II

Infant-Related Challenges to Breastfeeding

Chapter 5

First 24–48 Hours: Common Challenges

INTRODUCTION

Proper positioning of the mother and infant and a correct latch of the infant to the breast form the foundation of each breastfeeding encounter. Many problems stem from improper positioning, incorrect latch, and subsequent failure to transfer milk. Some problems innate to the infant or the mother require modification of positioning and latching techniques. This chapter explores positioning, latch, plus selected infant-related problems encountered during the first few days after birth. These days set the stage for successful breastfeeding and the mother's capacity to meet her breastfeeding goals.

CLINICIAN INFLUENCE

Advice given to mothers by healthcare professionals, family, and the media regarding infant care practices such as breastfeeding is a modifiable factor that can influence adherence to evidence-based guidelines. A recent study of more than 1,000 mothers found that approximately 20% of mothers reported receiving no advice from physicians regarding breastfeeding and 10–15% received advice that was not consistent with breastfeeding guidelines such as those promulgated by the American Academy of Pediatrics (Eisenberg, Bair-Merritt, Colson, Heeren, Geller, & Corwin, 2015). Approximately 14.9% of advice from birth hospital nurses was inconsistent with recommended guidelines, and 13.3% of mothers reported receiving no advice from such nurses. The prevalence of advice consistent with recommended guidelines can be improved with evidence-based hospital breastfeeding policies and incentives for physicians to discuss breastfeeding recommendations consistent with accepted national guidelines.

A breastfeeding mother benefits most when a nurse or lactation consultant remains with her for early feedings, ensuring that the infant is latched correctly and transferring milk. Nurses need to demonstrate appropriate positioning and latch, while allowing the mother to perform the task (Gill, 2001). Mothers find it helpful when clinicians offer prenatal information of the realities of breastfeeding, deliver practical help with positioning and latch-on, perform effective interventions for early problems, and offer enlightenment on questions such as how long and how often to breastfeed, when to switch breasts, and whether nipple shields and supplementing with bottles of formula will undermine breastfeeding (Graffy & Taylor, 2005). Inadequate, insensitive, or apathetic approaches to breastfeeding often culminate in a downward spiral of fatigue, frustration, and weaning by 2 weeks postpartum. Neutrality of clinicians regarding infant feeding negatively affects breastfeeding initiation and duration. Mothers who reported that hospital staff expressed no preference regarding infant feeding were more likely to be bottle-feeding at 6 weeks, especially if the mothers had intended to breastfeed for less than 2 months (DiGirolamo, Grummer-Strawn, & Fein, 2003).

Mothers are especially frustrated by inconsistent advice about breastfeeding techniques and the tendency of some clinicians to quickly support the use of a bottle when feeding difficulties are present—sometimes even offering a bottle before the infant goes to breast (Mozingo, Davis, Droppleman, & Merideth, 2000). Inconsistent advice, rushed encounters with mothers, lack of skilled nurses, unavailability of lactation consultants, and the promotion of unhelpful practices sabotage breastfeeding right from the start (McInnes & Chambers, 2008). A meta-synthesis of research examined mothers' perceptions and experiences of breastfeeding support. The study found that mothers actively seek realistic, accurate, and detailed information, especially practical help. The findings emphasized person-centered relationships and continuity of care as being especially effective in establishing supportive care and a trusting relationship with healthcare professionals (Schmied, Beake, Sheehan, McCourt, & Dykes, 2011). Failure to offer assistance with latch-on, failure to follow up after a feeding, inadequate assessment of breastfeeding technique, anecdotal descriptions of personal experience that differs from other professional information, and failure to provide information regarding community resources have been identified by mothers as behaviors by clinicians that are nonsupportive of learning to breastfeed (Hong, Callister, & Schwartz, 2003).

Clinicians must be mindful of interventions perceived by the mother as being unhelpful, discouraging, or ineffective (Ebersold, Murphy, Paterno, Sauvager, & Wright, 2007). Staff shortages and increasing demands on nurses can contribute to the inability of staff to provide the type of assistance and care that new mothers require. When mothers deem nurses to be too busy or rushed, they may feel disinclined to ask for the help they need (Hong et al., 2003). Mothers with low confidence levels are particularly vulnerable to insufficient and inadequate lactation care and services (Mantha, Davies, Moyer, & Crowe, 2008). Short postpartum hospital stays, inadequate staffing, and busy maternity units decrease contact between nurses and mothers, limiting teaching time and resulting in many mothers being discharged with unmet learning needs.

A study looking at the perceptions of 191 mothers who had initiated breastfeeding asked them to identify both the helpful advice they received and the information that they did not receive but wished they had (Leurer & Misskey, 2015). The results suggested that a number of the information gaps closely aligned with commonly cited reasons for abandoning breastfeeding—namely, perceived insufficient milk production, latching difficulties, and nipple discomfort. Information deficits mentioned by some mothers included:

- Lack of clarity regarding feeding length and frequency (how often and how long to feed infants in the early days, reading the infant's feeding cues, and reassurance that infants were receiving sufficient milk)
- Milk production issues (assessing adequacy of milk supply, ways to increase or decrease milk production, timing of lactogenesis II, managing engorgement)
- Ways to latch the infant effectively and different positions for feedings

- Milk expression (hand expression and pump use)
- Nipple discomfort (prevention and treatment of nipple pain)
- Prenatal discussion of the realities of breastfeeding (common challenges)

In the appendix to Chapter 4, Box 4-14 contains a checklist of what mothers need to know prior to hospital discharge and may help fill some of the gaps identified in maternal knowledge acquisition mentioned by these authors. Mothers value reassurance during their breastfeeding experience, but specifically state that what they really want is advice specific to their own infant and their own particular situation rather than general breastfeeding information (Miller et al., 2015). Individual analysis of a dyad's problem with adequate clinician's time for its resolution and written guidelines are most helpful for new mothers.

On busy maternity units, nurses can teach content that mothers and families are most in need of knowing (Ruchala, 2000), which may be different from or in addition to unit checklists. Some nurses find it helpful to teach mothers basic breastfeeding information and observe infant feeding with small groups of two or three mother–baby pairs to ensure that each mother has a core knowledge of breastfeeding and each infant has been assessed for successful milk transfer. Clinicians must also refrain from telling mothers what to do, and instead acknowledge the mothers' feelings and help them develop their own solutions. Karl, Beal, O'Hare, and Rissmiller (2006) described a compelling role for the nurse during the newborn period as an "attacher." Facilitating physical closeness and regular contact between mother and baby strengthens the attachment system between them, providing an oxytocin-rich environment that has a physiological and psychological positive effect on both of them.

Weddig, Baker, and Auld (2011) conducted a study to assess the variations in breastfeeding knowledge and practices of nurses on hospital maternity units. Substantial differences were noted between hospitals with the Baby-Friendly designation (bestowed by the Baby-Friendly Hospital Initiative, a program of the World Health Organization and UNICEF), as well as those working toward it, and those hospitals without such a designation or that were not working toward it. A glaring difference and barrier to evidence-based lactation care was the lack of breastfeeding policies seen in many of the hospitals. Descriptions of such practices as less than 5 minutes of skin-to-skin contact following delivery, random formula supplementation, frequent pacifier use, lack of support for rooming-in, little to no actual observation and assessment of latch and milk transfer, and measured times at the breast were reported. Nurses in non–Baby-Friendly hospitals stated that they did not have time to observe a feeding and relied on mothers' reports about the adequacy of feedings. Poor documentation resulted in relying on personal communication between nurses to track problems. Inconsistency and lack of continuity of care resulted when transitioning responsibility from one nurse to another. This study illustrated a significant disparity between nurses' intentions to support breastfeeding and their knowledge of how to do so. Lack of Baby-Friendly standards and education hampers a proper start to breastfeeding. These types of institutional barriers result in a precarious start to breastfeeding. In contrast, if staff nurses are provided with research-based knowledge regarding breastfeeding and the use of human milk, they can and will integrate breastfeeding care practices into their daily clinical routines (Spatz, Froh, Flynn-Roth, & Barton, 2015). Such knowledge translates into nurses who are empowered to help mothers successfully breastfeed, who advocate for the breastfeeding family, who are motivated to go beyond what is needed, and who share this knowledge with others in their community (Froh, Flynn-Roth, Barton, & Spatz, 2015).

It is especially important that mothers who anticipate or who are having difficulty with breastfeeding have access to a lactation consultant with the International Board Certified Lactation Consultant (IBCLC) credential. Castrucci, Hoover, Lim, and Maus (2006) showed a positive association between delivering an infant at a hospital using IBCLC-certified lactation consultants and breastfeeding at hospital discharge. The U.S. Lactation Consultant Association has determined that optimal IBCLC lactation consultant staffing is 1.3 full-time equivalent (FTE) per 1,000 deliveries each year in a Level I hospital, 1.6 FTE per 1,000 deliveries in a Level II hospital, and 1.9 FTE per 1,000 deliveries in a Level III hospital (U.S. Lactation Consultant Association, 2010; Mannel & Mannel, 2006).

POSITIONING OF THE MOTHER

When the mother is first learning to breastfeed, she needs to be positioned comfortably herself before putting the infant to breast. Typically, she may be in a sitting position on a bed, chair, or couch. She also may be reclining in a bed or lying on her side. Her back and arms can be supported with pillows when necessary so that her posture is relaxed. Some mothers appreciate a footstool when sitting in a chair, which tilts the mother's pelvis back, prevents her from feeling the need to lean forward, and elevates the infant so that the mother is not compelled to lean down or over her infant. Some mothers use commercial pillows designed to provide an inclined and/or firmer support surface than bed pillows, finding that they reduce back strain and facilitate an easier latch (Humenick, Hill, & Hart, 1998; see **Figure 5-1**). For other mothers, pillows simply get in the way.

A mother who experiences a cesarean birth may wish to breastfeed in a side-lying position, sitting upright with a pillow in her lap, or placing the infant to her side in a clutch or football hold (Frantz & Kalmen, 1979). A pillow under her knees or elevation of the knee gatch in a hospital bed may also be helpful. If an intrathecal or epidural catheter remains in place for continued pain relief after birth, care must

Figure 5-1 Commercial pillow for firm surface support.
Courtesy of Marsha Walker, RN, IBCLC.

be taken in positioning the mother and placing pillows behind her back such that the catheter is not dislodged. Mothers may have a number of areas of postpartum pain, including the perineum, back, cesarean incision site, intravenous (IV) line site, muscle aches and strains, or headache. Positioning options should also take these considerations into account so that pain is not exacerbated in these areas, the mother can be medicated if needed, and she is able to remain comfortable during the time it takes to feed the infant.

Assistance with positioning and latch is usually necessary during the early days of learning for both primiparous and multiparous mothers because each infant and each situation are different. Under normal circumstances, once the mother and baby have mastered the art of positioning and latch, positioning techniques and latch approaches become integrated into daily life, mothers and babies work out a mutually comfortable arrangement, and special or intricate positioning and latch techniques are no longer needed.

Hand Positions

Most mothers and many babies find it helpful if the breast is supported during the early learning period. There are two common ways to hold the breast, scissors and C-hold, with a number of variations also available for special situations. The way in which a mother is positioned and how she holds her breast can affect the angle at which the infant approaches the breast and can distort and firm the shape of both the breast and the areola (Minchin, 1998).

1. Scissors or V-hold. The breast is held by the index and middle fingers separated over the top and bottom of the areola. Some mothers and babies thrive with this hand position. Others find that although this is not "wrong," it has some potential drawbacks:
   - The fingers may exert enough pressure over milk ducts to partially obstruct the milk flow.
   - If the areola is large and/or the mother's hands are small, the fingers may cover parts of the areola that should be in the infant's mouth, causing an incorrect latch-on to only the nipple.
   - Too much pressure from one or the other finger could distort the nipple shape in the infant's mouth by tipping it up or down.
   - Pressure toward the chest wall from either or both fingers could exert enough traction on the nipple/areola to keep the infant from drawing sufficient tissue far enough into the mouth or pull the nipple out of the infant's mouth such that the infant applies vacuum to just the tip of the nipple.
2. C-hold. The breast is supported by four fingers underneath the breast and the thumb rests on top (**Figure 5-2**). This position helps keep the infant's jaw from having to support the weight of the breast. Women with large breasts may find that they cannot comfortably hold the breast in this manner and may benefit from folded towels or a rolled receiving blanket tucked under the

Figure 5-2 The C-hold.
Courtesy of Marsha Walker, RN, IBCLC.

Figure 5-3 The Dancer hand position. This position supports the baby's mouth while gently compressing the cheeks.
Photo courtesy of Childbirth Graphics, copyright 1984 Sarah Coulter Danner.

breast for support. The support from the C-hold often helps to firm a very soft breast, stabilizing it during the latch and controlling the angle of the nipple/areola as it is presented to the infant (Chute, 1992).

- U-hold or Dancer hand position. This is a C-hold rotated 90 degrees such that the thumb is placed on the lateral margin of the breast and the four fingers rest on the medial aspect of the breast or vice versa (**Figure 5-3**). This hand position is often recommended for preterm infants, infants with a weak suck, or infants with muscular or neurological problems that prevent them from executing normal jaw movements (Danner & Cerutti, 1984). The entire jaw is supported simultaneously with the breast. The thumb and index finger are in a position to be placed on both cheeks of the infant and can be gently pressed inward to cause contact between the buccal surfaces of the mouth and the nipple. This action fills the gap in a preterm infant's mouth between the buccal surface inside the mouth and the nipple, causing all parts of the infant's mouth to come in contact with the breast.
- A modified C-hold with an index finger slipped under the infant's chin provides support for jaw instability when an infant's mandible exhibits excessive jaw excursion to the point where contact is lost with the nipple. In this situation, smacking sounds may be heard, indicating that the infant's jaw movement is excessive. A finger that is moved slightly back from the chin can also be gently placed under where the base of the tongue attaches to provide external support for the tongue.
- There is a great variety of shapes, sizes, and tissue elasticity of breasts, as well as numerous variations in the anatomic structure and function of infants' mouths. Although most of these combinations eventually accommodate to each other, some mismatches require more attention to positioning and alterations of standard positioning and latch techniques (Escott, 1989). In particular, the breast can be shaped (**Figure 5-4**) and adjusted to present a better match to the long axis of the infant's mouth depending on how the infant is positioned (Wiessinger, 1998).

Figure 5-4 Shaping the breast.

- The breast can be shaped into a horizontal or vertical oval by the use of a U-hold or scissors hold modified to a more vertical position.
- Sometimes presenting "less" breast tissue (as with large or very soft breasts) for the latch results in more tissue being drawn into the infant's mouth.
- In very small infants, an elastic areola can be shaped with the index finger and thumb to present tissue in a manner more easily grasped by a tiny mouth.

POSITIONING OF THE INFANT

Poor positioning can compromise an infant's ability to feed effectively. Proper head, neck, and trunk alignment are important to smooth feeding performance (Shrago & Bocar, 1990). The head and neck are typically in neutral alignment, with the overall body position being one of slight flexion, including the hips (Wolf & Glass, 1992). There is a strong interaction between head and neck position and feeding function. Proper positioning during feeding affects respiratory mechanisms, oral motor control, swallowing, and the development of head and neck postural responses (Bosma, 1988). Blair, Cadwell, Turner-Maffei, and Brimdyr (2003) found that no one attribute of positioning (head flexion, body alignment, etc.) was more important than others in relation to the degree of nipple pain experienced by the mother. It appears that all attributes work together to achieve a position that is compatible for good milk transfer in each individual mother–baby pair.

Coca, Gamba, de Sousa e Silva, and Abrao (2009) found an increased proportion of mothers experienced nipple trauma when newborns were positioned with heads bent, chins placed away from the breast, and lips turned inward. Women whose infants were incorrectly positioned in this study were 1.94 times more at risk for developing nipple trauma compared with mothers whose infants were positioned correctly. Goyal, Banginwar, Ziyo, and Toweir (2011) described an increased association between poor positioning and cracked nipples, mastitis, and sore nipples. Kronborg and Vaeth (2009) found that ineffective positioning and latch contributed to early breastfeeding problems. Early problems were positively associated with later breastfeeding problems. Proper positioning is an important skill to be taught to new mothers but requires ongoing monitoring and assessment to prevent or remedy early problems with breastfeeding.

Four common positions for breastfeeding exist, with many variations available to suit special circumstances. A mother does not need to know all these positions but can be assisted to find which position or positions work best for her and her infant. Before her discharge from the hospital, the mother should be able to demonstrate at least one position in which she is comfortable and in which she can position the baby by herself on both sides or with minimal help.

1. Cradle hold. The infant is held completely facing the mother, typically on a slight angle with the head and shoulders a little higher than the hips (**Figure 5-5**). The infant lays on his or her side in direct contact with the mother's midriff. The infant's head rests on the upper forearm. The breast should not be pushed sideways to the infant. The infant is well supported by the mother's arm

Figure 5-5 The cradle position.

across his or her back, tucking the hips into flexion and molding or wrapping the infant's body around her waist. This positioning should place the infant's nose at about the level of the nipple and the lower lip and chin below the nipple. The infant's head and neck should be straightly aligned with the shoulders and hips. Some mothers find this position awkward at first, with the infant's head difficult to control and position and the breast difficult to embrace in a C-hold without disrupting the contact between the infant's mouth and the breast.

