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ABM Clinical Protocol #23: Nonpharmacological Management of Procedure-Related Pain in the Breastfeeding Infant, Revised 2016

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A central goal of The Academy of Breastfeeding Medicine is the development of clinical protocols for managing common medical problems that may impact breastfeeding success. These protocols serve only as guidelines for the care of breastfeeding mothers and infants and do not delineate an exclusive course of treatment or serve as standards of medical care. Variations in treatment may be appropriate according to the needs of an individual patient. These guidelines are not intended to be all-inclusive, but to provide a basic framework for physician education regarding breastfeeding.

Purpose

The International Evidence-Based Group for Neonatal Pain and the American Academy of Pediatrics recommends that all neonatal units develop strategies to minimize the number of minor painful or stressful procedures and to provide effective nonpharmacological and/or pharmacological pain relief for newborns.[1,2] The purpose of this protocol is to provide healthcare professionals with evidence-based guidelines on how to incorporate nonpharmacological or behavioral interventions to relieve procedure-induced pain in the breastfeeding infant.

Background

Newborns and young infants routinely experience pain associated with commonly used invasive procedures such as blood sampling and intramuscular injections (e.g., vaccinations and vitamin K) and, in some countries, circumcision (the removal of some or all of the foreskin [prepuce] from the penis).[1] Reduction of pain is both a professional imperative and an ethical expectation because untreated pain has detrimental consequences[2] such as greater pain sensitivity in later childhood[3–6] and may lead to permanent neuroanatomical and behavioral abnormalities as demonstrated in animal models.[3,7]

Moreover, pain is a source of concern and distress for new parents and may disturb mother–infant bonding.[8] Pain reduction therapies are often underused for the numerous minor procedures that are part of routine medical and nursing care for neonates.[9,10] Growing scientific and clinical evidence from both animal and human newborns points to the efficacy of natural, nonpharmacological interventions to reduce pain due to minor procedures. Parents should be educated about the benefits of using breastfeeding and human milk in these situations.[11]

Soothing the Newborn Infant

There are several techniques that have been shown to provide pain relief for newborns (0–28 days of age) undergoing painful procedures. In breastfed newborns, breastfeeding itself is the preferred method to alleviate procedural pain. In addition to being safe, effective, natural, and without added cost, it provides an additional opportunity to promote and support breastfeeding. The individual components of breastfeeding (sucking, sweet taste, and warm contact) may be used separately or in combination when breastfeeding itself is not possible.

Breastfeeding or human milk

1. Breastfeeding should be the first choice to alleviate procedural pain in neonates undergoing a single painful procedure, such as venipuncture or heel lance (IA).[12–14] (Quality of evidence [levels of evidence IA, IB, IIA, IIB, III, and IV] is based on levels of evidence used for the National Guidelines Clearing House[15] and is noted in parentheses.) Breastfeeding should not be discontinued before the procedure (IB). Studies show that when breastfeeding is stopped shortly before a painful procedure, there was no significant difference in the infant's orogustatory, emotional, tactile, or thermal experience compared with a control group that was not breastfed at all.[16] When breastfeeding is not possible, whether because of the unavailability of the mother or difficulties

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with breastfeeding, expressed human milk given by dropper, syringe, or bottle has been shown to soothe newborns experiencing procedural pain (IA).[17–20] Administration of human milk can also be combined with sucking, by dipping a pacifier (dummy) in the milk, as described hereunder for sucrose.
2. Although some studies have demonstrated the efficacy of human milk alone,[18,21] human milk may not be equivalent to breastfeeding because of breastfeeding's multicomponent experience. Breastfeeding throughout the painful procedure is likely to be superior to human milk alone on the basis of synergism between the components of breastfeeding (IB).[16,21] One study that used near-infrared spectroscopy to evaluate brain activity in infants undergoing heel prick found generalized cortical activation in breastfed infants that was lacking in infants receiving glucose for analgesia. It was theorized that breastfeeding's multisensory experience helped to overwhelm the pain sensation.[22]

Skin-to-skin contact

1. Coordinating a breastfeeding session with the timing of the procedure is best, but, if this is not possible, skin-to-skin contact with the mother or other caregiver can comfort infants undergoing a procedure such as a heel lance (IA).[22] Skin-to-skin contact also gives the mother a caretaking role during the procedure that is unobtrusive and, by diminishing infant stress, can increase maternal confidence as to her importance in all aspects of her newborn's care.[23] At least one study has found that breastfeeding performed in conjunction with skin-to-skin contact provided superior analgesia during a painful procedure than with sucrose alone or with only skin-to-skin contact.[24]
2. Parental contact and sucrose may act synergistically to reduce pain in neonates. Therefore, if feasible, this combination can be employed (IB).[25] Sucrose taste—first studied in 1991[26]—is readily available for increasing the efficacy of other nonpharmacological techniques.[15] Sucrose administration is covered in more detail in the following section. The use of sucrose and a pacifier can be combined with the skin-to-skin contact.

