Management of Neonatal Stress & Pain

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Management of Neonatal Stress & Pain

Painful procedures in the NICU are unavoidable and it is vital that caregivers assist infants to cope with and recover from necessary but painful clinical procedures. Greater neonatal procedural pain is associated with reduced white matter and impaired early brain development to preterm infants (Brummelte, 2012). The goals of pain management in infants are:

- Minimize the intensity, duration, and physiologic cost of the pain experience.
- Maximize the infant’s ability to cope with and recover from the painful experience.
- Maintain a balance between pain relief and adverse effects of analgesics.

Minimizing stress in preterm infants may have many neurologic benefits such as reducing the likelihood of programming abnormal stress responsiveness; which may help preserve existing neuroplastic capacity (Pitcher et al, 2011). Strategies to prevent stress as well as pain should be employed whenever possible, which includes behavioral, environmental and pharmacologic interventions. Typically, the treatment of pain starts with non-pharmacologic techniques and progresses to pharmacologic methods for increasing pain. Pharmacologic interventions are beyond the scope of this module, however, it is important to acknowledge its use in pain management and that when needed; it is employed in combination with environmental and behavioral therapeutic strategies.

Non-Pharmacologic Strategies for Minimizing Stress & Pain

The AAP/CPS and Joint Commission all mandate that pain for infants are managed (AAP/CPS, 2006; Joint Commission, 2001). Evidence based practices of non-pharmacologic strategies are hypothesized to reduce pain by blocking nociceptive transduction or transmission, activating descending inhibitory pathways, or activating attention or arousal systems that modulate pain. Pharmacologic and non-pharmacologic management of pain is a top priority in NICU caregiving.

Non-pharmacologic behavioral support interventions to minimize an infant’s pain and stress experience while maximizing the infant’s own regulatory and coping abilities includes the support of the macro-environment, reducing the number of procedures/interventions, clustering care, providing swaddling, nonnutritive sucking, oral sucrose, positioning, facilitated containment/tucking, kangaroo care, holding, nesting, human touch, infant massage, rocking, and positioning strategies (Altimier & Philips, 2013; Chidambararam, et al. 2014, Herrington & Chiodo, 2014). These are all strategies that are generally nurse-driven and frequently underutilized.

Support of the Macro-environment

Care strategies to reduce infant, family and staff stress in the neonatal intensive care unit ranges from decreasing light and sound levels in the environment to facilitating parent-infant interactions to ensuring physical and emotional support to staff members. Excessive and unpredictable sound
levels and bright or continuous lighting levels have been associated with increased physiologic and behavioral stress in preterm NICU infants. Strategies to minimize noise and light levels should be employed in the entire unit. By dimming overhead lighting, people tend to lower their voices, decreasing the overall noise level. Maternal presence is also a mediator for pain relief in neonates.

The efficacy of breastfeeding, kangaroo care, as well as multi-sensorial stimulation such as auditory and olfactory recognition; which are all provided by the mother, cannot be overlooked. Health care clinicians strive to balance a medically intense environment with supportive, nurturing, developmentally appropriate care.

**Reduce the number of Procedures if possible.**

All diagnostic and therapeutic procedures should be examined daily in caregiver rounds to determine medical necessity (AAP/CPS, 2006). Laboratory studies that will not be acted upon should be discontinued. Care procedures should also be examined, such as frequency of endotracheal suctioning; grouping of blood draws, establishing central vessel access to minimize capillary, vein and artery punctures.

**Clustering Care**

Caregiving activities should be organized to provide periods of rest and recovery. A “wind-up” phenomenon is a period of sensory hypersensitivity, suggests that for prolonged periods after a painful stimulus, other nonnoxious stimuli (handling, physical examinations, nursing procedures, etc.) may cause heightened activity in nociceptive pathways, leading to systemic physiologic responses to stress in preterm infants. Therefore, it is recommended to have adequate rest periods after painful clinical procedures. It is also reasonable to consider introducing the least noxious stimuli first in a caregiving cluster and the most noxious stimuli last so the stress of caregiving is not unnecessarily heightened for the infant (Wallden & Jorgenson, 2010).