2. Cross-cradle hold. The infant is in the same position as in the cradle hold but is held with the mother's opposite arm (**Figure 5-6**). The neck and shoulders of the infant are supported with the mother's hand, her fingers rest back behind the ears, there is no pressure on the occipital region of the head, and the mother's forearm supports the infant's back. This gives the mother more control over positioning the infant's head and may be easier to learn at first. The breast is accessed by the mother's hand without having to be inserted between the infant and the breast

Figure 5-6 The cross-cradle hold.

tissue, and the nipple/areola is more visible to the mother. Some mothers start the feeding with the cross-cradle hold and, once the infant is positioned, change to the cradle hold. This position is frequently used as a learning position for a full-term infant or to position a small or preterm infant who tends to "roll" up when placed in a cradle hold.

3. Clutch or football hold. The infant is positioned on a pillow to the side of the mother turned slightly sideways or sitting partially upright (**Figure 5-7**). The mother's hand and wrist support the infant's back and shoulders, and her fingers rest behind the infant's ears. This position may be much easier for some mothers, giving them the most control over the infant's head and allowing the best visualization of the nipple/areola. Care should be taken that the weight of the breast is not placed on the infant's chest, that the infant is not placed so low that he or she pulls down on the nipple, or that the mother leans down over the infant. This position is also good for both the mother and the infant as they learn their respective breastfeeding skills. This position is also used for small or preterm infants.

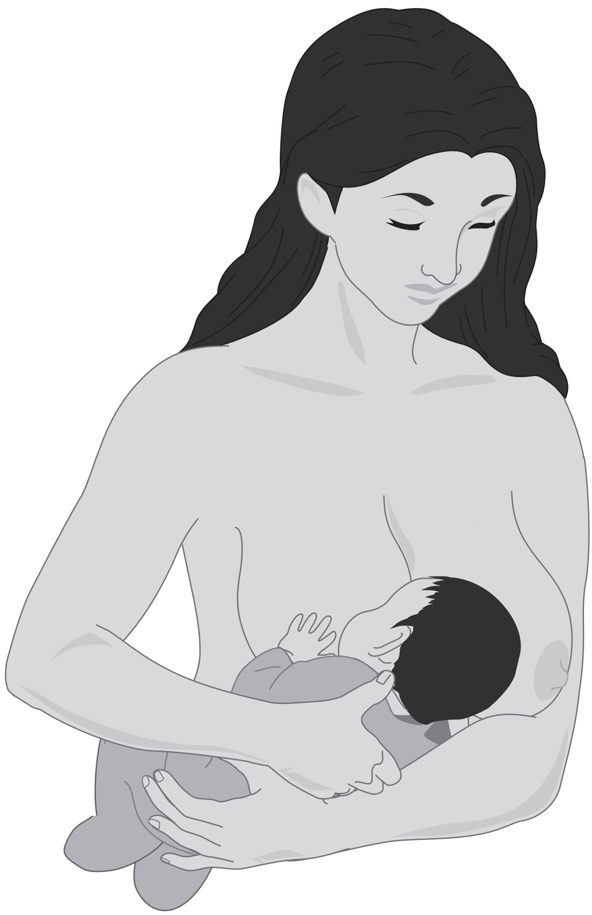


Figure 5-7 The football or clutch hold.

Figure 5-8 The side-lying position.

4. Lying down. Many mothers find this position an especially restful way to feed their infants, although some mothers may find it difficult to learn at first. The mother lies on her side with the infant's body on his or her side and completely facing and in contact with her (**Figure 5-8**). The infant's head may be resting on the bed or on the mother's forearm that supports the infant's back and hips. Some mothers place a rolled towel or blanket behind the infant to keep the infant on his or her side and place a pillow behind their own backs for support. Mothers can offer the top breast by adjusting their position such that they are turned further prone, thus avoiding having to move the infant and themselves to the other side.

Marmet and Shell (2008) described a number of therapeutic positions that function to compensate for sucking problems or for use in infants with anatomic variations, neurological deficits, respiratory issues, state control problems, young gestational age, or sensory integration variations:

- Infant and mother sitting. Useful in infants older than 6 weeks to help bring down an elevated tongue, for infants with a cleft palate, to help improve alertness in a sleepy infant, for velopharyngeal inadequacy, or repeated ear infections. The infant sits facing the mother's breast with legs straddled over the mother's leg.
- Mother supine and infant prone. The prone position is frequently used for positioning sick or preterm infants because it improves oxygenation and has been shown to increase sucking pressures when bottle-feeding (Mizuno, Inoue, & Takeuchi, 2000). With the mother supine and the infant prone, infants who need to bring their tongue forward, such as with tongue-tie or infants who have difficulty handling a fast flow of milk, may feed better.
- Mother semireclining and infant semiprone. This position may be helpful for infants with upper respiratory problems such as tracheomalacia or laryngomalacia (**Figure 5-9**). It is also helpful for infants with a receding chin or for a mother who has had a cesarean delivery. This position is also referred to within the biological nurturing concept.

Figure 5-9 Semireclining position of mother and semiprone position of infant.

Biological Nurturing

Biological nurturing is a concept that involves how certain feeding positions and behaviors are associated with the release of primitive neonatal reflexes necessary to establish successful breastfeeding (Colson, de Pooy, & Hawdon, 2003; Colson, Meek, & Hawdon, 2008). It is any mother–baby behavior at the breast where the infant is in close chest contact with the mother's body contours.

- For the infant, biological nurturing means:
  - Mouthing, licking, smelling, nuzzling, and nestling at the breast
  - Sleeping at the breast
  - Groping and rooting at the breast
  - Latching onto the breast
  - Sucking and swallowing breastmilk through active feeding
- For the mother, biological nurturing means:
  - Holding the infant in close contact with a maternal body contour
  - Offering unrestricted access to the breast with as much skin-to-skin contact as the mother desires

Extended holding in postures where the mother leans back and the infant lies prone in close frontal apposition with maternal body contours (ventral positioning) is thought to aid in the release of primitive neonatal reflex-like movements necessary for successful breastfeeding.

Primitive neonatal reflexes is a collective name given to more than 50 unconditioned reflex responses and spontaneous behaviors to environmental stimuli such as rooting, sucking, swallowing; head, cheek, tongue, and lip reflexes; hand-to-mouth; stepping; and crawling. A greater number of primitive neonatal reflexes and a reduction in feeding problems at the breast were observed when mothers were in full biological nurturing postures (Colson et al., 2008). Biological nurturing positions also work well for the late preterm infant. Colson and colleagues (2003) noticed that although infants appeared to be asleep in the biological nurturing position, they were often actively feeding with strong sucking and swallowing. Thus an infant may not need to be fully awake to engage in nutritive sucking and swallowing.

The maternal semireclined position with the infant in a prone position adhering to her body contours may also be an effective intervention for the infant who "fights" at the breast. Clinicians have seen infants who arch away from the breast, bob their heads, and engage in erratic and jerky movements at the breast, preventing latch-on. To counteract the effects of gravity on positioning, mothers are taught to hold their infants close, often using pressure or holds that suppress or limit the expression of the neonatal reflexes used in breastfeeding (Colson, 2010). Placing the mother and infant into a biological nurturing position may use gravity to assist in moving the infant's chin and tongue forward and stop the movements that are preventing the infant from latching on. This type of ventral positioning may allow the full expression of the complete array of newborn reflexes by reducing the negative effect of gravity. Biological nurturing during the first 72 hours may also trigger higher peak concentrations of oxytocin at an earlier time, helping to offset oxytocin aberrations caused by oxytocin infusion during labor epidurals.

In a study of 86 mother–infant dyads, the release of all the rhythmic reflexes, the gravity reflex, and the total number of primitive neonatal reflexes in the group of infants exposed to synthetic oxytocin during labor was significantly lower than that in the non-exposed group of infants (Gabriel et al., 2015). These effects may occur due to large doses of synthetic oxytocin adversely affecting the central nervous system of the infant, reducing the expression of the oxytocin receptor or causing its desensitization. A study of 47 full-term healthy infants showed that the group of infants exposed to synthetic oxytocin during labor was 11.5 times more likely to demonstrate low/medium prefeeding cues compared to the group of unexposed infants (Bell, White-Traut, & Rankin, 2013). Prefeeding cues are oral–motor neurobehaviors that communicate feeding readiness, and the ability to self-comfort and regulate behavioral state. The higher the dose of oxytocin infusion during labor epidurals, the lower the oxytocin levels in mothers during breastfeeding on day 2 (Jonas et al., 2009).

Assisted by their mothers, babies in biological nurturing positions utilize antigravity reflexes to locate the breast and latch without complicated trunk and head support. Biological nurturing research seemed to show that breastfeeding continues to be mediated by newborn reflexive behavior well after birth, that numerous types of positions may either support or hinder these reflexes, and that by inhibiting or overriding instinctive maternal behaviors, common breastfeeding instruction may be counterproductive (Romano & Goer, 2008).

Clinicians may find that this type of prone positioning of the infant with a semireclining mother is a good option when other positions are found to be problematic for individual mother–baby pairs. If the dyad is struggling with finding a comfortable pain-free position, changing to this type of positioning may remedy the problem.

Sudden unexpected postnatal collapse has been described in breastfed newborns both in the delivery suite and in the postpartum hospital room (Friedman, Adrouche-Amrani, & Holzman, 2015). While rare, this event has been linked to positions where the infant's nose is occluded by pendulous breast tissue, the infant is face down or prone on the mother's chest or breast, the mother is on a cell phone or not paying attention to the location of the infant's nose, the mother has fallen asleep, or the infant's neck is in deep flexion. It is important that clinicians and mothers are aware of the head positioning of the infant both while breastfeeding and during maternal holding. During skin-to-skin holding, the infant's head should be turned to the side with the nares clearly visible and the head slightly extended.

LATCH

Latch has been described as possibly the single most important moment and movement in breastfeeding (Brandt, Andrews, & Kvale 1998). McAllister, Bradshaw, and Ross-Adjie (2009) demonstrated that 2 variables of hospital care were significantly associated with the duration of breastfeeding in their sample of 266 mothers—formula supplementation (negative) and the ability of the mother to be able to independently latch the baby to the breast upon discharge (positive). Teaching in the hospital should assure that the mother can successfully latch the infant to the breast, a skill that should be monitored and documented during the hospital stay. Once the infant is positioned correctly, the infant's lips can be brushed gently against the areola if his or her mouth is not already opening in anticipation. When it is opened like a yawn, the infant's mouth is moved to the breast, with the chin and lower lip making contact first, followed by the upper lip and tip of the nose. The infant's mouth must open wide, ranging up to approximately 160 degrees. Only the lower jaw can move to achieve this type of opening, so the infant's head must tilt back far enough to accommodate the dropping of the jaw (Cadwell, 2007). Some mothers and infants find an easier latch when the mother shapes the breast to offer the areola under the nipple as the first contact point, making that area more accessible. The lower lip and chin can be planted well down on the areola with the infant's mouth rolled the rest of the way on as the upper lip makes contact just above the nipple. An infant who is crying or who has an elevated tongue tip will need to be calmed, and the tongue can be stroked down and forward before latching.

In an effort to aid or hasten latch-on, some mothers, helpers, or healthcare providers push on the back of the infant's head as the infant is brought to the breast. Pushing on the occiput may cause the infant to compensate by extending the head, biting the nipple, or detaching from the breast. Increasing neck flexion causes the airway to become more prone to collapse, interfering with breathing. Anatomic structures change their relative positions when pressure is exerted on the occiput. The hyoid bone should move up and forward, which happens with slight extension of the head to facilitate swallowing. Excessive flexion with distortion of the cervical vertebrae can impinge on the proper movement of the hyoid bone, which has six other connections involved in sucking, swallowing, and breathing. Forcing the infant's head onto the breast may disturb placement of the tongue, encouraging it to elevate rather than cupping and moving down and forward (Widström & Thringstrom-Paulsson, 1993). Too much flexion of the neck, nose-first attachment to the breast, and continued pressure on the occiput create a scenario for nipple pain and poor milk transfer.

Blair and colleagues (2003) looked at positioning and latching behaviors of infants whose mothers reported varying degrees of nipple pain. Several factors of the latch and positioning of the infant combined to contribute to the soreness experienced by the mothers in the study, including the observations that only 18% of 92 infants had the optimal angle of mouth opening of 160 degrees (**Figure 5-10**), just 36.6% had both their nose and chin on or in close proximity to the breast, and merely 34.4% had their nose opposite the mother's nipple at latch. Poor attachment to the breast that leaves the nipple in the anterior portion of the mouth can contribute to sore nipples as well as obstructed milk flow (Morton, 1992), resulting in weight loss, hyperbilirubinemia, and low milk supply.

A deep latch or attachment to the breast is important to ensure uniform drainage of all the mammary lobes. Mizuno and colleagues (2008) found on examination of milk from three milk ducts in each breast that each duct contained milk with differing compositions. They measured the degree of emptying in three milk ducts from each breast of 37 breastfeeding mothers. Findings confirmed that the changes

Figure 5-10 Optimal angle of mouth opening.

in the degree of emptying of each mammary lobe differed by the depth of attachment of the infant at the breast as measured by the creamatocrit of milk obtained before and after breastfeeding. A deep attachment was defined as the nipple and approximately 0.7–1.3 cm of the areola in the infant's mouth and the angle of the open mouth greater than 130 degrees. If the depth of attachment was shallow, milk was excreted unevenly from different mammary lobes.

Milk retention in a lobe can predispose a breast to plugged ducts and mastitis. If the depth of attachment is deep, the lobes drain uniformly, leaving a reduced risk of plugged ducts and mastitis. If a lobe is poorly drained over an extended period of time, less milk will be made in that lobe, reducing the amount of milk that the breast produces. Thus, achieving a deep latch is important in preventing breast problems and milk supply issues.

Problems with Latch

A number of indicators of poor positioning or latch should be checked before hospital discharge, if the mother reports nipple pain or damage, if there is a low milk supply, or if weight gain problems arise. A mother and infant who are experiencing difficulties with latch should be checked for the following:

- Body position of the infant
  - Misalignment of the head, trunk, and hips
  - Infant not tucked close and facing the mother, hips extended or back arched, neck flexed, or nose buried in the breast tissue
  - Head too high over the breast
  - Nose or chin not touching the breast
- Mouth and tongue
  - Angle of the infant's mouth opening less than 160 degrees (**Figure 5-11**)
  - Upper (tight labial frenulum) or lower lip not flanged

Figure 5-11 Mouth angle less than 160 degrees.

Figure 5-12 Flat tongue.

- Tongue not down, cupped, and forward
  - Humped (anterior to posterior direction)
  - Bunched (compressed in a lateral direction)
  - Retracted (tip behind alveolar ridges)
  - Elevated
  - Flat (**Figure 5-12**)
  - Short or tight lingual or labial frenulum
  - Large tongue, protruding tongue, short tongue
- Palate
  - High or arched
  - Bubble
  - Cleft (hard, soft)
- Cheeks
  - Drawn in, dimpled, or hollowed with each suck
  - Cheek line not a smooth arc (**Figure 5-13**)
- Jaw
  - Retrognathia or receding jaw (**Figure 5-14**; can position the tongue posteriorly where it leads to obstruction of the airway; can contribute to sore nipples unless chin is brought very close to the breast)
  - Large jaw excursions (cannot close over the areola)
  - Small jaw excursions (cannot open over the areola)
  - Lack of graded jaw excursions heard as clicking or smacking sounds
  - Jaw asymmetry or tilted jaws (may include torticollis; Wall & Glass, 2006)
- Lips
  - Poor occlusion of lips around the areola (milk leaking from the sides of the mouth)
  - Lips do not form a seal, preventing the creation of a pressure gradient between breast and mouth

Figure 5-13 Cheek line not in a smooth arc.

Figure 5-14 Receding jaw.

- Nipple
  - Slides back and forth within the infant's mouth during the feeding
  - Pops in and out of mouth (may indicate tongue-tie)
  - Creased in a horizontal, vertical, or oblique plane
  - Distorted shape or flattened
  - Blanched or in spasm after the infant releases the nipple
  - Pain, blisters, maceration, fissures, cracks, bleeding, craters
  - Flat, dimpled, retracted
  - Edematous areola that envelops the nipple
  - Engorged breast that flattens the nipple
- Rhythmicity or coordination of suck–swallow–breathe
  - Diminished suck-to-swallow ratio less than 1–3:1
  - High respiratory rate, stridor
  - Coughing or choking

Other situations may occur that cause problems with latch. These are described in the sections that follow.

State and Feeding Readiness

Many breastfeeding recommendations from the past and, to some extent, those used currently tend to lead to insufficient breastmilk and a hungry infant. Feeding schedules that are determined by the clock rather than infant feeding readiness cues can result in an over-hungry crying infant (Millard, 1990), or one who remains underfed because scheduled feeds coincide with deep sleep states. An infant in a deep sleep state cannot feed, nor can a vigorously crying infant organize his or her behavior to latch and feed effectively. Infants can breastfeed in the other four states: light sleep, drowsy, quiet alert, and active alert. Infants feed best in a quiet alert state but should be put to breast whenever feeding cues are demonstrated. The quiet alert state may be difficult for some newborns to achieve and may require organizational maturation before they develop competency in alerting themselves to feed from a sleeping state. Other infants may experience state control problems as a result of maternal labor medications, becoming more competent at state control as the drugs clear their body and the effects of the medications diminish.

