Cue-Based Feeding in the NICU: Using the Infant's Communication as a Guide

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Abstract

Although studies have shown cue-based feeding can lead to earlier achievement of full oral feeding, the successful implementation of cue-based feeding has been constrained by the volume-driven culture, which has existed for many years in the NICU. This culture was built on the notion that a "better" nurse is one who could "get more in," and infants who are "poor feeders" are ones who "can't take enough." The infant who feeds faster is often viewed as more skilled in this task-oriented approach.

The feeding relationship and the infant's communication about the experience of feeding may not be nurtured. This article will explain the central role of the preterm infant's communication in successful cue-based feeding. When the infant is perceived as having meaningful behavior (i.e., communicative intent), the focus changes from a volume-driven to a co-regulated approach, through which the infant guides the caregiver. This is cue-based feeding.

Keywords: NICU; preterm; cue-based; feeding; neonatal; swallowing

Advances in neonatal care have led to significant changes in survival rates of very small and extremely preterm infants. However, improved survival rates bring increased risks for nutritional, growth, motor, and sensory problems.[1–3] The delay in acquiring feeding skills is the most frequent cause of prolonged hospitalization in the neonatal intensive care unit (NICU).[4,5] Early feeding difficulties with the transition from tube feeding to oral feeding are prominent and often persist beyond discharge to home. Hawdon and colleagues reported that although less than 1 percent of preterm infants required supplemental tube feedings at time of discharge from NICU, more than 50 percent of parents of NICU graduates report problematic feeding behaviors in their former preterm infant at the age of 18–24 months.[6] The incidence of enduring feeding problems in preterm infants ranges from 19 to 80 percent.[7–11] Given these adverse feeding outcomes, one might ask what it is about the experience of feeding in the NICU that may predispose preterm infants to feeding problems that persist.

STRESS ASSOCIATED WITH FEEDING EXPERIENCES

During the time when preterm infants are learning to feed in the NICU, motor and sensory neuropathways are developing.[11] Stress during feeding may promote altered sensory–motor pathways in the brain that guide the infant away from feeding and adversely affect the ability and desire to feed both in the NICU and after discharge.[12] Increased exposure to stressors in the NICU has been associated with alterations in neurobehavior and brain structure at 40 weeks postmenstrual age (PMA).[13] Preterm infants are establishing their learned experiences with feeding, and, therefore, every feeding experience must be as positive as possible.[14,15] As a result, there is growing concern about reducing the stress experienced by the preterm infant in the NICU while encouraging and facilitating the infant's emerging competence, particularly with respect to feeding.

PHYSIOLOGIC VULNERABILITY DURING FEEDING

Work of breathing, oxygen saturations, heart and respiratory rates, and suck-swallow-breathe synchrony are sensitive indicators of the preterm infant's ability to cope with the stress of feeding. The challenge of feeding can quickly trigger changes in any or all of these parameters. The caregiver must use watchful vigilance to avoid potentially serious

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consequences of instability (i.e., apnea, bradycardia, tachypnea, color change, and loss of state arousal and/or postural control). If feeding provides a significant challenge to physiologic stability, there may be a resulting negative effect on the control of the larynx, pharynx, and esophagus. The consequence of this deterioration is the potential for laryngeal penetration or indeed aspiration. In addition, the potential for silent aspiration is heightened in this fragile population.[16–18] Because of the dynamic nature of feeding, its impact on the stability of the physiologic, motor, and state systems must be assessed continuously during feeding.[19]

DYNAMIC SYSTEMS UNDERLYING INFANT COMMUNICATION DURING FEEDING

In a dynamic systems model of feeding, physiologic stability is considered the foundation for organizing behavioral state, attention/interaction, movement, and self-regulation. These systems are the underpinnings for safe and efficient feeding as observed in the infant's arousal, physiologic regulation, posture, oral structures, upper airway function, and suck-swallow-breathe patterns. A disruption that negatively affects the infant's breathing system, for example, may cause the infant to compensate via the motor system, observed as a change in sucking.[20] The preterm may also compensate via the state system, through moving to light sleep, which is not optimally supportive of successful feeding.[21] In an attempt to keep the systems in balance, the preterm may use adaptive or compensatory strategies to reduce bolus size, such as: limited jaw and tongue excursions or compression-only sucking, which purposefully expels excess fluid out of the oral cavity.[12,22,23] These compensatory strategies may be perceived incorrectly as "sucking" problems if they are not viewed in the context of dynamic systems.[24] Recognizing and then conceptualizing disruptions in infant system synergy increases the likelihood the caregiver will address the underlying issue versus applying an arbitrary intervention that may actually override the infant's own beneficial compensatory mechanism.[20] For example, an infant who is having trouble coordinating swallowing and breathing may stop sucking, although awake and hungry. A well-intentioned caregiver may then increase the flow rate to "help" the infant, either by using a faster flow nipple or providing cheek or jaw support, which may deliver a large uncontrolled bolus passively toward the airway. Because the infant then "fights the flow" to breathe, a decrease in oxygenation may result. This can then compromise the infant's physiologic stability, with a resulting loss of coordinated feeding behaviors, as the infant attempts to protect the airway.[20] This compromise in physiologic stability may lead to apnea and/or bradycardia.[25] Accumulation of these responses to physiologic instability may then provide negative feedback, leading to stress and feeding refusal behaviors early on.[26] A focus on emptying the bottle, or defining an empty bottle as "success," may negatively affect the preterm infant's feeding experience and have adverse effects on neuromaturation and on feeding outcomes.