**Swaddling or Facilitated Tuck**

Containment strategies to limit excessive, immature motor responses have been demonstrated to be effective in minimizing pain responses in preterm infants. Swaddling is thought to reduce pain by providing gentle stimulation across the proprioceptive, thermal, and tactile sensory systems. Hand swaddling is a broad term that describes the use of hands to encompass or position infants to provide a "nest". A hand –swaddling technique, also called “facilitative tucking” (holding the infants extremities flexed and contained close to the trunk) has been shown to attenuate pain responses in preterm infants by decreasing heart rates, increasing oxygen saturations, decreasing crying time and sleep disruption times, and reducing pain scores during heelstick procedures and endotracheal suctioning (Cignacco et al., 2012; Obeidat, Kahalaf, Callister, & Froelicher, 2009). This technique helps facilitate the infant’s self-regulatory development.

**Nonnutritive Sucking (NNS)**

Nonnutritive Sucking (NNS) is the provision of a pacifier/dummy into the mouth to promote sucking without breastmilk or formula for nutrition. NNS is thought to produce analgesia through stimulation of orotactile and mechanoreceptors when introduced into the mouth. NNS is hypothesized to modulate transmission or processing of nociception through mediation by the endogenous non-opioid system (Blass, Fitzgerald, & Kehoe, 1987).

Non-nutritive sucking is often successful for soothing and self-regulation. NNS has been shown to
reduce pain responses in both term and preterm neonates (Pillai, Riddell et al., 2011), during immunizations (Liaw, et al., 2011), and heelstick procedures (Liaw, et al., 2010). The efficacy of NNS is immediate but appears to terminate almost immediately on cessation of sucking (Walden & Jorgenson, 2014).

**Sucrose**

Sucrose with and without NNS has been the most widely studied non-pharmacologic intervention for infant pain management. Sucrose is a disaccharide comprised of fructose and glucose. A systematic review of 44 randomized control trials of full-term and preterm infants (N = 3,496) found that sucrose is safe and effective for reducing procedural pain in term and preterm neonates, particularly heelstick and venipuncture procedures (Stevens, Yamada, Ohlsson, 2010). Doses of 24% sucrose or greater are most effective in the management of pain. A pain-reduction response is noted with dose volumes ranging from 0.05 mL to 2 mL of a 24% solution administered approximately 2 minutes before the painful stimulus. This 2 minute time interval appears to coincide with endogenous opioid release triggered by the sweet taste of sucrose. The effect of sucrose lasts approximately 4 minutes; therefore, repeated doses may be necessary if procedures are prolonged (Stevens, Yamada, et al., 2010). The use of sucrose in combination with other behavioral interventions such as NNS, skin-to-skin care, and containment are synergistic, enhancing the analgesic effects of sucrose.

The most common non-pharmacologic techniques include the combination of nonnutritive sucking with sucrose. The combination of sucrose and NNS is a safe, effective, and clinically significant means of providing procedural pain relief in neonates, both term and preterm. There is increasing evidence that the synergistic effect of sucrose and NNS is more effective than the effect of sucrose or NNS alone (Naughton, 2013).

**Skin-to-Skin Care/Kangaroo Care/Human Touch**

Families often do not receive the information they need regarding pain assessment and management. This limits parental involvement and increases parental stress (Franck, Cox, Allen, & Winter, 2004). Additionally, the loss of the parental role, including providing comfort, particularly for mothers, has been expressed as a major concern by parents (Franck, Allem, Cox, & Winter, 2005a; Franck, Allem, Cox, & Winter, 2005b; Franck, Allem, Cox, & Winter, 2004). Most studies of NICU parents demonstrated that over 80% of mothers wanted to participate in managing their infant’s pain in some method. One study engaged mothers in skin-to-skin care while their infant underwent routine heel lance in the NICU. Eighty percent of the mothers reported positive feelings and 99% said they would do it again. Both breastfeeding and SSC has been consistently associated with a reduction on behavioral pain response and improvement in physiological stability.

NICU caregiving patterns differ significantly from those in the fetal intrauterine environment and the normal home setting. The sense of touch is highly developed in utero, with gentle human touch normally providing consistent positive tactile input after term birth. Touch in the NICU, however, is usually related to medical care rather than social nurturing. NICU interventions are often intrusive or aversive, and are typically constant throughout a 24-hour span. Endorphins are released both by stress (including pain) as well as positive stimuli such as touch (Gressens, et al., 2002; Maquet et al., 2003). The mechanisms underlying the comforting effects of breastfeeding and maternal and familiarized smell remain unknown although it too has been theorized to act via the activation of endogenous opioid pathways and are almost certainly multisensorial (Comaru & Miura, 2009).