Some newborns require help in achieving a state that is optimal for latch, whereas other infants demonstrate state organization and sucking competency with a minimum of effort on the part of the mother. The ability of infants to suck appropriately, demonstrate alertness and stamina, and possess the ability to self-regulate and respond to maternal soothing behaviors are major influences on the initial pattern and the ultimate duration of breastfeeding (Lothian, 1995). Sucking behavior in the early neonatal period affects the breastfeeding duration at 3 and 6 months. Vigorously feeding infants are much more likely to be fully breastfed and to breastfeed longer than infants described by their mothers as "procrastinators," who are at a higher risk for short-term breastfeeding (Mizuno, Fujimaki, & Sawada, 2004). Karl (2004) used an arousal model (Als, 1995) to describe behavioral breastfeeding difficulties on a continuum, with the quiet alert state as a neutral arousal reference and newborns unable to manage their state well enough to latch being viewed as either under-aroused (the sleepy infant) or over-aroused (the fussy or reluctant nurser).

Infants experiencing state overload appear to be sleeping but may be shut down or closed down in an attempt to block out negative stimuli that have raised their arousal levels beyond that which they can manage. A shut-down infant may appear to be asleep, and parents may have difficulty differentiating between these two states (**Table 5-1**). Increasing stimulation to an infant who is shut down further exacerbates the problem. Parents need to become knowledgeable regarding infant states and how best to assist their infant in achieving a latchable state. One of the most effective interventions for modulating infant arousal levels in over-aroused, under-aroused, and shut-down infants is the use of a combination of vestibular (upright rocking) and skin-to-skin tactile stimulation that affect state organization itself (Anderson, 1991). In an effort to encourage infant self-regulation and to positively modulate infant state, skin-to-skin care can be initiated directly after birth, which is the normal mammalian postnatal condition (Ferber & Makhoul, 2004).

Previous or Concurrent Use of Artificial Nipples and Pacifiers

Milk transfer from the breast to the infant is contingent upon the smooth functioning of a group of interrelated behaviors, intact anatomic structures, and coordinated physiological actions. Some infants have been observed to have difficulty in latching and sucking from the breast if artificial nipples and/or

Table 5-1 Differentiation Between Sleeping Infants and Over-Aroused, Shut-Down Infants

Sleeping Infant Descriptors	Shut-Down Infant Descriptors
Relaxed muscle tone	Tense muscle tone (not relaxed)
Peaceful facial expression	May reflect internal tension with furrowed eyebrows
Normal skin color	Color flushed or pale
Eyelids fluttering in light sleep	Eyes held tightly closed

Data from Karl, D. J. (2004). Using principles of newborn behavioral state organization to facilitate breastfeeding. *MCN: The American Journal of Maternal/Child Nursing, 29,* 292–298.

pacifiers have been introduced before breastfeeding is well established (Neifert, Lawrence, & Seacat, 1995). Popularly known as "nipple confusion," this phenomenon has several definitions:

- Type A: A neonate's difficulty in establishing the necessary oral configuration, latching technique, and sucking pattern to extract milk from the breast after exposure to an artificial teat. Type B: Older infants who have already established breastfeeding but begin to refuse the breast or prefer the bottle (Neifert, Lawrence, & Seacat, 1995).
- The infant's response to the various mechanical and flow characteristics of an artificial nipple compared with the breast, which causes the infant to prefer one feeding mechanism over the other (Dowling & Thanattherakul, 2001).
- The infant's difficulty with or preference for one feeding mechanism over another after exposure to artificial nipples (Zimmerman & Thompson, 2015).

Zimmerman and Thompson (2015) reviewed 14 articles supporting and refuting the concept of nipple confusion. This review of the literature found evidence that supported the concept of nipple confusion when breastfed infants were offered the artificial nipples on feeding bottles, but did not support the contention that pacifier use caused nipple confusion.

Nipple confusion may result from a combination of infant factors and equipment factors (Ross & Fuhrman, 2015). The shape and size of artificial nipples vary, with shorter nipples sitting farther forward in the oral cavity and longer nipples positioned farther back in the oral cavity, Because compressive forces of the tongue originate in the back or posterior portion of the tongue (Eishima, 1991), shorter artificial nipples may alter tongue movements such that when breastfeeding is attempted following the use of a short nipple, tongue mechanics may place compression incorrectly on the maternal nipple–areolar complex. The width of the artificial nipple at its base near the collar changes the angle of the infant's chin during feeding, which may alter the amount of vacuum the infant generates (Segami, Mizuno, Taki, & Itabashi, 2013). If replicated at the breast, this altered vacuum application may affect the infant's ability to generate enough vacuum to transfer milk. The shape of the artificial nipple has a direct effect on how the infant's oral structures engage in the sucking process, with a wider nipple base engaging the masseter muscles more, as in feeding at the breast (Gomes, Da Costa Gois, Oliveira, Thomson, & Cardoso, 2013). Healthy full-term infants may or may not be able to alter their sucking rate, pressure, and mouth configuration to regulate milk flow from an artificial nipple. Preterm infants, late preterm infants, infants challenged during the birth process, and medically fragile infants may not be resilient feeders and may demonstrate a limited ability to self-regulate milk flow from an artificial nipple or configure and adapt their oral structures to multiple feeding modalities.

Pacifier use is associated with a reduced length of breastfeeding (DiGirolamo, Grummer-Strawn, & Fein, 2008). This may be due to interference with proper sucking or may be an indicator of breastfeeding problems where a pacifier is used to soothe an infant who is not adequately transferring milk. In a study involving 670 mothers, 79% of the infants were given a pacifier, most commonly to soothe the infant or help put the baby to sleep. However, some mothers used a pacifier to stretch the length of time between breastfeedings, to help take the infant off the breast following a feeding, and to reduce non-nutritive sucking at the breast. The study reported that infants given a pacifier prior to 4 weeks of age and those using pacifiers on most days had a 3-fold risk of shorter breastfeeding duration (Mauch, Scott, Magarey, & Daniels, 2012).

Pacifier shape, length, and material, just as with other artificial nipples, can have an impact on the mechanics of sucking (Nowak, Smith, & Erenberg, 1995). Characteristics of the nipple can impact tongue and lip position as well as their movements during sucking. Orthodontic-shaped nipples may interfere with the central grooving of the tongue, whereas pacifiers with a ball-shaped tip may result in reduced functional sucking activity (Wolf & Glass, 1992). Levrini, Merlo, and Paracchini (2007) evaluated the distribution of stress on the palate using three different types of pacifiers, showing that pacifiers with different geometrical shapes caused a different stress distribution on the palate. Orthodontic-shaped pacifiers distributed the stress on the palate during sucking over a wider area than pacifiers that were narrow or that had a bulblike tip. The latter two types of pacifiers concentrate stress on the central part of the palate that could lead to a narrowing of the palatal arch. Not only could sucking be affected, but the eventual position of the child's dentition and speech may also be involved.

The concept of human imprinting has been advanced to help explain the observation of nipple preference. Mobbs (1989) discusses imprinting as an aspect of learning that takes place early in life. It is known that nonhuman mammals imprint or demonstrate a one-nipple preference; for example, the piglet and kitten establish their preferred teat and drive away others who would use it. Displacing sucking from the breast to an artificial nipple could change the imprint and memory within the oral cavity, causing oral tactile recognition to be decoyed to an artificial nipple (Mobbs, Mobbs, & Mobbs, 2015).

The human infant is thought to be programmed to seek and attach to a suitable object on which to imprint using its most powerful sense organs at birth—the nose and mouth. Olfaction is one of the guides to the nipple directly after birth (Varendi & Porter, 2001). Within minutes of birth, maternal breast odors elicit preferential head orientation of the infant, contributing to successful nipple localization. The chemical profile of breast secretions overlaps somewhat with that of amniotic fluid. Lactating women emit odor cues that release activity in newborns. Such cues may be carried in various substrates, including milk or areolar secretions.

A study by Doucet, Soussignan, Sagot, and Schaal (2007) examined the responses of infants facing their mothers' breasts with the goal of sorting out the source(s) of active volatile compounds emitted by the lactating breast. Infants (aged 3–4 days) were presented their mother's breast in 2 consecutive trials of 90 seconds each: a scentless condition (breast entirely covered with a transparent film) paired with 1 of 4 odorous conditions (fully exposed breast, $n = 15$; nipple only exposed, $n = 15$; areola only exposed, $n = 13$; and milk exposed, $n = 12$). The infants were more orally activated when facing any of the odorous breast conditions than when facing the scentless breast. They cried earlier and longer and opened their eyes less when facing the scentless breast. Nipple, areola, and milk odors appeared to be equivalent to the whole breast odor in stimulating oral activity and in delaying crying onset. This study showed that volatile compounds originating in areolar secretions or milk release mouthing, stimulate eye opening, and delay and reduce crying in newborns.

The early attraction to the breast may also be a reflection of prenatal exposure and the recognition of a familiar scent (Mizuno & Ueda, 2004; Porter & Winberg, 1999). Infants are able to discriminate between their mother's scent on a breast pad and that of an unfamiliar woman (Macfarlane, 1975). Olfactory breast-associated cues are so important that both 3- to 4-day-old breastfeeding and bottle-feeding infants orient toward a pad worn on a breast rather than an unused or clean pad (Makin & Porter, 1989). Preferences to mother's milk odor lasts as long as 2 weeks, with 14-day-old bottle-fed infants responding preferentially to a breast pad from an unfamiliar lactating woman rather than a pad treated with their own familiar formula (Porter, Makin, Davis, & Christensen, 1991). Washing the breast or separating the infant from the mother before the infant becomes oriented to the biologically relevant chemical signal from the breast could be one precursor that inhibits correct latch (Varendi, Porter, & Winberg, 1994). For this reason the use of scented pacifiers should be avoided in breastfed infants. One of the first ways an infant recognizes his or her mother is through the distinctive features of her nipple. As with birds, who are known to be preferentially selective to supernormal size stimuli, a human infant may experience a mishap in attaching to the mother's nipple by fixating on an artificial nipple whose large, rigid features predominate when there is a choice between sizes (Mobbs, 1989).

Zanardo and Straface (2015) reported that in 70 mothers, the mean temperature of the areolar skin was significantly higher than the temperature of the adjacent breast tissue. This warmth was thought to act as a thermal signal to help guide the newborn directly to the nipple. The elevated temperature of the areola is also thought to favor or act as an odor fixative on the surface of the areola to enhance the olfactory stimulatory effect on the infant. This thermal feature of the areola can be triggered by infant crying, with optimal odor release occurring in anticipation of the infant arriving at the nipple.

Tongue placement and the sequential movements of the tongue are crucial to the infant latching to the breast, drawing the nipple/areola into the mouth by forming a teat, and covering the lower gum to prevent nipple damage. The extrusion reflex has been defined as the forward movement of the cupped tongue over the lower gum so as to grasp the breast at the start of the formation of a teat (Stephens & Kotowski, 1994). With an artificial nipple, the teat is already formed and is inserted into a fully or partially closed mouth. This can lead to the extrusion reflex being diminished or extinguished from lack of use. If the extrusion reflex does not occur in the latch sequence of events at the breast, a teat cannot be formed. Consequently, the infant will apply the gums to the breast first rather than the tongue, resulting in nipple pain and poor milk transfer. One of the prime motoric differences between sucking on an artificial nipple and sucking at the breast may be in the initiation of sucking (Wolf & Glass, 1992).

The muscles involved with breastfeeding are also affected by the use of artificial nipples. Masseter muscle activity is significantly weakened by the use of artificial nipples (Gomes, Thomson, & Cardoso, 2009). Weakening the muscles involved with breastfeeding by the use of artificial nipples may make effective milk transfer at the breast more difficult. Muscles involved with breastfeeding are either immobilized (masseter, orbicularis oris), overactive (chin muscle), or malpositioned (tongue is pushed backward) during artificial nipple use (Inoue, Sakashita, & Kamegai, 1995).

Gestational Age

Developmental maturity and feeding behaviors may vary depending on the gestational age of the infant, postnatal age of the infant (days since birth), and any growth rate abnormalities. Sucking patterns vary, change, and mature along a continuum of gestational age, postnatal age, and health status.

In measurements taken on an artificial nipple, preterm infants compared with full-term infants generally demonstrated lower sucking pressures, less fluid consumption per suck, fewer sucks per feeding, and an inability to maintain the suction for long periods of time (Medoff-Cooper, Weininger, & Zukowsky, 1989). As gestational age increases, feeding behavioral organization improves, with more reliable maximum sucking pressures starting an upward trend at 34 weeks (Medoff-Cooper, 1991). Preterm breastfed infants who are encouraged to feed at breast can catch up and exhibit similar milk consumption to those born after a longer gestation (Nyqvist, 2001). Infants of lower gestational ages often lack the strength and endurance to engage in a correct latch and sustain it. Gestational age and birth weight classifications (Hankins, Clark, & Munn, 2006) and their effects on breastfeeding typically include the following categories:

- Preterm: less than 34 weeks. Latch may be complicated by poor initiation of sucking with excessive rooting, inability to close the mouth/wide jaw excursions, lapping at the nipple, oral defensiveness, elevated tongue tip, oral/facial hypotonia, a closed mouth, weak suck (suboptimal or immature sucking pressure), and jaw instability. If the infant cannot form a teat and draw it into his or her mouth, the infant's gums may contact the breast at the base of the nipple rather than farther back on the areola, interfering with efficient milk removal (Meier et al., 2000).
- Late preterm: 34 0/7 to 36 6/7 weeks. Latch may be complicated by respiratory instability in some breastfeeding positions, little energy reserve or stamina, immature state regulation, sleepiness, low tone, depressed sucking vacuum, or uncoordinated sucking (Wight, 2003).
- Early term: 37 0/7 to 38 6/7 weeks. Latch may be compromised by the increased risk from severe respiratory distress syndrome.
- Term: 39 0/7 to 41 6/7 weeks. Latch may be compromised by maternal labor medications, an overstimulating environment, high ambient temperature (Elder, 1970), or artificial nipple use.
- Postterm: 42 weeks or more. The infant may be lethargic; may have trouble sustaining sucking; may have experienced hypoxia (with depressed suck), birth injury, or trauma; and is prone to hypoglycemia.
- Macrosomia or large for gestational age (LGA): 4,000 g or more (8 lb, 14 oz). The infant may have experienced birth trauma and may be susceptible to hypoglycemia.
- Normal birth weight: 2,500–3,999 g (5 lb, 9 oz to 8 lb, 13 oz).
- Low-birth-weight: less than 2,500 g (< 5 lb, 9 oz).
- Very low-birth-weight: less than 1,500 g (< 3 lb, 5 oz).
- Small for gestational age (SGA): can occur in term, near-term, and preterm infants; mostly defined as two standard deviations below the mean for gestational age or as below the 10th percentile; sometimes referred to as intrauterine growth retardation. One may see poorer reflex performance with rooting and sucking, poor tone, difficulty coming to an alert state, stress when handled, and an easily fatigued infant (Als, Tronick, Adamson, & Brazelton, 1976).

Birth Trauma, Medications, Conditions, and Events

Events or conditions experienced during birth, such as hypoxia, brachial plexus injuries, fractured clavicle, vacuum extraction, facial muscle trauma, or deep or aggressive suctioning, can impinge on achieving a correct latch. Congenital conditions not discovered prenatally may first become apparent when an infant experiences feeding difficulties. Epidural analgesia (0.25% bupivacaine) is associated with insufficient milk and early formula supplementation, because infants may have difficulty in executing correct and effective suckling that results in diminishing maternal milk production (Volmanen, Valanne, & Alahuhta, 2004).

Fernandez and colleagues (2012) demonstrated a negative relationship between the amount of intrapartum oxytocin received by laboring mothers and difficulties seen with latch and sucking.

Newborns whose mothers received higher doses of oxytocin experienced the blunting of several primitive neonatal reflexes related to breastfeeding (sucking, jaw jerk, swallowing, and gazing). The inhibitory effect on sucking was observed 24 to 48 hours after birth and oxytocin has a known effect on the regulation of ingestive behaviors. Mothers who received higher doses of intrapartum oxytocin were also unlikely to be exclusively breastfeeding at 3 months. Bai, Wu, and Tarrant (2013) found an association between intrapartum interventions and breastfeeding duration. Mothers who experienced at least three intrapartum interventions (such as induction of labor, opioid medication, and emergency cesarean) demonstrated a median duration of 1 month less than mothers with no intrapartum interventions.

Widström and colleagues (1987) observed that organized breastfeeding behaviors in full-term infants develop in a predictable way during the first hours of life. These behaviors are initially expressed as spontaneous sucking (low at 15 minutes after birth, maximal at 45 minutes postdelivery, and absent by 2–2½ hours after birth when asleep) and rooting movements (low at 15 minutes and maximal at 60 minutes after birth) when placed on the mother's chest immediately at birth. They progress to hand-to-mouth movements (observed at a mean time of 34 $\pm$ 2 minutes), more intense rooting and sucking activity, and breast-seeking behaviors, and they culminate in attachment to the breast. Unmedicated infants found the breast unassisted and started vigorous suckling at 55 $\pm$ 4 minutes after delivery.