MOVING AWAY FROM VOLUME-DRIVEN FEEDING

As a result of these adverse feeding outcomes, most NICUs have introduced "cue-based" feeding in an attempt to promote individualized feeding experiences based on the infant's cues. Although studies have shown cue-based feeding can lead to earlier achievement of full oral feeding, the successful implementation of cue-based feeding has been constrained by the volume-driven culture, which has existed for many years in the NICU.[27,28] This culture was built on the notion that a "better" nurse is one who could "get more in," and infants who are "poor feeders" are ones who "can't take enough." Interventions in the NICU are accordingly often unfortunately focused on increasing intake or volume rather than on enhancing quality of feeding.[29] In a volume-driven culture, there is pressure on professional caregivers to "get infants to eat," with a well-intentioned goal of getting them home. This means a successful feeding is then measured by volume intake, at times, regardless of infant communication about physiologic stress, trouble coordinating swallowing and breathing, or "being done." The focus is on an empty bottle, which may be accomplished by the caregiver's manipulation of the bottle during feeding (i.e., twisting the bottle, moving the nipple in and out to "prod," which passively expels fluid from the nipple).[30] Efficiency is often valued over the infant's experience of feeding, and ratings such as "well, fair, poor" reflect only intake. The infant who feeds faster is viewed as more skilled in this task-oriented approach. The feeding relationship and the infant's communication about the experience of feeding are often not nurtured. Strategies used are intended to empty the bottle with minimal regard for infant communication (Table 1). The caregiver who is volume driven has a tendency to feed "past the infant's stop signs," which communicate "I want to stop, I am done" (Table 2). Lack of contingent response to the infant's communication may lead to maladaptive feeding behaviors, learned feeding refusals, and long-term feeding aversions.[11,31] The pressure to empty the bottle is often then passed along to parents. Feeding becomes something they do "to" their infant, instead of a relationship-based experience through which communicative interactions build trust.[32]

TABLE 1 ■ Volume-Driven Strategies[31]

- Removing blanket and feeding unswaddled
- Increasing flow rate
- Prodding
- Chin/cheek support
- Putting infant's head/neck back
- Continuing to feed despite signs of
  - Mild physiologic instability
  - Swallow-breathe incoordination
  - Disengagement

TABLE 2 ■ Signs of Infant Disengagement During Feeding

- No active rooting, no active sucking
- Inability to realert, passivity
- Pulling off the nipple, pushing the nipple out
- Purposeful use of a weak or "compression-only" suck to signal a preference for return to only pacifier sucking instead of nutritive sucking

Intake is indeed an important measure of feeding integrity required for discharge from the NICU. However, intake must be viewed in the context of the infant's developmental strivings and as the by-product of a quality feeding. If the focus is primarily on intake, the infant's communication during feeding may take on a different meaning, may not be understood, or may be overlooked.[31] Reciprocity must exist between the infant and the caregiver if safe and successful feeding is to occur. When the infant is perceived as having meaningful behavior (i.e., communicative intent), the focus changes from a volume-driven to a co-regulated approach, through which the infant guides the caregiver.

MOVING TOWARD INFANT-GUIDED FEEDING

Research has shown that the ability to feed well is closely related to the caregiver's ability to understand and sensitively respond to the infant's physiologic and behavioral communication.[18] Preterm infants actively communicate through their behaviors and contingent responses. The infant's communication then guides the caregiver in understanding the infant's thresholds of stress versus stability. The dynamic nature of feeding requires the caregiver to partner with the infant during feeding, such that the infant and the caregiver together co-regulate the feeding. Barnard's model of reciprocal interaction between infant and caregiver describes the communicative interaction that occurs when the infant offers behavioral and physiologic signs to a caregiver.[33] The caregiver then interprets the infant's communication within a problem-solving context to optimize the feeding experience for the infant. The caregiver provides opportunities for communication, reflects on the meaning of the infant's communication, selects contingent interventions that support and strengthen the infant's efforts, and respects the infant's limits.[34] The infant informs the caregiver about the flow of milk; ability to tolerate bolus size; if the sucking burst is too long; if more postural support is needed; if re-alerting or calming is needed; when feeding should be started, paused, or stopped; and if swallowing and breathing are becoming uncoupled.[17,34] The contingent co-regulated interventions need to be dynamic, that is, specific to the infant's need at that moment, and continuously titrated based on the infant's communication from moment to moment.[34] Arbitrary interventions, such as routinely pausing the infant after every three to five sucks, are instead replaced by co-regulated pacing, in which the infant's communication guides the timing, frequency, and length of the pausing provided by the caregiver. This communicative interaction helps anticipate the infant's needs throughout the feeding, thus avoiding the need to all-of-a-sudden "rescue" an infant who eventually communicates through coughing/choking, or a major event of physiologic instability, such as bradycardia or apnea.