Warmth and scent

1. Two studies evaluating the effects of warmth on infant pain associated with immunization found a significant analgesic effect when used as the sole intervention and when used in concert with administration of a sucrose solution.[23,24] Infants received 2 minutes of radiant warmer exposure, which was shown not to affect infant core temperature. This maneuver may be a safe and easy intervention if skin-to-skin contact or breastfeeding is not available (IB).
2. The scent of human milk and various other substances such as lavender, vanilla, formula, and amniotic fluid has been evaluated as possible analgesics for painful procedures in preterm and full-term infants, with human milk consistently found to be effective at reducing pain (IB).[25–29]

Sucrose and Sucking (in Combination or Separately)

Sucrose taste has been shown to be an effective analgesia for newborns and young infants for many minor procedures[30,31] but not for more lengthy or invasive procedures such as circumcision[32] or bladder catheterizations in infants older than 30 days.[33] When breastfeeding infants are undergoing painful procedures without mother available for direct breastfeeding and when expressed human milk is not available to use as a supplement, use of sucrose and sucking may be considered (IA).

1. *Sucrose and pacifier*. The combination of oral sucrose and pacifier or non-nutritive sucking is remarkably soothing.[34] This technique offers consistent pain reduction to infants undergoing heel lance, venipuncture, and intramuscular injection. Evidence for pain reduction in procedures such as arterial puncture, subcutaneous injection, insertion of nasogastric or orogastric tubes, bladder catheterization, and eye examinations is less conclusive though most trials demonstrate at least some benefit of sucrose use.[1,31,35] Because pain reduction achieved when using both sucrose and non-nutritive sucking is similar to that with breastfeeding, using a pacifier dipped in 24% sucrose (by weight) solution whenever breastfeeding is not possible is an effective option (IB).[36,37] Sucrose administration should begin 2 minutes before the procedure (IB). If use of a pacifier is not an available or acceptable option, sucrose can also be combined with sucking by dipping a clean, gloved (or nongloved parental) finger in the sucrose solution. When parents are present, they should be educated that sweet substances other than human milk and pacifiers are recommended in the newborn period only for procedural pain.
2. *Sucrose by syringe*. If sucking a pacifier or finger is not an option, 0.5–2 mL of a 24% sucrose solution can be administered orally through syringe 2 minutes before the painful procedure (IB).[1,38] Several 24% sucrose solutions are commercially available. Sucrose administered by oro- or nasogastric tube is not analgesic.
3. *Glucose versus sucrose*. Glucose has also been shown to be an acceptable and effective alternative analgesic (IB).[32,33] Taste difference is not a factor. Studies in rat[39] and human[40] newborns have not shown a preference for sucrose over glucose. The commercial availability of sucrose (table sugar) may have increased its use.
4. *Sucrose better than human milk?* At least one small study indicates that sucrose is significantly more effective than human milk, when both are administered orally through syringe, at reducing infants' cry time, recovery time (heart rate peak returns to baseline), and change in heart rate (IB).[30] The sugar in human milk is lactose, which has been shown to be an ineffective analgesic agent.[36] The analgesic component of human milk may be attributed to its fat content or other constituents.
5. *Pacifier alone*. Although pacifiers alone may decrease crying associated with painful procedures, they do not have the same effect on physiological parameters such as heart rate or vagal tone.[41,42] Moreover, sucking a pacifier has been found to reduce pain only when the suck rate exceeds 30 sucks/minute.[31] A pacifier (or clean gloved or parental finger) should be used as the sole soothing intervention only if breastfeeding, human milk, sucrose (or glucose), and skin-to-skin contact are unavailable

(IB). Non-nutritive sucking has consistently been found to be better than no intervention at all.[43]

Soothing the Preterm Newborn

Less research has been undertaken for preterm than term newborns, but there are several techniques that can be used to relieve pain in this population. Breastfeeding may be difficult secondary to the medical status of the infant. Preterm infants may be medically compromised and/or may be developmentally unable to suck or swallow. In such cases, individual components of breastfeeding or a combination of the components (e.g., contact and sweet taste) is available (IB). There are concerns about prolonged sucrose exposure in the preterm infant.[39] One study documented infants born at <31 weeks who were given a higher number of sucrose doses had lower scores in motor development and attention when assessed at term.[44] There are no uniform gestational age criteria for studies on analgesia used in preterm infants. The following recommendations are based on studies of infants with an average gestational age of 30 weeks or greater. Not all studies have included infants between 28 and 30 weeks gestational age, and it is unclear whether the following recommendations are generalizable to that age range. Available data do not allow us to extrapolate these recommendations to the smallest preterm infants (<27 weeks).