In order to provide a more detailed analysis of the behavioral sequence a newborn infant engages in to locate and latch to the nipple, Widström, Lilja, Aaltomaa-Michalias, Dahllòf, Lintula, and Nissen (2011) delineated 9 distinct stages of infant behavior during uninterrupted skin-to-skin care in the first hour following birth. These stages include:

1. Birth cry: follows birth and facilitates lung expansion and aeration
2. Relaxation phase: no movements of the infant for a few minutes, possibly from high oxytocin levels, which may contribute to slight sedation
3. Awakening: small movements of the head and shoulders
4. Activity: mouthing and sucking movements are seen and the rooting reflex becomes more apparent
5. Rest: rest phases may be seen between periods of activity
6. Crawling: crawling movements began in search of the nipple/areola
7. Familiarization: touching and licking the areola with massaging-like motions of the hand begins an acquaintance with the food source
8. Suckling: the infant attaches to the breast and begins to suckle; infants whose mothers have received labor medications may take longer for this to happen
9. Sleep: about 1H to 2 hours following birth, infants generally fall into a restful sleep

Facilitating skin-to-skin contact, not only immediately after delivery but for up to 3 hours following birth, increases the likelihood that infants will leave the hospital exclusively breastfed (Bramson et al., 2010; Crenshaw et al., 2012).

Although newborn human infants and other mammals both crawl to the breast soon after birth to feed, this "instinctive" behavior is easily disturbed. Separation of the infant from the mother before the first attachment to the breast has occurred can disrupt subsequent correct latch to the breast (Righard & Alade, 1990). Infants separated from their mothers before they have suckled from the breast may have more difficulty in latching and exhibit an incorrect latch and suck at the subsequent feeding.

Combinations of these factors may cause difficulties in latching and staying attached to the breast. Babies whose mothers have been heavily medicated during labor may need more time to travel through the 9 stages of skin-to-skin contact, with bathing and wrapping being delayed.

A young infant who is reluctant to feed at breast may be unable to do so because of residual conditions still present from the delivery. The normal overlap or overriding of the cranial bone plates generally self-corrects within a couple of days after birth. Traction on the head during either a vaginal or a cesarean delivery, and the possible resulting hyperextension of the neck, may displace the occipital bone forward, potentially compromising the jugular foramen and/or the foramen magnum (Smith, 2004). The jugular foramina provide passage out of the skull for three nerves:

1. The glossopharyngeal (IX) cranial nerve works with the vagus nerve to help control swallowing and airway function along with function of the tongue. It also works with the hypoglossal (XII) nerve to control the tongue. The hypoglossal nerve exits the skull through the hypoglossal canals located beside and beneath the joint surfaces of the occiput.
2. The vagus (X) nerve also helps maintain a normal heart rate.
3. The spinal accessory (XI) nerve innervates major neck muscles such as the sternocleidomastoid and a portion of the trapezius.

Pressure on these nerves is thought to contribute to some feeding problems. Abnormal presentations such as face, mentum (chin), arm, footling breech, or breech may also set the stage for compressive forces on nerves that are responsible for normal feeding activities.

An infant whose head is misshapen (one side of the head higher than the other) or whose bones are out of alignment may signal the need for closer inspection of the infant's feeding capacity. Fascia or connective tissue surrounds, supports, and connects one type of tissue to another and affects the normal range of motion for structures. Observations of infants and their limiting movements have led to a number of forms of bodywork for infants to correct these limitations. Craniosacral therapy (CST) is a gentle form of massage that focuses on the bones, connective tissues, and fluid that surround the brain and spinal cord to relieve constrictions that may be impinging on the functioning of these structures (Upledger, 2003a, 2003b). About 5 g of pressure is used to evaluate and correct mobility restrictions or misalignments along the cranial sutures (Brussel, 2001). Practitioners of CST may be chiropractors, massage therapists, physical therapists, physicians, dentists, or allied healthcare providers who have taken courses in CST.

Chiropractic treatment has also been described as an intervention to remediate cervical spine dysfunction due to birth or birth trauma. Such dysfunction may impede normal motion and function of the infant anatomy necessary for proper latch and sucking. Chiropractic treatment is designed to correct restrictions of motion in joints and stimulate optimal nervous system function. Coordination between the perioral muscles and the temporomandibular joint (TMJ) is important for optimal sucking. Restriction of motion in the TMJ or hypertonicity of the muscles that control this joint can interfere with the infant's ability to latch or create a vacuum. Chiropractic care has been used to improve restrictions in TMJ mobility and facilitate optimal latch and sucking (Holleman, Chiro, Nee, & Knaap, 2011).

Myofascial release is another therapy intended to produce and improve changes in tissue mobility. Most evidence on the usefulness or outcomes of CST is anecdotal or consists of case studies (Hewitt, 1999; Turney, 2002). Holtrop (2000) described resolution by cranial adjusting of sucking dysfunction in a

6-month-old infant with an inward dishing at the occipitoparietal junction and upper cervical (C1–C2) asymmetry and fixation. Although the available health outcome research consists mainly of low-grade evidence (Green, Martin, Bassett, & Kazanjian, 1999), Vallone (2004) suggested that biomechanical dysfunction based on articular or muscular integrity may influence the ability of an infant to suckle successfully and that intervention via soft tissue work, cranial therapy, and spinal adjustments may have a direct result in improving the infant's ability to suckle efficiently. Wescott (2004) believed that cranial osteopathy is a useful treatment when dealing with instances of breastfeeding problems resulting from birth trauma. If parents are interested in these forms of therapy, the practitioners of these treatment modalities should be qualified to provide them safely.

Some infants experience troublesome breastfeeding due to a nervous system that does not respond appropriately to sensory stimuli. Sensory-processing difficulties were first described in the 1960s by A. Jean Ayers, who was working with neurologically involved children (Ayers, 1977). Sensory integration has evolved over time and is now defined as the ability of the nervous system to accept sensory information, process it, and respond with motor and behavioral responses that are appropriate to the context (Weiss-Salinas & Williams, 2001). The nervous system is designed to modulate environmental stimuli and provide graded responses. However, with sensory-processing difficulties, there may be poor coordination, sensory defensiveness (extreme reactions to ordinary sensations), or sensory-modulation difficulties (extremes in activity, emotional levels, and arousal levels) (Reisman, 2002). An infant can be hypersensitive to some stimuli and hyposensitive to others (Genna, 2001). Indications of sensory-integration disturbance may first be manifested in the newborn as feeding difficulties and should be followed and remedied (**Box 5-1**). Infants with poor tactile processing who fail to root, attach to the breast, or ignore the breast may benefit from use of a nipple shield. The shield may present a stronger tactile signal to such an infant, helping to trigger rooting and mouth opening (Genna, 2013).

Some infants may simply become overwhelmed by multiple people handling them, loud noise, bright lights, radio, television, and ringing telephones. As a result, they may basically shut down until the environment becomes quieter.

Box 5-1 Possible Indicators of Sensory-Integration Difficulties

Hyperactive gag reflex
Shallow latch (breast not drawn deeply into mouth)
Low oral muscle tone
Poor sucking rhythmicity
Excessive jaw compression
Malpositioning of the tongue
Unusual posturing
Avoidance of certain positions (arching of the back)
Increased tone, withdrawal responses from the breast
Latch refusal, tonic bite
Passive at breast
Mother's belief that the infant does not like to breastfeed or does not like her

Oral aversion or oral–tactile hypersensitivity may be another manifestation of sensory integration difficulties but can often have iatrogenic origins. These conditions and the ensuing aversive responses can be caused by prematurity, immaturity, illness, delayed oral feeding, and unpleasant oral–tactile experiences (Wolf & Glass, 1992). The possibility of oral aversion resulting in maladaptive imprinting, faulty sucking techniques, and dysphagia (difficulty in swallowing) should be taken into account when an infant is reluctant to breastfeed (Healow & Hugh, 2000). Suctioning, intubation, and gavage feeding are all invasive to the oral cavity. Petechiae and bruises on the posterior palates of infants who were suctioned with a standard bulb syringe after a vaginal delivery have been reported (Black, 1993). Conditioned dysphagia from aggressive suctioning and procedures can be acquired and learned when a negative stimulus is associated with swallowing (Di Scipio, Kaslon, & Ruben, 1978). Other intrusions into a newborn's mouth that may contribute to oral-aversive behaviors include gastric lavage, use of artificial nipples or pacifiers, digital assessment of the mouth, finger feeding, use of latex gloves or finger cots, unpleasant-tasting fluids, and repeated suctioning with a bulb syringe.

Latch difficulties may be an early marker of a congenital condition previously called benign congenital hypotonia. Although not identifying a disease, this general descriptive term refers to an infant with low muscle tone at birth and a generalized floppiness. Diagnostic advances have been able to identify specific neurological disorders and myopathies such as central core disease, congenital muscular dystrophy, and spinal muscle atrophy, resulting in this term being phased out in favor of the more accurate diagnoses (Prasad & Prasad, 2003). An accurate diagnosis is important, because some neuromuscular disorders carry the risk of malignant hyperthermia (Thompson, 2002). The "floppy baby" referred to here represents a neuromuscular disorder of unknown origin that is nonprogressive and tends to improve over time. The infant feels like a rag doll with general weakness and flaccidity of the muscles. The infant may be unable to lift his or her head, has a weak cry, displays poor reflexes, shows poor suckling, has hypermobile joints, demonstrates an underactive gag reflex, has a high arched palate, demonstrates fasciculations of the tongue, and has an open mouth. Mothers may describe decreased fetal movements during the pregnancy. Some infants are born with joint contractures (arthrogryposis) of the ankles, knees, elbows, or wrists. An affected infant may also have congenitally dislocated hips and weakness in the anterior neck muscles, causing the head to lag when lifted. Sucking difficulties may be found with inactive lip, cheek, and tongue muscles as well as lack of sensory input from hand-to-mouth movements (Cohen, 1998). Such hypotonia may originate from an insult to the central nervous system that was not severe enough to cause permanent damage. It can also result from perinatal asphyxia, intraventricular hemorrhage, and prematurity. Clinicians may wish to look at the labor and delivery records to check for hypoxia, difficult delivery, or vacuum extraction in such cases.

Age-appropriate hypotonia may be expected to be seen in preterm and late preterm infants. Hypotonia commonly occurs in infants with Down syndrome. All infants with low tone should be well supported in positions that do not require extra effort to maintain their latch on the breast. Their efforts need to be directed to sucking, not supporting their body position. Mothers may need both hands to support the infant and the breast and may find that well-placed pillows or the use of a sling may help provide extra body support for the infant (Thomas, Marinelli, Hennessy, & Academy of Breastfeeding Medicine Protocol Committee, 2007). There are many additional ways to help infants with low tone to breastfeed.

Infant hypotonia is one of a number of symptoms of vitamin B_{12} deficiency. Infants of mothers who have undergone gastric bypass surgery should be checked for congenital B_{12} deficiency and monitored during their early months of breastfeeding (Celiker & Chawla, 2009). Vitamin B_{12} deficiency can also occur in breastfeeding infants whose mothers are vegetarians. Problems may not show up until the infant is several months old, with not only hypotonia being present but other symptoms, such as failure to thrive, lethargy, microcephaly, or developmental delay (Chalouhi et al., 2008; Honzik et al., 2010). Clinicians may find it prudent to determine the vitamin B_{12} status of mothers who have undergone gastric bypass surgery, gastric banding, or any other of these types of procedures and to monitor vegetarian mothers and their infants for B_{12} deficiencies. While most of the symptoms are reversible with treatment, permanent neurological damage can result in infants who are not promptly treated. Problems latching to the breast in these situations may determine the need to assess for hypotonia as well as the B_{12} status of both the mother and the infant.

Drug-exposed infants experiencing neonatal abstinence syndrome (NAS) present an almost completely opposite picture; that is, they may be hypertonic, be irritable, demonstrate abnormal movements, be hypersensitive, thrash at the breast, clamp down on the nipple, be unable to modulate their state to feed well, be difficult to position at breast, and pull back from the breast if experiencing nasal stuffiness (Jansson, Velez, & Harrow, 2004). Intrauterine drug exposure may temporarily impact the development of brainstem respiratory and swallow centers, transiently altering the suck–swallow–breathe cycle. During the early days after birth, some of these infants may ingest a lower volume of milk per sucking burst and/or demonstrate less rhythmical swallowing, especially if they have been opiate exposed in utero (Gewolb, Fishman, Qureshi, & Voce, 2004).

According to the Substance Abuse and Mental Health Services Administration (2014), among pregnant women aged 15 to 44, 5.4% were current illicit drug users based on data averaged across 2012 and 2013. This was lower than the rate among women in this age group who were not pregnant (11.4%). Among pregnant women aged 15 to 44, the average rate of current illicit drug use in 2012–2013 (5.4%) was not significantly different from the rate averaged across 2010–2011 (5.0%). Current illicit drug use in 2012–2013 was lower among pregnant women aged 15 to 44 during the third trimester than during the first and second trimesters (2.4% vs. 9.0% and 4.8%, respectively). The rate of current illicit drug use in the combined 2012–2013 data was 14.6% among pregnant women aged 15 to 17, 8.6% among women aged 18 to 25, and 3.2% among women aged 26 to 44. These rates were not significantly different from those in the combined 2010–2011 data (20.9% among pregnant women aged 15 to 17, 8.2% among pregnant women aged 18 to 25, and 2.2% among pregnant women aged 26 to 44). Clearly, substance abuse remains a significant problem, especially among younger mothers. In a worrisome trend, the abuse of prescription pain medications has seen a rampant increase among pregnant women (Epstein et al., 2013).

Mothers on methadone maintenance or other treatments for opioid dependence who are receiving proper care and counseling through substance abuse treatment programs should be encouraged to breastfeed with close follow-up (American Academy of Pediatrics, 2012). Early and consistent education for mothers and clinicians on the benefits of breastfeeding and how breastfeeding can compensate for some of the adverse effects of in utero exposure to opioids and other substances of abuse such as tobacco is most important (Pritham, 2013):

- Breastfeeding reduces the incidence of sudden infant death syndrome (SIDS), possibly because of its positive effects on breathing and arousal mechanisms.
- Breastfeeding may compensate for the psychomotor and cognitive performance delays seen in drug-exposed infants.

- The act of breastfeeding may positively affect the infant's central nervous system by reducing pain, stress, and anxiety.
- The act of breastfeeding may improve cardiac vagal tone and heart rate variability, thereby improving the infant's autonomic regulation.
- Infants who are breastfed are discharged from the hospital sooner than those who are formula-fed and are less apt to require treatment for NAS.
- Breastfeeding that is initiated at birth and continued for at least 72 hours has been shown to reduce the severity of NAS and the need for pharmacological treatment (Dryden, Young, Hepburn, & Mactier, 2009).

Boston Medical Center in Boston, Massachusetts, relies on an illicit drug use and breastfeeding policy that requires certain criteria be met in order for mothers to be encouraged to breastfeed. These criteria include that 10 weeks before birth a urine toxicology screen be done. If it is negative and the mother is compliant for a minimum of 12 weeks with an addiction recovery program, attends standard prenatal visits, and has a negative urine screen upon arrival to the labor and delivery service, then the mother is encouraged to breastfeed (Wachman, Byun, & Philipp, 2010).

Allegaert and van den Anker (2014) recommend that breastfeeding be added to any clinical pathway regarding the treatment of NAS. Infants experiencing in utero exposure to opioids may need to be medicated as the infants withdraw from opioids, because 60–90% of opiate-exposed infants develop NAS (Kandall, 1995) even with the low amounts of the medication received through breastmilk (Begg, Malpas, Hackett, & Ilett, 2001; Jansson, Choo, Velez, Lowe, & Huestis, 2008). NAS is a result of the abrupt discontinuation of fetal exposure to licit or illicit substances used or abused during pregnancy. Neonates with NAS demonstrate a range of symptoms, including central nervous system irritability, gastrointestinal dysfunction, respiratory distress, and vague autonomic symptoms such as mottling, yawning, sneezing, and fever (Kocherlakota, 2014). Dryden, Young, Hepburn, and Mactier (2009) demonstrated that breastfeeding was associated with reduced odds of the infant requiring treatment for NAS. Abdel-Latif and colleagues (2006) documented that breastfeeding has a significant positive impact on the neonate that included reduced NAS severity, delayed onset of NAS, and decreased need for pharmacological treatment regardless of gestational age and the type of drug exposure. McQueen, Murphy-Oikonen, Gerlach, and Montelpare (2011) found that predominantly breastfed infants had lower mean NAS scores, suggesting a decreased severity and duration of NAS symptoms when compared to infants who were combination fed or predominantly formula fed. Thus, breastfeeding is to be encouraged and supported because these infants are extremely vulnerable and can benefit greatly not only from the receipt of breastmilk but by the act of breastfeeding itself (Bagley, Wachman, Holland, & Brogly, 2014).

Jansson and colleagues (2004) identified eight potential challenges to breastfeeding presented by methadone-exposed infants and suggestions for handling them (**Table 5-2**). Wachman and colleagues (2010) reported that breastfeeding rates remained low among opioid-dependent women, even when receiving exemplary lactation care and services. This may be due to the significant challenges that these women face during their recovery from drug dependency as well as the difficulty of breastfeeding a drug-exposed infant who may be irritable and demonstrate feeding problems.