This co-regulation between caregiver and infant forms the foundation for a positive infant-guided feeding approach as described by Shaker, which includes (1) observing the infant from moment to moment during feeding for communication of stress versus stability specific to swallowing, breathing, physiologic stability, postural control, and state regulation (Table 3); and (2) continuously modifying the feeding approach through dynamic individualized interventions contingent on the infant's ongoing communication (Table 4).[17] Because the quality of a feeding takes priority over the quantity ingested, feeding skill develops pleasurably

TABLE 3 ■ Signs of Stress During Feeding[17]

- Change in state of alertness
- Change in postural control or tone and movement patterns
- Change in cardiorespiratory behavior:
  - Color change from baseline (pallor, cyanosis)
  - Respiratory fatigue
  - Tachypnea
  - Nasal flaring and/or blanching
  - Chin tugging
  - Shallow short breaths instead of a series of deep breaths
  - Unstable saturations
  - Bradycardia, apnea
- Uncoupling of swallowing and breathing reflected in:
  - Loss of bolus control orally ("drooling")
  - Gulping
  - Gurgling sounds in the pharynx
  - Multiple swallows to clear bolus
  - Coughing and/or choking

TABLE 4 ■ Supportive Infant-Guided Interventions

- Providing a more controllable flow rate to protect the immature preterm infant[35–40]
- Providing an elevated side-lying position[31,41,42]
- Providing supportive swaddling to optimize postural stability and control[17,43]
- Providing co-regulated pacing and resting infant during feeding to avoid uncoupling of swallowing and breathing[17,32,34,44,45]
- Providing support for state regulation through re-alerting or calming[17,21]
- Using a developmentally supportive framework for feeding with preterms and their families[14,17]
- Avoiding prodding[20,46]

and at the infant's own pace, and intake improves as a result. In this infant-guided co-regulated approach, caregivers support feeding success by using the infant's communication to inform their feeding decisions and actions.

IMPACT OF INFANT-GUIDED FEEDING ON FEEDING OUTCOMES

Research has looked at the impact of a co-regulated feeding approach using the infant's behavioral and cardiorespiratory signs to guide feeding duration, frequency, and volume. In two studies with healthy preterm infants at 32–34 weeks PMA, bottle feedings were offered to the experimental group based on physiologic and behavioral responses. The experimental group of infants gained more weight and achieved full bottle feeding sooner compared with controls whose feedings were not guided by infant observations but rather were offered according to standard care.[47,48] McCain showed that preterm infants with chronic lung disease (CLD) born at <24 weeks gestation who were offered bottle feedings based on their cardiorespiratory and behavioral responses achieved full bottle feeding 5–6 days sooner than infants with CLD who were fed using a standard approach based only on ability to ingest volume.[49] For infants with CLD, who have altered suck-swallow-breathe patterns, attention to the infant's signs of tolerance or intolerance can result in more safe and less stressful feedings.[37] Thoyre et al. noted that a co-regulated approach to feeding infants with lung disease born at <32 weeks gestation resulted in more stable oxygen saturations, less heart rate fluctuation and decline, improved swallowing, and less excessive breathing effort.[34]

CUE-BASED FEEDING AT ITS BEST

The experience of feeding, both for the preterm infant and for parents, is strongly influenced by the assessments, decisions, and actions of NICU professional caregivers.[50] All caregivers involved in feeding must be knowledgeable about the communication cues of preterm infants during feeding to provide true "cue-based" feeding. When interventions are not individualized to the infant's continuous feedback, the approach to feeding will be task oriented versus relationship based. Because the preterm infant's behavior is the main channel of communication, it is critical that all caregivers appreciate its central importance. This requires both sensitivity and watchful vigilance during feeding to recognize and appreciate the infant's clear, although sometimes subtle, communication. Through appreciating the meaningfulness of preterm infant communication, the culture of feeding in the NICU can be transformed from volume driven into one in which the infant's earliest communication guides caregivers. When cue-based feeding is at its best, the preterm infant is "supported to feed" in an individualized manner through infant-guided co-regulation versus "being fed." Appreciating the difference is at the heart of developmentally supportive care.

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