**Stress Reduction Strategies**

Minimizing stress in preterm infants may have many neurologic benefits such as reducing the
likelihood of programming abnormal stress responsiveness; which may help preserve existing
neuroplastic capacity (Pitcher et al, 2011). NICU caregiving patterns differ significantly from those in
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term birth. Touch in the NICU, however, is usually related to medical care rather than social
nurturing. NICU interventions are often intrusive or aversive, and are typically constant throughout a
24-hour span. Care strategies to reduce infant, family and staff stress in the neonatal intensive care
unit ranges from decreasing light and sound levels in the environment to facilitating parent-infant
interactions to ensuring physical and emotional support to staff members. Healthcare clinicians
strive to balance a medically intense environment with supportive, nurturing, developmentally
appropriate care. The following strategies have been divided into infant, family and staff domains for
stress management in the NICU. These lists are not exhaustive, and we invite you to list additional
strategies for stress reduction.

Stress Reduction Strategies for the Hospitalized Infant
1. Ensure that light and sound levels are maintained within the recommended specifications.
2. Cluster care interventions to avoid sleep disruptions.
3. Ensure adequate pain assessment, management and evaluation of the efficacy of selected
   interventions is a standard of NICU care.
4. Prior to care, gently approach & introduce your self gently to the infant, to allow the infant
time to arouse.
5. Promote frequent parental interactions with the infant, to include hand containment,
kangaroo care and infant massage as indicated by the infant’s behavioral cues.
6. Provide positive sensory experiences (tactile, olfactory, and auditory) to promote a sense of
calm for the infant.
7. Ensure that the infant is contained and hands are free to the face and mouth.
8. Provide and support nonnutritive sucking.

Stress Reduction Strategies for the Family of the Hospitalized Infant
1. Provide unrestricted access for the parents to their infant.
2. Partner with parents in providing infant care and offer the parents the opportunity to be
   present for invasive procedures, resuscitative interventions as well as participating in first
   events, i.e., bathing, feeding, etc.
3. Share information about the infant’s medical condition on a regular basis using culturally
   appropriate language to ensure understanding.
4. Connect family with appropriate resources (social services, chaplaincy, mental health).

Stress Reduction Strategies for the NICU Clinician
1. Support a primary nursing care model to provide continuity of care for the patient, family and
   staff.
2. Promote a collaborative practice model supported by ongoing continuing education of
   developmentally supportive family-centered care.
3. Provide debriefing/grieving opportunities for staff caring for the long-term NICU patient.
4. Create an environment of shared governance to enhance clinicians’ participation in
decision-making process that effects care delivery.

Conclusion

Pain in the NICU setting may be inevitable and may not be entirely avoided. Premature infants,
especially the very sick and fragile are exposed to 2-17 painful procedures a day, not to mention the
routine procedures that may be as noxious. It is now well established that even VLBW infants
experience pain though they not be capable of manifesting overt behavioral cues. It behooves
nurses to be cognizant of behavioral cues and to have the necessary critical skills to differentiate
pain behaviors from other stressful behaviors that occur apart from painful situations (Reyes, 2003).
It is also essential that nurses differentiate the responses of preterm infants of differing gestational
ages and those who are sedated or not fully conscious. Abundant infant pain measurement tools
are available and have documented reliability and validity however, most need further testing for
clinical applicability and sensitively. Studies note that while nurses acknowledge that infants
experience pain and are familiar with pain assessment tools they may not have adequate
knowledge regarding the expression of pain not are assessments routinely used (Boyd, 2003; Byrd
et al., 2009). As a result pain management remains unsystematic and capricious (Bernardini, et al.,
2011). This is especially true in NICUs of less developed countries. It is recommended that nurses
working in the NICU are educated about pain assessment in order to adequately assess pain in
preterm infants on regular basis. The use of the most reliable and valid multidimensional instrument
is encouraged taking into consideration practicality and ease of administration.