Table 5-2 Challenges to Breastfeeding in Methadone-Exposed Infants

Challenge	Intervention
1. Irritability/crying	Feed when in a drowsy state or before full crying appears Swaddle Vertical rocking Hold baby's hand Gentle cupping of head if tolerated "Tame" the environment by dimming lights and minimizing noise
2. State lability • Rapid fluctuation between states • Not achieving quiet alert state	Minimize stimulation Bring infant from sleep to quiet alert state slowly Watch for signs of stress
3. Hypertonicity • Generalized, often with asymmetries • Clenched jaw and poor gape (mouth opening) • Easily overstimulated ▪ Neck arching ▪ Side-to-side head thrashing • Arched posture	Gradual oral stimulation Respond to overstimulation cues (irritability, hiccups, tremors, excessive gas, gaze aversion, tachypnea [rapid breathing], mottling) Head support Wrap baby in a soft blanket to restrain thrashing movements Avoid the clutch hold and have baby facing the mother Use ventral positioning
4. Suck-and-swallow incoordination • Poor or disorganized suck patterns	Feeding therapy referral to occupational therapist, physical therapist, or speech-language pathologist Mothers may need to pump their milk Alternative feeding devices may be required until baby can feed at breast
5. Hypersensitivity	Feed in a dim, quiet room with comfortable, constant temperature Gentle and minimal handling Swaddling Have mother breastfeed in a side-lying position Artificial nipples may not be well tolerated and should be avoided Shape the breast to fit the long axis of the baby's mouth if he or she does not open wide enough to latch Wrap a soft blanket around baby's arms, upper body, and back of head to minimize thrashing
6. Nasal stuffiness (may cause detaching from the nipple, pulling back of baby's head, arching, and stiffening)	May require gentle nasal suctioning with saline drops
7. Vomiting	Small, frequent feeds and frequent burping
8. Pull-down (may appear to be sedated or asleep in an effort to avoid stimuli and create a tolerable environment)	Baby may actually be in an awake or hypersensitive state; vigorous stimulation in an attempt to wake baby should be avoided Soft handling, gentle talking, and skin-to-skin contact

Data from Jansson, L. M., Velez, M., & Harrow, C. (2004). Methadone maintenance and lactation: A review of the literature and current management guidelines. *Journal of Human Lactation, 20,* 62–71.

Rooming-in should be encouraged as it may promote more effective mothering behaviors and reduce the severity of the infant's withdrawal symptoms (Hilton, 2012). Oxytocin, which is released each time the infant is put to breast, may help the mother relax, increase feelings of love for the infant, reduce stress and pain, and generally help her cope with an infant who may be irritable and difficult to feed and calm.

Recently, buprenorphine (Buprenex, Subutex) has been used to treat opioid-abusing mothers during pregnancy. Infants seem to experience a less severe course of NAS when their mothers were treated with buprenorphine (Kakko, Heilig, & Sarman, 2008). Due to its poor oral bioavailability, buprenorphine is considered compatible with breastfeeding as the infant dose would be subclinical (Hale, 2012). Ilett and colleagues (2012) concluded that the dose of buprenorphine and norbuprenorphine that a breastfeeding infant receives via milk is generally less than 1% of the weight-adjusted maternal dose and unlikely to cause any acute adverse effects in the infant. The Center for Substance Abuse Treatment (2004) panel recommends breastfeeding for mothers undergoing buprenorphine treatment unless other contraindications exist. While these mothers often stop breastfeeding within a week, recent studies have shown that mothers treated with buprenorphine (O'Connor et al., 2011) and provided with excellent lactation support services (Wachman et al., 2010) breastfeed far longer.

Women receiving methadone treatment face opposition, stigma, misinformation from peers and healthcare professionals, and logistical challenges in their efforts to breastfeed (Demirci, Bogen, & Klionsky, 2015). In their study, Demirci and colleagues (2015) found that mothers feared the passage of methadone into their milk and lacked support and correct information from the healthcare community. Correction of misinformation, positive support from clinicians, and educating family and friends regarding the importance of breastfeeding are modifiable barriers to breastfeeding success. The Academy of Breastfeeding Medicine has published a protocol on breastfeeding and substance abuse that may be a helpful resource for educating clinicians on the importance of breastfeeding for this vulnerable and fragile population of infants and mothers (Reece-Stremtan, Marinelli, & Academy of Breastfeeding Medicine, 2015). The use of laser acupuncture combined with pharmacological therapy has been shown to significantly shorten the length of morphine therapy as well as significantly reduce the length of hospital stay in infants who were drug exposed in utero (Raith et al., 2015).

Infants who are exposed to other drugs during pregnancy may also exhibit stress or abstinence behaviors. Prenatal use of less potent opiates, some nonopiate central nervous system depressants, alcohol, marijuana, or tobacco can generate side effects in the newborn (Lester et al., 2002).

The overall smoking rate during the last 3 months of pregnancy in 2012 and 2013 in the United States was 15.4% (Substance Abuse and Mental Health Services Administration, 2014). Women who smoke are less likely to breastfeed than those who do not smoke and are more likely to wean earlier than nonsmoking mothers (Liu, Rosenberg, & Sandoval, 2006). There may be a number of explanations for this:

- Smoking > 10 cigarettes daily was reported to decrease milk production and alter milk composition (Hopkinson, Schanler, Fraley, & Garza, 1992).
- Mothers who smoke may perceive that their milk supply is inadequate (Hill & Aldag, 1996).
- The milk of smoking breastfeeding mothers has a lower fat content than the milk of mothers who do not smoke (Powers, 1999). Cigarette smoking during pregnancy is associated with lower milk-fat content and lower polyunsaturated fatty acids in the first 6 months of lactation

(Agostoni et al., 2003). Docosahexaenoic acid (DHA) levels were found to be lower in the milk of mothers who smoked. Bachour, Yafawi, Jaber, Choueiri, and Abdel-Razzak (2012) found that smoking resulted in a 26% decrease in the lipid concentration of the milk of mothers who smoked. These authors also report a 12% decrease in the milk-protein content of mothers who smoke. Alterations of this magnitude in the milk of mothers who smoke agree with previous studies that show a slower growth rate in breastfeeding infants of mothers who smoke (Vio, Salazar, & Infante, 1991). Clinicians may need to be more vigilant with infants of mothers who smoke, making sure that growth parameters remain in the normal range. Mothers who smoke may need to feed their infants more frequently to assure that growth does not falter. They can also employ the use of alternate massage during feedings to boost calorie and fat intake.

- Mothers who experience chronic exposure to nicotine may boost dopamine activity in the tuberoinfundibular tract, which functions to inhibit prolactin release (Bahadori, Riegiger, Farrell, Uitz, & Moghadasian, 2013). Such a side effect of smoking may serve to limit milk production.
- Mothers who smoked five or more cigarettes daily had infants who exhibited behaviors such as colic and crying that may contribute to early weaning (Matheson & Rivrud, 1989).
- Smoking mothers perceived a strong risk of harming the infant by smoking and weaned earlier due to concerns regarding the toxic effects of nicotine on the composition and quantity of their milk. Mothers did not receive a strong message from healthcare providers that the benefits of breastfeeding superseded the harm of smoking, as many smoking mothers remain unaware that the benefits of breastfeeding outweigh the potential harm posed to their infants by nicotine in their breastmilk (Goldade et al., 2008).
- In 102 samples of breastmilk purchased over the Internet, 58% had detectable levels of nicotine or cotinine, 4% had levels indicating active smoking, and 97% had detectable levels of caffeine. Sellers of breastmilk may misrepresent or be unaware of health behaviors that affect the content of their milk (Geraghty et al., 2015). Mothers and clinicians should be aware of potential contamination of breastmilk purchased over the Internet.

Tobacco-exposed infants have been shown to demonstrate neurotoxic effects such as greater excitability, greater hypertonia, the need for more handling, and signs of withdrawal or abstinence (Law et al., 2003). Smoking-exposed infants may demonstrate poor self-regulation with all side effects persisting up to a month after birth (Stroud et al., 2009). Yolton and colleagues (2009) examined the relationship between prenatal tobacco smoke exposure and infant neurobehavior. While finding significant differences out to 5 weeks in infant neurobehavior due to tobacco exposure, these authors found that infant neurobehavioral outcomes differed by race. Among white infants, as prenatal tobacco smoke exposure increased, infants were more excitable, more aroused, and less able to calm themselves. They also showed a reduced capacity to focus their attention during the neurobehavioral assessment with increased agitation. As tobacco exposure increased with black infants, they became less responsive during the neurobehavioral exam, were less able to interact socially, and were less affected by the manipulation of the examiner. These alterations in behavior may cause early breastfeeding to be more difficult due to over- or under-aroused infants. Clinicians may need to take these alterations in neurobehavioral profiles into account when working with infants of mothers who smoke.

Postnatal exposure to the nicotine in breastmilk can alter autonomic cardiovascular control in infants. Heart rate variability has been shown to decrease as the amount of nicotine in breastmilk increases (Dahlstrom, Ebersjo, & Lundell, 2008). Shorter times between the mother smoking a cigarette and the onset of breastfeeding increase the concentration of nicotine in breastmilk (Dahlstrom, Ebersjo, & Lundell, 2004). Mothers who smoke can be advised to smoke immediately after a breastfeeding to prolong the interval between nicotine intake and breastfeeding. Nicotine is not stored in breastmilk, and levels peak in breastmilk 30 to 60 minutes after cessation of smoking (Mennella & Beauchamp, 1998). Even passive smoke in the household increases the nicotine levels in breastmilk. Although mothers who smoke should be encouraged to breastfeed, they should also be helped to eliminate smoking from their homes. The following may provide potential motivations to stop smoking:

- Infants spend significantly less time sleeping during the hours immediately after breastfeeding when their mothers have recently smoked (Mennella, Yourshaw, & Morgan, 2007).
- Smoking is a leading risk factor for SIDS (Anderson, Johnson, & Batal, 2005).
- Nicotine-induced disruptions in sleep may contribute to long-term behavioral and learning deficits (DiFranza, Aligne, & Weitzman, 2004) because sleep promotes learning in infants (Gomez, Bootzin, & Nadel, 2006) and deprivation of active sleep impairs learning and the formation of new memories in animal models (McDermott et al., 2003).

Breastfeeding has been shown to be a protective factor against increases in smoking after childbirth. Supporting mothers who stop smoking during pregnancy so that they can breastfeed for at least 3 months can have lasting benefits for smoking reduction (Shisler et al., 2015). Breastfeeding also reduces children's susceptibility to the respiratory side effects of tobacco smoke exposure, as it appears to protect against asthma-related symptoms in early childhood (Liu et al., 2015).

Approximately 6% of pregnant women experience exposure to selective serotonin reuptake inhibitors (SSRIs), a commonly prescribed family of antidepressant medications (Andrade et al., 2008; Cooper, Willy, Pont, & Ray, 2007). Mothers taking antidepressant medications during pregnancy are less likely to breastfeed than mothers not taking such medications (Gorman, Kao, & Chambers, 2012). Infants born to mothers who were treated prenatally for depression with SSRIs, such as the commonly prescribed paroxetine (Paxil), fluoxetine (Prozac), citalopram (Celexa), and sertraline (Zoloft), can demonstrate a wide range of neurobehavioral alterations (Lattimore et al., 2005), including increased tremulousness and difficulty achieving more alert states (Zeskind & Stephens, 2004). As many as 35% of women use some type of psychotropic medication during pregnancy (Goldberg & Nissim, 1994). A neonatal behavioral syndrome, termed poor neonatal adaptation, has been described in infants whose mothers have been treated with SSRIs; it includes tremors, shaking, agitation, spasms, hyper- or hypotonia, irritability, hypoglycemia, temperature instability, and sleep disturbances. Respiratory system involvement includes indrawing, apnea/bradycardia, and tachypnea (Jordan et al., 2008). These signs appear during the 1st day of life and resolve within 3 to 5 days (Ferreira et al., 2007). Other differences observed in the exposed group were higher rates of vomiting, tachycardia, and jaundice. Some studies report an increase in persistent pulmonary hypertension (Yonkers et al., 2009). Salisbury and colleagues (2011) compared the neurobehavioral profile of infants born to mothers who had a major depressive disorder without SSRI exposure and those infants whose mothers had both a major depressive disorder and were treated with

SSRIs. The authors found different neurobehavioral profiles between the two groups of infants. Full-term infants of mothers with a major depressive disorder and SSRI treatment had a lower gestational age, lower quality of movements, and more central nervous system signs of stress. Infants of mothers with a major depressive disorder but no treatment with SSRIs had higher quality of movement scores but lower attention scores. Any or all of these signs may disturb early breastfeeding behaviors, necessitating close observation and a potential need for intense breastfeeding support. While short-term adverse outcomes for term infants are generally mild and time limited, preterm or unstable infants should be more closely monitored for adverse effects (Kendall-Tackett & Hale, 2010). Some of the signs and symptoms of withdrawal are seen in healthy non–drug-exposed infants or are indicative of other types of underlying problems. A withdrawal scoring sheet may be helpful to identify the drug-withdrawing infant from a collection of symptoms that persist over time (http://newborns.stanford.edu/ScoringSheet.html). The Neonatal Intensive Care Unit Network Neurobehavioral Scale was developed to provide a comprehensive assessment of neurological integrity and behavioral function in drug-exposed infants and to identify the types and ranges of withdrawal and stress behaviors likely to be seen in these infants (Lester, Tronick, & Brazelton, 2004). Use of this scale is intended to ensure a home environment sensitive to infant tolerance for stimulation and handling and to provide the clinician with insight regarding positioning, handling, and environmental conditions that are most beneficial in caring for these infants during hospitalization (Boukydis, Bigsby, & Lester, 2004). Depressive symptoms early in pregnancy have been associated with reduced concentrations of DHA in breastmilk (Keim et al., 2012). This study recommends early screening for major depression during pregnancy and looking at ways to improve the DHA status of these mothers to reduce both the burden of perinatal depression and the alteration of the breastmilk of these mothers.

Hale, Kendall-Tackett, Cong, Votta, and McCurdy (2010) found that discontinuation syndrome (poor adaptation, jitteriness, irritability, and poor gaze control) was seen in a small number of infants whose mothers took antidepressants during pregnancy. Six symptoms (jitteriness, vomiting, irritability, low body temperature, shivering, and problems with eating and sleeping) were 2 to 8 times more likely to be reported in infants whose mothers took antidepressants while pregnant compared to taking these medications during lactation. Infants were shown to have much lower odds of experiencing these symptoms if their mothers took antidepressants during pregnancy with mid-range or long half-lives (sertraline or fluoxetine) instead of ones with a short half-life. Clinicians should be watchful for these manifestations and be ready to manage them in mothers who have a history of antidepressive medication use. Some mothers who can switch to a longer acting agent may be able to reduce the odds of their infant experiencing symptoms associated with the discontinuation syndrome. Sertraline (Zoloft) and paroxetine (Paxil) have shown a better neonatal safety profile during breastfeeding compared to other antidepressive drugs (Orsolini & Bellantuono, 2015). Formula feeding has been shown to increase the risk of an infant experiencing poor neonatal adaptation when exposed to maternal antidepressants compared to breastfeeding or mixed feeding (Kieviet et al., 2015).

Marshall and colleagues (2010) reported that mothers taking SSRIs were at a two-fold greater risk of delayed lactogenesis II (onset of copious milk secretion). This delay in the milk coming in was related to the disruption that the SSRIs caused in serotonin within the breast. Serotonin is a regulator of lactation homeostasis. Increased vigilance is warranted to ensure adequate infant milk intake in the early days following delivery. Mothers with a history of SSRI treatment should be informed that a delay in lactogenesis II might occur and a feeding plan to anticipate this should be in place prior to discharge from the hospital.

Early feeding resistance in some infants may have an organic basis. Abadie and colleagues (2001) described a set of feeding behaviors in bottle-fed infants that they attributed to poor organic perinatal control of oroesophageal motility: early onset of poor sucking and swallowing skills, refusal to feed, excessive regurgitation, and occasional cough or pallor attacks during bottle-feeding. Some infants also displayed minor facial dysmorphism (retrognathia and arched palate) and mild hypotonia of the tongue base or larynx. The congenital nature of these behaviors combined with manometric findings in the esophagus led to the suspicion that these feeding behaviors were the result of prenatal factors, because central control of the coordinated peristalsis of esophageal motility, sucking, and swallowing originates in a central pattern generator in the brainstem (Jean, 2001). Also, retrognathia and arched palate are anatomic variations that have been observed in children with poor fetal sucking movements (Sherer, Metlay, & Woods, 1995).

Persistent and unresolved difficulties with latching may result in an infant who never achieves latch, early weaning from the breast, or a mother who pumps her milk and provides it to her baby in a bottle. Clinicians have the option of using a nipple shield to achieve latch. Although early shield design and use often yielded unwanted and detrimental outcomes to breastfeeding (Desmarais & Browne, 1990), more recent data have described beneficial outcomes. Central to such outcomes are the use of ultrathin silicone shields, critical assessment by a skilled lactation consultant, and continuous follow-up, both in the hospital and postdischarge. Many infants who otherwise may have been unable to breastfeed can and have benefited from the judicious use of this tool.

