toward pediatric nurses, although the subject matter will be of interest to all those seeking to understand children's pain. Carter prefaces the book with a reference to her own experiences of caring for children in pain. Her admission that these children "would not have had to have been as tough or brave" had she had a better understanding of the complexity of pain provides us with insight into why this book was written, and serves as a powerful reminder that all nurses who care for children have a responsibility to develop their knowledge and skills in pain prevention and management.

In the first section, pain is defined and classified, myths and misconceptions are refuted, and factors that affect pain are addressed. The critical role of the nurse and the family in pain prevention and management is clearly defined, and a short but comprehensive overview of currently accepted theories of pain is provided. The guiding principle, namely belief in the child's pain, and the commitment to ensure that the pain is diminished or controlled, provides the framework for discussion. Research studies are critically appraised, and areas which require further research activities are noted.

The premise that effective management of a child's pain is fundamentally linked to effective assessment provides the focus for the next section. The discussion is logical and well organized. The approaches to pain assessment are separated into three major components; cognitive (self-report), behavioural, and psychological, and the importance of using a combination approach to ensure holistic management of the child's pain is emphasized. These measures are described in depth and the methodological and developmental issues that both support and complicate their use are explored. Carter acknowledges the debate on the reliability of both behavioural assessment and physiologic measurements of pain, and supports divergent views with extensive references to key research studies.

The section dealing with pharmacological and

nonpharmacological management of pain is detailed and prescriptive, and readily applicable to clinical practice. Each technique is clearly and comprehensively described, and includes a discussion on the age appropriateness of various interventions, and which approaches are most effective for different types of pain.

The final section addresses special pain experiences in children including perioperative pain, procedural pain, chronic pain, neonatal pain, and oncology pain. Specific nursing interventions are discussed within the context of each type of pain. Throughout the discussion, Carter communicates the need to understand, to imagine, and to feel what the pain experience is like for the child. This subjectivity is accomplished through the inclusion of excerpts from interviews with children which speak more to the qualitative nature of the experience than any amount of empirical data.

This book is a comprehensive, well organized synthesis of current knowledge related to assessment, prevention, and management of children's pain. The detailed, instructive presentation, the discriminating use of tables and figures to supplement written text, and the comprehensive, up to date bibliography makes this text a valuable resource, not only for nurses but for all health professionals who care for children.

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Announcements

Meetings

April 25 - 26, 1997: *Children in Pain: Meeting the Challenge*, Hyatt Regency Hotel, Dearborn, Michigan. Co-sponsored by the Children's Hospital of Michigan, Wayne State University and the University of Michigan C.S. Mott Children's Hospital. This interdisciplinary conference will address important issues relevant to management of children's pain. Contact: Carol Williams, Tel. (313) 763-5283 or email: cwms@umich.edu.

June 29 - July 4, 1997: *International Symposium on Pediatric Pain*, Sponsored by the SIG on Pain in Childhood. Contact: Dr. Eeva-Liisa Maunukela, Department of Ophthalmology, Helsinki University, Central Hospital, 00290

Helsinki, Finland.

Tel. 358-0-471-3101; Fax. 358-0-471-5008.

Other

PEDIATRIC-PAIN electronic mail list: The PEDIATRIC-PAIN electronic mail list is an international Internet forum for informal discussion of pain in children. There are currently over 500 members on 6 continents. Appropriate subjects include: clinical problems or questions, research problems or proposals, announcements of meetings, book reviews, and political or administrative aspects of children's pain management and prevention. To subscribe to the list, send an e-mail message to: **MAILSERV@ac.dal.ca**. The first line of the body of the message should read **subscribe PEDIATRIC-PAIN**. If you have questions or problems relating to the list, please contact us at: **owner-pediatric-pain@ac.dal.ca** or **allen.finley@dal.ca**.

Newsletter: *The Network News*, Editor-in-Chief William Breitbart, MD, presents literature abstracts, education resource materials, journal announcements, internet resources, and meetings on issues related to oncology, pain, palliative care, and HIV/AIDS. To order contact Noelle Wootten, Managing Editor, *The Network News*, Memorial Sloan-Kettering Cancer Center, Box 421, 1275 New York Ave, New York, NY, 10021, USA. Tel: (212) 583-3042; Fax: (212) 230-1953.

Special Issues: The Fall, 1996 (Vol. 25, No. 4) and Winter, 1997 (Vol. 26, No. 1) issues of *Children's Health Care* (ISSN 0273-9615), the journal of the Association for the Care of Children's Health, are 2 special issues devoted to Pediatric Pain. Guest Editor is Ronald T. Brown. Subscription orders and requests for information can be sent to Journal Subscription Department, Lawrence Erlbaum Associates, Inc., 10 Industrial Avenue, Mahwah, NJ, 07430-2262, USA.

Website: Visit us on the World Wide Web (<http://is.dal.ca/~pedpain/pedpain.html>).

Short announcements on pediatric pain will be published gratis.

If you would like to participate

Your participation in abstracting and writing commentaries for the Pediatric Pain Letter is welcomed. Please send submissions according to the specifications outlined in our Author's Kit. An Author's Kit can be obtained from Julie

Goodman, Managing Editor, Pediatric Pain Letter, Psychology Department, Dalhousie University, Halifax, Nova Scotia, B3H 4J1; email jgoodman@is2.dal.ca; requests can be made in writing or by email. Abstracts and commentaries on any aspect of pain in infants, children, and/or adolescents are appropriate. We will attempt to use abstracts and commentaries but the editors reserve the right to edit or reject contributions.

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