1. Skin-to-skin contact provides effective pain reduction for preterm newborns (IB).[38,45]
2. In very-low-birth-weight neonates (27–31 weeks gestation) undergoing consecutive heel lances, a pacifier dipped in sucrose or water significantly reduced pain compared with infants who did not receive any intervention (IB).[46]
3. The value of sucrose as a pain reducer in the preterm infant is well established (IB).[40,44,47,48] The recommended dosage in this population is 0.1–0.4 mL of 24% sucrose solution.[1,47] Further pain reduction can be achieved when preterm infants receive 24% sucrose as three doses (0.1 mL, 2 minutes apart given 2 minutes and immediately before heel lance and 2 minutes after lance) rather than as a single dose (IB).[48]
4. The efficacy of breastfeeding and human milk as a pain reducer for the preterm or low-birth-weight infant is less well established; a single study has shown comparable analgesic effects between human milk and breastfeeding with sucrose administration in a population of infants aged 32–37 weeks gestation.[43] Certainly if a mother wishes to breastfeed or provide her preterm infant with human milk instead of using other interventions, this should not be discouraged (IB).
5. Scent of human milk has been found to be an effective analgesic in the preterm infant undergoing venipuncture and heel lance procedures and may be considered in conjunction with other analgesic techniques (IB).[26,27,29]
6. Skin-to-skin contact plus sucrose has not been formally evaluated in preterm infants, but may provide pain reduction for the preterm or low-birth-weight neonates (IV).

Soothing the Older Infant (1 Month to 1 Year)

Breastfeeding or its components as an analgesic technique has not been fully researched across this older population. For children older than 1 year, the focus of published literature is on the use of distraction techniques, which falls outside the scope of this protocol.[49] Discussion of additional nonpharmacological techniques such as acupressure, topical vapocoolant spray, and vibration-based devices is also beyond the scope of this protocol.

1. *Sucrose.* Two meta-analyses of 10 and 14 randomized clinical trials on infant pain[50,51] found sucrose to be an effective pain management strategy for infants up to 12 months of age (IA). Two mL of 25% sucrose was effective during vaccination up to 6 months of age[52]; however, 2 mL of 24% sucrose was not effective for more invasive procedures such as bladder catheterization in children older than 1 month.[53] Increasing the concentration of sucrose solution may be more effective as the infant ages.[51] One study explored the pain-relieving qualities of sucrose in children up to 48 months of age[54] and found it was effective compared with no treatment. Others, however, report lack of effectiveness with lower concentrations and younger ages.[52,55] Sucrose taste alone was effective for one vaccination up to 12 months of age,[56] but did not demonstrate similar analgesia for multiple (three) vaccinations.[57] The higher concentrations of sucrose solutions may be more effective at older ages.[58] However, the majority of studies used differing concentrations, therefore, precluding recommendations on the optimal concentration and dose.[50,51]
2. *Maternal/caretaker behavior.* Maternal behavior during a painful procedure accounts for up to 26% of infant pain behavior during both the procedure and the recovery period.[59] Maternal distress was an especially important determinant of pain behavior in infants with low vagal tone compared with infants with high vagal tone.[60] Giving parents a caretaking role, such as securing or distracting the child, can reduce parental sense of helplessness. When parents are unavailable or unable to play a caretaking role, consider enlisting another healthcare provider to help secure and/or distract the child (IV).[61]
3. *Breastfeeding.* Although the efficacy of breastfeeding and human milk as a pain reducer for older infants has not been extensively studied, there is potential benefit/minimal risk. Therefore, mothers who are breastfeeding should be invited to breastfeed the infant during painful procedures (IV).
4. *Older than 12 months.* The upper age limit of effectiveness of sucrose as a pain reducer has not been fully studied, and sucrose, therefore, cannot be recommended as a pain reducer in children older than 12 months at this time (IA).[50,52,61] A publication of workshop proceedings reviewing the evidence for other techniques such as physical, psychological, and pharmacological interventions shows a range of nonpharmacological treatments to be effective at reducing older childhood vaccine injection pain (IA).[50,62–64]

Recommendations for Further Research

Further research is needed to establish the most effective nonpharmacological methods to treat procedural pain for

both preterm newborns and infants out of the newborn period. In particular, research should focus on the potential of breastfeeding and human milk to reduce pain for preterm newborns, newborns experiencing multiple painful procedures, and the older breastfeeding infant. Research is also needed on the effectiveness and effect of increasing concentrations of sweet tastes across different ages in early childhood, as well as the comparison of different combinations of analgesic treatments for older infants/toddlers experiencing procedure-induced pain.

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ABM protocols expire 5 years from the date of publication. Content of this protocol is up-to-date at the time of publication. Evidence-based revisions are made within 5 years or sooner if there are significant changes in the evidence.
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