NIPPLE SHIELDS

Nipple shields can be quite helpful as an intervention in certain breastfeeding situations (Brigham, 1996; Wilson-Clay, 2003) and may help prolong the duration of breastfeeding when mothers encounter certain types of breastfeeding problems (Ekstrom, Abrahamsson, Eriksson, & Martensson, 2014). An understanding of what shields can and cannot accomplish is essential to the clinical decision-making process. Shields can:

- Therapeutically supply oral stimulation that an infant cannot obtain from the mother's nipples due to inability to latch or transfer milk
- Create a nipple shape in the infant's mouth
- Allow extraction of milk by expression with minimal suction, with negative pressure inside the shield tip keeping milk available
- Compensate for weak infant suction
- Present a stable nipple shape that remains during pauses in sucking bursts
- Maintain the nipple in a protruded position
- Affect the rate of milk flow
- Shields cannot:
  - Correct milk transfer problems or weight gain if the mother has inadequate milk volume
  - Fix damaged nipples if the cause is not discovered and remedied
  - Replace skilled intervention and close follow-up

While high-level research on shield use is lacking (McKechnie & Eglash, 2010), shield use can aid learning to feed at breast, allows supplementation to occur at breast (i.e., thread tubing under or alongside of the shield), encourages nipple protractility, does not overwhelm the mother with gadgets, and avoids the infant fighting the breast. Shield use may prevent premature termination of breastfeeding. Use of shields does not affect maternal prolactin levels, and infants are able to gain weight appropriately while using a nipple shield (Chertok, Schneider, & Blackburn, 2006).

The clinician must also consider some of the disadvantages of nipple shield use. It is sometimes used as a substitute for skilled care or as a quick fix but may not correct the underlying problem; may exacerbate or mask the original problem; may lead to insufficient milk volume, inadequate weight gain, or weaning; can be problematic without follow-up; may prevent proper extension of the nipple back into the infant's mouth (Minchin, 1998); could pinch the nipple and areola, causing abrasion, pain, skin breakdown, and internal trauma to the breast if not applied properly; could create nipple shield addiction (DeNicola, 1986), after which the infant will not feed at breast without the shield in place; might predispose the nipple to damage when the infant is put to breast without the shield, because the infant may chew rather than suckle; and could be discarded as a useful intervention in select situations. One case report noted nipple damage with the use of a 24-mm nipple shield due to excessively high intraoral vacuum generated by the infant when using the shield (Perrella, Lai, & Geddes, 2015). Blisters were noted on the nipple tip that corresponded to the openings on the nipple shield. When sucking pressures were measured, the intraoral vacuum was as much as 307% higher than reference values. While the distinct pattern of nipple blisters suggested high intraoral vacuum, outside of a research setting there is no clinical screening tool available to assess for excessive vacuum generation. This condition might be suspected when the mother continues to complain of nipple pain when using the shield. Clinicians might recommend changing to a larger nipple shield (28 mm), alternating breastfeeding positions to vary pressure at the nipple base, offering shorter but more frequent feedings, and breastfeeding when the infant is in a drowsy state.

The teat portion of a nipple shield is much stiffer than the maternal nipple, may be larger than the mother's nipple, presents a different texture to the infant, and does not deflect and elongate like a human nipple. The texture of an oral object in the infant's mouth can modulate the sucking instructions from the suck central pattern generator. When presented with either a smooth or a textured pacifier, healthy term infants were seen to reorganize and change their non-nutritive sucking pattern depending on the texture presented to them (Oder, Stalling, & Barlow, 2013). The act of sucking on a nipple shield produces sensory cues from Merkel cells that line the lip vermillion and buccal mucosa. These oral mechanoreceptors encode specific information regarding such features as the shape, texture, curvature, and edges to create a neural image of the object in the infant's mouth. The brain then modulates the timing and output from the suck central pattern generator according to the cues it has received from the Merkel cells. Central pattern generators are located in the brain stem reticular formation and are composed of networks of interneurons that produce rhythmic motor patterns such as breathing, walking, and sucking (Marder & Bucher, 2001). The oral tactile input from the Merkel cells is a learned form of perceptual recognition that governs the imprinting process. If the Merkel cells have encoded a nipple shield rather than the maternal nipple during a critical window of learning, would it then alter how the infant sucks in the absence of a shield? Should a shield be avoided during the early hours and days so that the Merkel cells encode the maternal nipple as the imprinted object to avoid altering suck instructions from the suck central pattern generator? Little is known regarding their effect on infant feeding behaviors relative to the imprinting that may be affected by presenting a superstimulus to an infant during a sensitive or critical period of time. Because most nipple shields cover the part of the areola that contains the glands of Montgomery, might nipple shields either mask or eliminate the infant's use of olfaction to locate and identify the mother's specific odor? How important are the pheromones of the mother? Would a nipple shield with a cut-out section present better olfaction guidance to the breast?

Eglash, Ziemer, and McKechnie (2010) surveyed 490 healthcare professionals regarding nipple shield use in their practices. The most common reason for shield use was to aid infants younger than 35 weeks gestational age to latch and feed. Many other reasons were given for shield use including as a way to transition an infant from bottle to breast. Most of the respondents were concerned regarding the lack of follow-up once shield use was started. Most mothers reported positive experiences with nipple shield use (Chertok, 2009). Follow-up is crucial during shield use to assure ongoing monitoring of appropriate infant growth, abundant maternal milk supply, and ongoing efforts to correct the original problem that resulted in shield use to begin with.

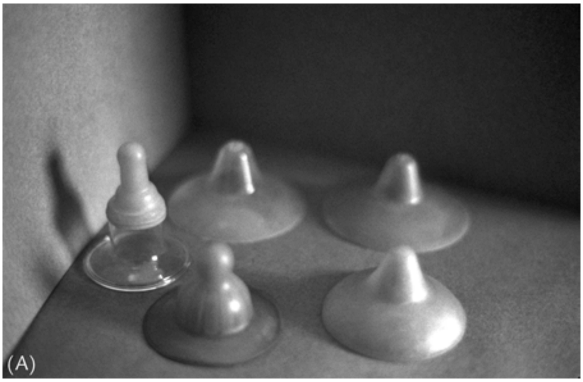
Hanna, Wilson, and Norwood (2013) described the experience of 81 mothers with breastfeeding difficulties who were given nipple shields to aid in the initiation of breastfeeding. Most were given nipple shields for problems with infant latch, but other reasons included nipple pain and damage, flat nipples, disorganized suck, or a combination of reasons. Most mothers found the shield to be helpful and its use allowed them to avoid premature weaning. Some problems with shields were mentioned such as difficulty with the adherence of the shield, shield too big for the infant's mouth, and longer feeding times. With the added use of a nipple shield, 31% of the mothers in this study reached the Healthy People-recommended goal of breastfeeding for 6 months. There was a significant positive relationship between use of the nipple shield at week 5 and total weeks of breastfeeding. Powers and Tapia (2004) found in a telephone survey of 202 breastfeeding women that most used a shield due to flat nipples and an infant with disorganized sucking.

Use of a nipple shield could be considered in situations involving latch difficulty, oral cavity problems, upper airway problems, prematurity (Clum & Primomo, 1996), and damaged nipples when other avenues to achieve latch have been attempted and failed to produce the desired outcome and when discharge or weaning is imminent. (A complete list of such situational examples is provided in **Appendix 5-1**.)

Shield Composition and Dimensions

Shields exclusively composed of rubber are no longer seen today, and standard bottle nipples placed over the mother's nipple or attached to a glass or plastic base are not appropriate interventions (**Figure 5-15A**). Silicone shields are extremely thin and flexible, with a firmer nipple portion. Because the silicone is so thin, more stimulation reaches the areola and milk volume is not as seriously depleted as with the other designs (Auerbach, 1990). Due to the increasing incidence of latex allergy in the general population, latex-containing shields should be avoided. Silicone shields (**Figure 5-15B**) are available in a number of shapes and sizes, ranging from 16 mm to 28 mm (**Table 5-3**).

Few data exist in the literature regarding shield selection and instructions for their use. (A summary of shield-use instructions is presented in Appendix 5-1.) The height of the nipple portion of the shield should not exceed the length of the infant's mouth from the juncture of the hard and soft palates to lip



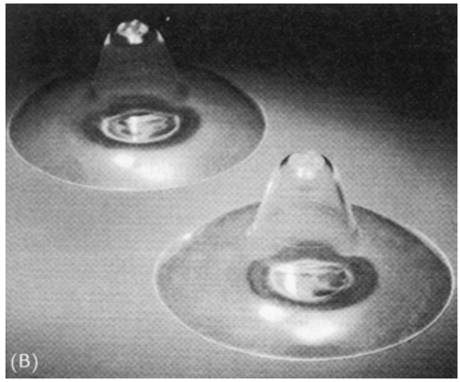


Figure 5-15 (A) Old-style nipple shields; (B) modern silicone nipple shields.

Table 5-3 Dimensions of Silicone Nipple Shields

Product	Size	Number of Holes
Avent	21 mm	3
Medela		
Standard	16 mm 20 mm 24 mm	4
Contact	16 mm 20 mm 24 mm	
Ameda	24 mm	5
Ardo	20 mm 24 mm	4
Mamivac		4
Conical	18 mm 20 mm 28 mm	
Cherry shaped	18 mm 22 mm	
Nuk	20 mm 24 mm	4
Lansinoh	24 mm	4

closure (Wilson-Clay & Hoover, 2002). If the height of the teat of a shield is greater than this length, the infant's jaw closure and tongue compression will fall on the shaft of the teat, and not over the breast. The teat must be large enough to allow for the expansion of the nipple during sucking. If the height of the teat is too short for the nipple, it may abrade against the inside of the teat or extrude through the teat holes.

The base diameter should fit the mother's nipple and better results occur with the shortest teat height and smallest base diameter.

Most nipple shields are conical shaped, but Mamivac makes a shield that has a cherry-shaped or more bulb-like tip. The cherry-shaped teat may be more appropriate for some infants and can be tried if a conical-shaped nipple shield does not provide the desired results.

Weaning From the Shield

There is no set time to wean an infant (or mother) from shield use. Extended use of the ultrathin silicone shield has not been shown to be detrimental (Bodley & Powers, 1996). Mothers start the shield-weaning process simply by encouraging skin-to-skin contact next to the nipple, starting the feed with the shield and then removing it, and gradually trying feeds without the shield. The tip of the shield should not be cut off in an attempt to present less and less of the device to the infant. Rough edges may scrape the infant's mouth, and the altered shape and consistency of the shield may not be appropriate to the desired outcome.

Follow-Up on Shield Use

Clinicians should provide proper written instructions for the mother and referrals if a shield is recommended as an interim measure to assist with breastfeeding. If a mother is discharged from the hospital using a shield, a community referral must be made to a lactation consultant or the nurse practitioner at the pediatrician's office for daily follow-up. Weight checks may need to be obtained twice a week. The pediatrician should be alerted to the problem that required use of the shield in the first place and should be aware of suggestions for discontinuing its use.

RELUCTANT NURSER

The mother is likely to experience frustration and anxiety over an infant who cannot feed at her breast. If breastfeeding attempts are internalized as failure, the mother may experience disappointment and disconnection from her infant rather than the beginnings of connection and competence (Driscoll, 1992). The mother's perception of the neonate's competence at breast serves as a primary reinforcer in her persistence with breastfeeding. An infant who does not latch to the breast generally presents a reality clash with a mother's expectation of breastfeeding as automatic and pleasing (Mozingo et al., 2000). It acts as a stressor that can lead directly to weaning if sensitive, consistent, and evidence-based interventions are not received. Mothers whose infants experience difficulty latching or sucking are significantly less likely to be breastfeeding at all at 12 weeks (Taveras et al., 2004). Positive feedback in the form of an infant who breastfeeds well reinforces the mother's decision to breastfeed and increases maternal self-esteem (Matthews, 1991). Problems related to latch include the infant who is reluctant to or unable to latch to the breast, with interventions for the reluctant nurser varying depending on what is contributing to the problem (**Box 5-2**).

Sleepy Infant

An infant who is "unavailable" to feed can be especially worrisome to both the mother and the clinician. With hospital stays of 48 hours or less being the norm for full-term healthy infants, many infants can be discharged without ever having actually fed at the breast. Infants "cycle" through active sleep, quiet sleep, and waking. Infant sleep cycles are 60 minutes long (adult cycles are 90 minutes long). Initially, newborns may wake with each cycle (every 1–2 hours), sometimes giving the impression that they are not receiving enough milk, when they are simply moving from one state to another. Babies do not sleep like adults. During the neonatal period, babies fall asleep in "rapid eye movement" (REM) sleep and then move more slowly to "deeper" forms of sleep. They spend about equal amounts of time in active and quiet sleep, alternating with

Box 5-2 Problem of the Reluctant Nurser

Problem Description

- Baby may latch to the breast only after many attempts
- Baby may be unable to latch
- Baby may completely refuse to latch to breast, either falling asleep or aggressively pushing away with an arched body
- Baby may exhibit rapid side-to-side head movements and may or may not latch to breast
- Baby may have a one-sided preference

Contributing Factors

- Poor positioning at breast
- Hypertonia (jaw clenching, pursed lips, neck and back hyperextension, tongue retraction or elevation)
- Interruption in the organized sequence of prefeeding behaviors immediately after birth
- Infrequent feeds leading to an over-hungry baby and excessive or prolonged crying, resulting in behavioral disorganization
- Drug-induced interference that prolongs the period of state disorganization in the newborn (epidural, butorphanol [Stadol], nalbuphine hydrochloride [Nubain], meperidine [Demerol])
- Interference with imprinting on the breast from separation, artificial nipples, or pacifiers
- Fetal history of breech presentation, extension in utero, protracted labor, cervical spine pain or damage, precipitous delivery, dislocated hip, fractured clavicle, or asymmetrical positioning in utero with right-sided preference
- Excessive pressure on the occipital region of baby's head from pushing the head forward into the breast
- Vigorous or deep suctioning or intubation that causes swelling or discomfort in the mouth or throat with resulting clenched mouth, tongue thrusting, neck extension, or pushing away from the breast
- Oral aversion or other sensory-integration problems
- Vacuum extraction, forceps, shoulder dystocia with misalignment of head, neck, and shoulders
- Cephalohematoma
- Short or tight lingual frenulum
- Flat or inverted nipples
- Upper airway disorders

(*continues*)

Management	**Rationale**
Check the positioning of baby at breast: • Baby completely facing mother with head, neck, and spine aligned • Mouth in front of and slightly below where nipple points • Baby brought to breast and held close • Mother does not lean forward or maneuver the breast sideways	Poor positioning increases the number of latch attempts needed before obtaining milk, which can frustrate both mother and baby. Improper positioning increases the chances that the baby will not attach to the breast, leading to sore nipples, engorgement, insufficient milk production, and slow weight gain.
Positioning may vary depending on the symmetry of the baby. Babies with a rightsided preference may need to be held in a football hold for the right breast and in a cradle or prone position for the left breast.	Positioning in utero and delivery events influence breastfeeding patterns.
Some babies do better when the mother is in a sidelying position. Breech babies may feed better sitting upright in a clutch hold (**Figure 5-16**). Babies with delivery trauma such as a cephalohematoma may be more comfortable and feed better when held with the affected side up. Babies with a fractured clavicle may feed better in a clutch hold if the weight of the breast is kept off the chest or in a cradle hold with the affected side up.	Several different positions may need to be explored to find one that is satisfactory.
Allow the baby time on the mother's breast immediately after delivery. Let baby seek and find the nipple before removal from the mother's chest.	This provides the opportunity for the prefeeding sequence of behaviors to occur, which increases the likelihood of proper attachment to the breast.
Keep the mother and baby together. Place the baby skin to skin on the mother's chest (Meyer & Anderson, 1999). Instruct the mother to feed her baby on cue: when he stirs at breast, when she sees rapid eye movements under the eyelids, when she sees movements of the tongue and mouth, when baby exhibits hand-to-mouth movements, or when baby makes small sounds.	This reestablishes and/or repatterns the initial sucking sequence that may not have occurred immediately post-delivery. With the baby in close, the mother can feel the infant's feeding cues and place him to breast before he becomes over hungry and when he is most likely to latch on.
An alternative technique is to place mother and baby in a bath, allowing baby to repattern in the warm water. To keep baby warm and soothed, a helper can gently pour warm water over the baby's back as he creeps to the breast and attaches (Harris, 1994).	
Place a warm towel over baby's neck; massage the shoulders and arms. This is helpful after a precipitous delivery, forceps, or vacuum extraction. It is also soothing to a high-tone baby.	Baby may be in pain from overriding cervical vertebrae. This helps relax the cervical structures and decrease tone in a high-tone baby.
For rapid side-to-side head movements, touch the midline of baby's upper lip with a dropper of colostrum or D5 (**Figure 5-17**). Move baby onto the breast as he follows the dropper to the nipple. When his mouth is wide open, place a few drops of water or colostrum on his tongue to elicit sucking and swallowing.	The dropper acts to provide external control and food incentives for attachment and sucking at breast.

Management	**Rationale**
An arching baby can be placed either in the football hold or with the mother lying on her side. The mother can also use a sling to help position the baby in flexion.	These techniques help to flex the back and hips to avoid arching and jaw clenching.
If this does not calm the baby, place him on a receiving blanket, have two adults pick up the corners of the blanket, and rock the baby from side to side like a hammock. Then put the baby to breast.	
Provide latch and sucking incentives to the baby, which can include: • A periodontal syringe placed in the side of the baby's mouth that delivers a small amount of colostrum or sugar water with each suck until the baby demonstrates rhythmic suck and swallow at breast. • A syringe or soft clinic dropper can be used to elicit sucking (**Figure 5-18**). • Butterfly tubing attached to a 10-cc syringe and taped to the breast can provide these incentives as well as a supplement if needed.	This helps prevent the baby from pulling away from the breast before he latches on or swallows.
A baby who is crying hard or has been crying for a period of time may not be able to organize himself to feed. Allow this baby to suck on a finger or place the tubing on a finger and allow baby to suck (**Figure 5-19**) a little colostrum or sugar water by finger feeding him before putting him to breast.	
Avoid pacifiers and bottles. If the baby will not suck on a finger, place some colostrum in a 28-cc medicine cup and have the baby sip from the cup until he calms down and has a little food in his stomach.	
If the baby will not open his mouth wide enough for painless latch-on or clenches his jaw, hold the baby's jaw between your thumb and index finger and move the jaw a small amount from side to side. If the lower lip is rolled under, keeping the mouth from achieving a large enough gape, or the mouth is not open to $>$ 130 degrees, gently pull down on the chin to evert the lower lip and encourage a more open mouth (**Figure 5-20**).	This helps inhibit jaw clenching. Pulling down on the chin too hard may dislodge the baby from the breast or cause him to bite down to stay attached.
Hand express milk into a spoon and spoon feed the baby.	Skipped feedings can lead to insufficient fluid and inadequate caloric intake.
If nothing else works, try the judicious use of a nipple shield.	Shield use may allow a baby who is experiencing difficulty latching or who may never latch without assistance to learn breastfeeding skills.

Figure 5-16 Upright hold.

Figure 5-17 Use of dropper to orient infant to breast.

Figure 5-18 Use of soft clinic dropper to elicit sucking.

Figure 5-19 Tubing taped to the finger to elicit sucking.

Figure 5-20 Gentle traction on the chin to encourage an open mouth.

a period of 50 to 60 minutes (Peirano, Algarin, & Uauy, 2003). Babies, like adults, are more likely to wake up when they are in lighter forms of sleep than if they are in deeper forms of sleep. If something happens to disturb them in this lighter sleep such as a ringing phone or being put down into a bassinet or crib, babies are more likely to wake. During active sleep, infants' eyelids will flutter and their faces and bodies will twitch. Mothers can be instructed to wait to put newborns down until they are in a deeper sleep state (20 minutes or so after a feeding). This helps break a cycle of repeated awakenings each time the baby is put down. As long as the infant has actually transferred sufficient milk, these types of awakenings may be reduced by either extended skin-to-skin holding or waiting to transfer the infant to a bassinet or crib until he has entered a deeper sleep state.

Sleep architecture in newborns during the first days after birth shows both ultradian (biological rhythms that occur less frequently than every 24 hours) and circadian (biological rhythms that occur every 24 hours) cyclicity (Freudigman & Thoman, 1994) that is responsive to a number of variables, including mode of delivery (Freudigman & Thoman, 1998), maternal labor medications, gestational age, and the surrounding environment. The earliest postnatal sleep patterns differ between vaginally and cesarean-born infants. The diurnal sleep pattern of infants is disrupted by a cesarean delivery such that infants born by cesarean section have shown significantly less active sleep. During the first 2 days, vaginally born infants show significant day/night differences with more wakefulness, shorter mean sleep periods, and shorter longest sleep periods during the daytime on both days (Freudigman & Thoman, 1998). This presents as a vaginally born infant having more opportunities to breastfeed, whereas a cesarean-born infant may not demonstrate breastfeeding cues as frequently. Heavier infants of diabetic mothers have been shown to have higher amounts of quiet and motionless sleep (Sadeh, Dark, & Vohr, 1996), which may limit optimal breastfeeding opportunities. An increase in quiet sleep on the day of birth compared to 24 hours later can be seen as a temporary adaptive response to the stress of the birth process (Carroll, Denenberg, & Thoman, 1999). Jaundiced newborns tend to sleep more than nonjaundiced infants, which may have origins in increased carbon monoxide production. Carbon monoxide is formed from the breakdown of heme to bilirubin and is produced at a rate equal to the rate of bilirubin synthesis. Increased carbon monoxide production in jaundiced infants may likely play a role in increased sleep states due to the regulatory effects on sleep circadian rhythm and REM sleep via the cholinergic system activation (Ozkan, Tuzan, Kumral, Yesilirmak, & Duman, 2008). The first 2 hours after delivery offer the earliest opportunity for imprinting and latch to take place. However, most newborn infants do not fall into a deep sleep state for the next 24 hours after that point. Infants experience sleep cycles during this time, which makes it important that infants be kept with their mothers to take advantage of feeding opportunities during sleep–wake transition times.

Many mothers may be under the impression that crying indicates when it is time to feed an infant. In reality, crying is a late sign of hunger, and a sleepy infant may not come to a full arousal state and cry. Feeding cues in some infants can be very subtle and easily overlooked. Maternal labor medications can interfere with state control in infants, making it difficult to feed a sleepy infant. When such an infant arouses, he or she may go from sound sleep to hard crying, bypassing the graded levels of arousal in between. Sleeping is not an indication that an infant is receiving sufficient amounts of milk. Some parents have been told never to wake a sleeping infant, believe that sleeping is an indication that the infant is content, work toward causing the infant to sleep as much as possible, and have unrealistic expectations regarding the nature of newborn sleep.

The sleep organization of breastfed and formula-fed infants is different (Butte, Jensen, Moon, Glaze, & Frost, 1992), changes over time, and is influenced by maturation, development, nutrition, and caretaking patterns. Over the first 4 months of life, non-rapid-eye-movement (NREM) sleep (light sleep) increases to about 60% and REM sleep (deep sleep) decreases to approximately 40% of total sleep (Roffwarg, Muzio, & Dement, 1966). Breastfed infants typically show more spontaneous arousals from sleep (McKenna, Mosko, Dungy, & McAninch, 1990), especially in the early morning, spend more time in NREM sleep, and demonstrate accelerated maturation of the central nervous system compared with formula-fed infants.

Many infant training programs (Pinilla & Birch, 1993) exist to cause young infants to lengthen their nighttime sleep bouts, especially during the early months of life, when they are also at higher risk for SIDS (Schechtman, Harper, Wilson, & Southall, 1992). Parents should be aware that sleep training books and programs may not be in the best interest of a young infant. Arousal from sleep is a survival mechanism that can be impaired by the major risk factors for SIDS such as prone sleeping and maternal smoking. Horne, Parslow, Ferens, Watts, and Adamson (2004) found that 2- to 3-month-old formula-fed infants are less arousable in active sleep than breastfed 2- to 3-month-old infants. They also state that breastfeeding during the critical risk period for SIDS (2–4 months) remains very important, because reduced arousability in active sleep could impair the ability of an infant to respond to a life-threatening situation.

The establishment of organized sleep states and a normal sleep pattern during the neonatal period contribute to brain development and plasticity. The consolidation of the circadian sleep–wake cycle typically occurs between 1 and 4 months in term infants and somewhat later in preterm infants. Human milk contains a number of bioactive sleep-promoting components that include melatonin, tryptophan, nucleosides/nucleotides, and vitamin B_{12}. Some of these show circadian rhythms. Human milk has the capability to function in a manner that may synchronize the infant to consolidate a circadian sleep–wake cycle (Arslanoglu, Bertino, Nicocia, & Moro, 2012).

Some infants whose breastfeeding needs are not met at night, when it is "not all right" to breastfeed, may be unable to differentiate when it is permissible or not permissible to breastfeed and refuse to breastfeed during the day. Young breastfed infants during the early weeks of life need to feed at night. This ensures adequate weight gain and an abundant milk supply. Feeding very young infants cereal at night to make them sleep longer is a misconception, does not cause longer sleep (Macknin, Medendorp, & Maier, 1989), and displaces breastmilk from the diet. An infant who is very sleepy in the early days of life is a challenge to the breastfeeding mother (Walker, 1997). She needs to know when the infant is actually swallowing milk (**Box 5-3**) and how to know that the infant is getting enough milk (**Table 5-4**).

These data assume that infants have not experienced breastfeeding difficulties or any interventions that might disrupt the normal acquisition of early breastfeeding skills. The length of time for meconium to transition to the typical breastfed stool varies with gestational age, pattern of feedings, amount of intake, and supplementation with other fluids. Transitioning stool color serves as one of a number of indicators of sufficient breastmilk intake and infant wellbeing (Salariya & Robertson, 1993). Parents and clinicians often find it easier and more accurate to use a handout that illustrates stool color and

Box 5-3 Signs of Swallowing

- Hearing a puff of air from the nose
- Hearing a "ca" sound
- Hearing a swallow in the throat
- Feeling the areola drawn farther into the infant's mouth
- Seeing the areola move toward the infant's lips
- Observing the infant's jaw drop lower than during non-nutritive sucking
- Feeling the swallow by placing fingers on the infant's throat
- Hearing swallowing by listening with a stethoscope on the infant's throat

Table 5-4 Signs of Sufficient Breastmilk Intake

Age	Wet Diapers	Color	Urates	Stools	Color	Volume	Consistency	Weight Gain
Day 1	1	Pale	Possible	1	Black	≥ 15 g	Tarry/sticky	< 5% loss
Day 2	2–3	Pale	Possible	1–2	Greenish/ black	≥ 15 g	Changing	< 5% loss
Day 3	3–4	Pale	Possible	3–4	Greenish/ yellow	≥ 15 g	Soft	≤ 8–10% loss
Day 4	≥ 4–6 disposable ≥ 6–8 cloth	Pale	None	4 large 10 small	Yellow/ seedy		Soft/liquid	15–30 g/day

Modified from Powers, N. G., & Slusser, W. (1997). Breastfeeding update 2: Clinical lactation management. *Pediatrics in Review, 18,* 147–161; Black, L. S. (2001). Incorporating breastfeeding care into daily newborn rounds and pediatric office practice. *Pediatric Clinics of North America, 48,* 299–319; Neifert, M. R. (2001). Prevention of breastfeeding tragedies. *Pediatric Clinics of North America, 48,* 273–297.

consistency changes (**Figure 5-21**), as well as a diaper log, which ensures adequate intake or signals a need for clinical intervention.

Drowsiness at breast may also be related to the normal release of metabolic hormones that occurs when an infant breastfeeds. One such hormone, cholecystokinin (CCK), is a gastrointestinal hormone that enhances gut maturation, promotes glucose-induced insulin release, is released mainly in response to fat in the diet, enhances sedation, and is thought to play a role in regulating food intake by signaling satiety (Marchini & Linden, 1992). Breastfed infants have higher plasma concentrations of CCK during the first 5 days than do formula-fed infants (Marchini, Simoni, Bartolini, & Linden, 1993). During the breastfeeding episode, CCK has the effect of inducing sleepiness in both the mother and the infant (Uvnas-Moberg, Widström, Marchini, & Winberg, 1987). CCK levels in infants demonstrate two peaks related to breastfeeding. The first increase is seen immediately after breastfeeding, most likely due to activation of the vagal nerve; it is followed by a decline at 10 minutes and then a secondary rise at 30–60 minutes after feeding due to the stimulation effect of food on the CCK-producing cells (Uvnas-Moberg, Marchini, & Winberg, 1993). The interval between these two peaks, especially at about 10 minutes after the feed on the first side, may subsequently determine the optimal timing for placing the infant on the second breast because he or she may more easily arouse at that point in the CCK cycle. Interventions to help sleepy infants to breastfeed depend on the contributing factors and may change over time (**Box 5-4**).

FUSSY INFANT

An infant who is fussy at the breast or who fusses and is fretful after a feeding is a cause of significant anxiety in a new mother. Many mothers interpret a fussing infant or one who is not satisfied after a feeding to mean an insufficient milk supply (Hillervik-Lindquist, Hofvander, & Sjolin, 1991; Sjolin, Hofvander, & Hillervik, 1977, 1979; Verronen, 1982). In fact, the major cause of supplementation and premature weaning is perceived (or real) insufficient milk (Bevan, Mosley, Lobach, & Salimano, 1984; Bloom, Goldbloom, Robinson, & Stevens, 1982; Hill, 1991). Newborns may temporarily lack the refined skills for abundant milk transfer and indeed remain hungry after a feeding. Normal fluctuations in milk

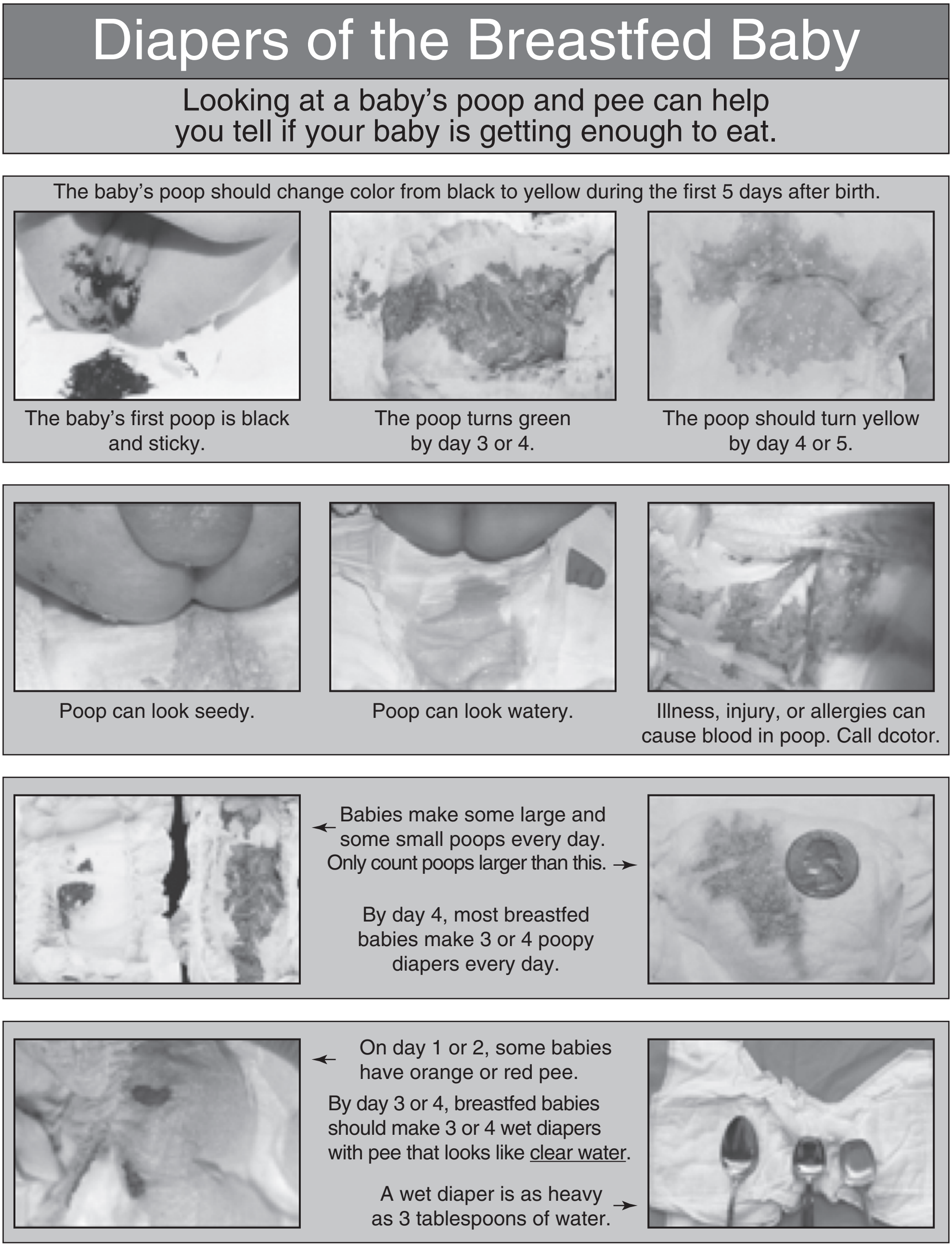


Figure 5-21 Diapers of the breastfed baby.

Box 5-4 Problem of the Sleepy Baby

Problem Description

- Baby does not wake or fuss on a regular enough basis to indicate hunger
- Baby falls asleep at breast after a few sucks
- Baby sucks sporadically at breast, falls asleep, wakes when put down, but continues to feed poorly
- Baby falls asleep before taking second breast

Contributing Factors

- Maternal illness or certain prenatal medications
- Birth complications with increased levels of endorphins
- Prematurity
- Neonatal illness
- Congenital anomalies
- Operative delivery
- Birth trauma
- Maternal labor medications with resulting state disorganization
- Overstimulating environment
- Invasive procedures
- Prolonged crying
- Increased levels of cholecystokinin (CCK)
- Hyperbilirubinemia
- Phototherapy

Management	Rationale
Keep mother and baby together.	This decreases crying, which is a behavioral sign of stress. Separated infants cry 10 times more often than when kept with their mother (Michelsson, Christensson, Rothganger, & Winberg, 1996).
Suggest skin-to-skin contact as much as possible: Baby can be carried in a sling once home so that breastfeeding cues are immediately recognized.	Mothers can respond immediately to these subtle cues. This helps to repattern the baby to suck at breast if artificial nipples have been used or if the mother was medicated during labor and delivery.
Teach alerting techniques to use when feeding cues are observed: • Talk to the baby with variable pitch. • Tickle or stroke the palms or soles. • Rub the baby's face. • Put his hand to his mouth. • Allow him to smell a nursing pad with colostrum on it.	These activities stimulate the trigeminal nerve (5th cranial nerve), which is the sensory arm for rooting and sucking. The trigeminal has input into the reticular activating system—the alarm clock of the brain. Sucking action decreases above 27°C (80°F) room temperature. Allows baby's movements to awaken him.

(continues)

Box 5-4 Problem of the Sleepy Baby *(continued)*

Management	Rationale
• Sit the baby upright. • Unwrap the baby; change the diaper. • Move in any direction with uneven rhythms.	
Provide incentives at breast to entice the baby to wake and feed: • Place a dropper of colostrum or D5 into the side of the baby's mouth while latching. • Use a feeding-tube device, butterfly tubing taped to breast and connected to a 10-cc syringe, gavage tubing taped to breast, or periodontal syringe (**Figure 5-22**) to deliver boluses at breast.	Establishing flow of fluid will often initiate and help sustain sucking.
If the baby is overstimulated and is shutting out the noise and light by sleeping, modify the environment and attempts at stimulation: • Provide a quiet, dim room. • Do some gentle walking. • Pat baby's back at the rate of his heartbeat, gradually slowing the patting to 72 beats per minute. • Feed the baby for short periods of time with timeouts. • Avoid talking to the baby or rubbing his head while at breast. • Avoid jiggling the baby. • Tug back gently on the nipple to induce a suck as long as the nipples are not sore. • Use alternate massage if baby dozes at breast between sucking bursts. • Avoid caretaking behaviors that promote sleep such as tight wrapping, solitary sleeping in a bassinet, use of a pacifier, rocking the bassinet, high ambient temperature, ignoring cries or feeding cues.	These modifications help supply behavioral organization to a disorganized or dysmature baby.
If baby refuses the second breast at a feeding, suggest that the mother offer it after 10 minutes or after about an hour or when she sees feeding cues again.	CCK levels usually fall at these times and baby may start to cycle into a lighter sleep state.
To help parents and clinicians keep track of feedings and diaper counts, a log can be given to parents to fill out for a week or so until the problem is resolved (**Figure 5-23**).	Recording feedings and diaper counts helps parents recognize when to seek help and avoid more serious problems such as dehydration and jaundice.

Figure 5-22 Periodontal syringes.

First Week Diaper Diary

1. Circle the hour closest to when your baby starts each breastfeeding.
2. Circle a **W** when your baby makes a wet diaper.
3. Circle a **P** when your baby makes a poopy diaper.

Some babies make more diapers each day than shown. This is great!

Sample Record for Day 4

Feedings: 12 1 2 3 4 5 6 7 8 9 10 11 Noon 1 2 3 4 5 6 7 8 9 10 11

Wet Diapers: W W W W W W

Green or Yellow Poops: P P P P

In this sample, the baby had nine feedings, six wet diapers, and three poopy diapers. By Day Four, most babies breastfeed 8 to 12 times each day

Birth Date: ______/______/______ Time: ______________ AM PM
Birth Weight: _______________ Discharge Weight: _______________
Baby's weight at one week: _______________________________
For breastfeeding help call:

Call your doctor, nurse, midwife, or breastfeeding helper if:
1. **Your baby is not making enough wet or poopy diapers**
2. **There is dark-colored pee after Day 3**
3. **There is dark-colored poop after Day 5**

Day 1

Feedings: 12 1 2 3 4 5 6 7 8 9 10 11 Noon 1 2 3 4 5 6 7 8 9 10 11

Wet Diapers: W

Black Tarry Poops: P

Day 2

Feedings: 12 1 2 3 4 5 6 7 8 9 10 11 Noon 1 2 3 4 5 6 7 8 9 10 11

Wet Diapers: W W

Black Tarry Poops: P P

Day 3

Feedings: 12 1 2 3 4 5 6 7 8 9 10 11 Noon 1 2 3 4 5 6 7 8 9 10 11

Wet Diapers: W W W

Green Poops: P P P

Day 4

Feedings: 12 1 2 3 4 5 6 7 8 9 10 11 Noon 1 2 3 4 5 6 7 8 9 10 11

Wet Diapers: W W W W

Green or Yellow Poops: P P P P

Day 5

Feedings: 12 1 2 3 4 5 6 7 8 9 10 11 Noon 1 2 3 4 5 6 7 8 9 10 11

Wet Diapers: W W W W W

Yellow Poops: P P P P

Day 6

Feedings: 12 1 2 3 4 5 6 7 8 9 10 11 Noon 1 2 3 4 5 6 7 8 9 10 11

Wet Diapers: W W W W W W

Yellow Poops: P P P P

Day 7

Feedings: 12 1 2 3 4 5 6 7 8 9 10 11 Noon 1 2 3 4 5 6 7 8 9 10 11

Wet Diapers: W W W W W W

Yellow Poops: P P P P

Figure 5-23 First-week diaper diary.

supply, growth or appetite spurts, or infant temperament can also influence an infant's behavior surrounding the feeding process. Maternal analgesia during labor has been described to have an effect on infant behavior, including increased crying (Ransjo-Arvidson et al., 2001). Maternal smoking during pregnancy has also been reported as contributing to infants who have more fussy periods and more intense reactions to events surrounding them (Kelmanson, Erman, & Litvina, 2002). Exposure to tobacco smoke and its metabolites has been linked to increased levels of plasma and intestinal motilin (a peptide that stimulates contractions in the gastrointestinal tract) in infants whose mothers smoked during pregnancy or who are exposed to second-hand smoke. Elevated levels of motilin have been linked with an increased risk of gastrointestinal dysregulation, including colic and acid reflux (Shenassa & Brown, 2004). There is a common perception that breastfed infants cry more, which may be related to the faster emptying of the stomach when it contains breastmilk, leading to the signal of fussing or crying as a hunger cue. However, changing an infant over to formula feeding may not reduce crying but may merely redistribute it away from evening and nighttime hours, giving the impression that the breastfed infant was not fed enough (Barr, Kramer, Pless, Boisjoly, & Leduc, 1989). Failure to address the cause of an unhappy breastfed infant can quickly lead to a downward spiral of formula supplementation, true insufficient milk, and weaning (**Box 5-5**).

On the other end of the spectrum, infant fussiness may be related to a cluster of symptoms variously described as hyperlactation (oversupply) and/or overactive letdown reflex, which often occur together, usually well after the mother has established an abundant milk supply. Sometimes an infant is fussy at breast and between feeds because of gastroesophageal reflux.

Box 5-5 Problem of the Fussy Baby

Problem Description

- Baby may fuss during a feeding
- Baby may fuss following a feeding or fall asleep at the breast and fuss when put down
- Baby may fuss between feedings, startle easily, or appear irritable
- Baby may resist being put to the breast, arch away from the breast, push back with the arms, extend the head, or turn away from the breast
- Once latched, baby may choke, gag, or repeatedly come on and off the breast
- Baby may stiffen when approaching the breast or flail his or her arms and legs

Contributing Factors

- Birth trauma or pain (fractured clavicle/humerus), vacuum extraction, forceps, cephalohematoma
- Intracranial hemorrhage
- Oral aversion (suctioning, intubation, gloved finger)
- Prenatal or perinatal medications
- Illicit drug use by mother or chemically dependent mother
- Sensory sensitivity
- Sensory overload
- Faulty imprinting on an artificial nipple
- Baby may be hungry due to poor feeding skills or limited milk transfer
- Insufficient milk supply
- Gastroesophageal reflux

Management	Rationale
Fussing or arching during feeding may indicate air in the baby's stomach, signaling that the baby needs to burp.	Babies swallow air when they cry; burping the baby may relieve his stomach discomfort.
If baby is overhungry, mother can express a small amount of colostrum or milk and feed the baby prior to latching attempts.	This helps to calm the baby by taking the edge off of hunger.
Offer more nighttime breastfeedings.	Many babies feed better at night because they prefer the darker, quieter environment.
Babies with birth injuries may be fussy; mothers should be instructed to: • Position baby to avoid further trauma or pain to injury. • Provide appropriate pain medication to a baby who is in pain.	Pain relief contributes to better organized feeding skills.

The sleepy infant, the reluctant nurser, and the fussy infant may all describe the same infant at different times. The fussy infant may respond to any of the interventions described for the sleepy infant or an infant who is reluctant to breastfeed. An infant who is fussy and reluctant to latch can be the infant with birth trauma who falls asleep at the breast. Too often, one intervention is attempted one time for one problem but does not work immediately, so another approach is tried, confusing the infant and the parents, leaving the problem unresolved, and allowing the situation to continue to deteriorate. Inconsistent information combined with recommendations to keep trying a variety of interventions with no systematic evaluation and follow-up is a recipe for early weaning.

A written care plan for infants and mothers experiencing problems, which is modified as needed until the problem resolves, is a more logical approach to early problematic breastfeeding situations (**Box 5-6**). Some hospitals have a whiteboard in patient rooms and use this to write the breastfeeding plan for each day of the hospital stay. This keeps the plan in prominent sight for both the mother and staff. During the time a mother and infant are in the hospital, charting systems should record breastfeeding progress and expected outcomes (Bassett, 2001; **Figure 5-24**). Variances from the expected behaviors are recorded, and a feeding plan should be devised to address outstanding issues. Some hospitals use care plans or care maps to organize teaching within short hospital maternity stays (Zander, 1991, 1992). A pathway is a collaborative plan of care that:

- Identifies critical components of intervention and care that must occur to achieve a predetermined length of stay
- Sequences major interventions to achieve the anticipated length of stay
- States the desired patient outcomes
- Ensures consistency of patient care
- Eliminates duplication or omission of information
- Provides objectives that are to be met each day to avoid information overload on the day of discharge
- Becomes a systematic plan of care so that each nurse has responsibility for a part of the total patient education plan

Box 5-6 Care Plan for the Infant Who Won't Latch On

Occasionally, there are times when an infant has difficulty latching on to the breast. Having a step-by-step plan to guide you will help you through those feeds. The goals are to stimulate milk production and make sure your infant has adequate nourishment.

Suggestions

1. Work with your infant in short increments of time.
2. Undress the infant to the diaper; take off your top and bra to maximize skin-to-skin contact. This will help keep infant awake and more alert during feeds.
3. Spend time snuggled with your infant skin-to-skin, with no attempt to latch on.
4. Make sure you are comfortable, with supporting pillows all around.
5. Watch closely for feeding cues. When your infant demonstrates interest in feeding, attempt to put him or her to breast. Wait until infant's mouth opens wide (you can gently tickle the lower lip with your nipple) and the tongue is down. Express a bit of breastmilk onto the nipple to entice infant. Quickly pull your infant to the breast, leading with the chin so that he or she gets a big mouthful of breast tissue.
6. Use your dominant hand to pull your infant to the breast quickly:
   - *Right handed:* Football (clutch) hold on the right side
   - *Left handed:* Cross-cradle (transverse) hold on the left side
7. If your infant cries, arches away, or pulls back, stop immediately; calm him or her by allowing infant to suck on your finger (nail side against the tongue). When infant's suck becomes rhythmical and infant is calm, try again. Try ventral positioning by leaning back at a 35-degree angle and placing the baby on his tummy to feed. If he or she is crying and arching away, try only three times at that feeding.
8. Work with your infant as long as he or she is calm and willing to work to go to breast. Do not push infant's tolerance level or try to get him or her to attach to the breast while screaming. You can try each breast and each position—you never know which one will work.
9. Use verbal positive reinforcement when your infant latches on.
10. If your infant does not latch on at that time, feed expressed breastmilk with a small cup or hollow-handled medicine spoon. Pump your breasts and save the milk for the next feed (breastmilk is safe at room temperature for 8–10 hours).
11. When your infant shows interest in the breast, try again. As long as you continue to pump your breasts, attempt to put your infant to breast, and feed him or her without a bottle nipple, you will maintain your milk supply.
12. Attempt to put your infant to breast at every feeding—at least 8 times in 24 hours.
13. Attempt feeding your infant before your infant is fully awake or crying to feed.
14. A successful latch-on during the night is common.

Mother's signature Date

Lactation consultant's signature Date

Data from parental care plan for infants who won't latch handout developed for Breastfeeding Support Consultants, 1996.

Nutrition and Elimination

Criteria for assessment of newborn infant at the breast position:

- Mother states that she is comfortable: back, feet, and arms supported (head supported in side-lying)
- Infant's head and body supported at the level of the breast (pillows usually helpful with cradle and football to support mother's arm that is holding infant's head and body)
- Infant turned completely on side with nose, chin, chest, abdomen, and knees touching mother (cradle and side lying)
- Infant's head in neutral position (hip, shoulder, and ear aligned)
- Infant kept close by support from mother's arm and hand along the infant's back and buttock
- Mother's breast supported with cupped hand; thumb and fingers will be back from areola

Latch:

- Mouth wide open (like a yawn)
- Lips visible and flanged outward
- ¾–1" of areola covered by the infant's lips (usually most or all of the areola)
- Tongue over lower gum line
- No clicking or smacking sounds
- No indrawing or dimpling of cheek
- Mother states she is comfortable (no persistent nipple pain)

Suck and Swallow:

- Chin moves in rhythmic motion
- Bursts of sucking, swallowing, and rests

First Side X Second Side		**Date**																
		Time																
	Breast																	
RIGHT SIDE	POSITION	Reverse arm hold																
		Cradle																
		Football																
		Sidelying																
	BABY RESPONSE	Latch achieved																
		Minimal sucking																
		Sustained sucking																
		Sucking & swallowing																
		No latch achieved																
		Too sleepy																
		Reluctant																
LEFT SIDE	POSITION	Reverse arm hold																
		Cradle																
		Football																
		Sidelying																
	BABY RESPONSE	Latch achieved																
		Minimal sucking																
		Sustained sucking																
		Sucking & swallowing																
		No latch achieved																
		Too sleepy																
		Reluctant																
ASSISTANCE	Independent																	
	Minimum																	
	Moderate																	
	Maximum																	
	Feeding observed by nurse																	
	Feeding reported by patient																	
	Formula																	
		RN initials																
STOOLS	Meconium																	
	Transitional																	
	Curdy																	
	Yellow																	
	Green																	
	for each stool																	
URINE	Normal																	
	Uric acid crystals																	
	for each void																	

Figure 5-24 Assessment of newborn at breast.

Data from original developed by the Ottawa Hospital, ON, Canada.

Accompanying a pathway would be a list of criteria for referral to a lactation consultant (Backas, 1998) for more specialized and intensive work with the mother and baby to create the in-hospital and discharge feeding plan (**Box 5-7** and **5-8**).

Mothers of infants who do not respond to a standard feeding plan need individualized plans with interventions based on what the infant responds to best during feedings. Because the mother is a partner in the development of feeding plans, any plans that are formulated should be done so with her input and assurances that the plan can be carried out (Cadwell & Turner-Maffei, 2004). Critical thinking

Box 5-7 Criteria for Referral to In-Hospital Lactation Consultant

On Admission to Postpartum

- Multiple birth
- Maternal history of breast surgery/biopsy
- Maternal–infant separation due to maternal illness
- Maternal breast or nipple pathology/anomaly
- Adolescent 19 years of age or younger
- Maternal insulin-dependent diabetes mellitus
- History of previous unsuccessful breastfeeding experience
- Newborn admitted to special care nursery
- Newborn low-birth-weight (less than 2,500 g at birth)
- Newborn with birth weight 9 pounds or greater
- Newborn repetitive low blood sugar
- Newborn repetitive low body temperature
- Newborn less than 38 0/7 weeks' gestation
- Sibling required phototherapy as a newborn
- Newborn with cleft lip/palate
- Newborn anomaly with potential feeding impact

After Admission to Postpartum—Mother/Newborn Experiencing Any of the Following Problems

- Failure to latch on
- Repeated difficult latch-on
- No/poor suckling
- Newborn weight loss of 7% or more of birth weight
- Anytime use of breast pump is initiated
- Sore nipples
- Newborn having significant jaundice with or without receiving phototherapy (TSB plotting greater than 75th percentile on risk assessment)
- Newborn receiving phototherapy
- At any time upon the mother's request after the postpartum nurse has provided education and intervention

Beth Allen, RNC, IBCLC, Manager, Lactation Center, Northside Hospital, Atlanta, GA, 2012.

Box 5-8 Situations in Which Consultation With an Expert in Lactation Management May Be Helpful

- Maternal request/anxiety
- Previous negative breastfeeding experience
- Mother has flat/inverted nipples
- Mother has history of breast surgery
- Multiple births (twins, triplets)
- Infant is premature ($<$ 37 weeks' gestation)
- Infant has congenital anomaly, neurological impairment, or other medical condition that affects the infant's ability to breastfeed
- Maternal or infant medical condition for which breastfeeding must be temporarily postponed or for which milk expression is required
- Documentation, after the first few feedings, that there is difficulty in establishing breastfeeding (e.g., poor latch-on, sleepy infant)
- Hyperbilirubinemia

Reproduced from Academy of Breastfeeding Medicine. (2013). *Clinical protocol number 5: Peripartum breastfeeding management for the healthy mother and infant at term, revision 2013.* Retrieved from www.bfmed.org/Media/Files/Protocols/Protocol_5_revised2013.pdf

(Bandman & Bandman, 1988) is necessary to start the problem-solving process (Burns & Grove, 1993) for the creation of a feeding plan tailored to each mother–baby unit's unique needs. The problem-solving process involves the following steps:

- Gathering and evaluating data
- Defining the problem
- Determining and evaluating potential options
- Choosing an approach and taking action
- Evaluating the outcomes of the action (Nichols & Zwelling, 1997)

A feeding plan also includes short- and long-term goals, outcome criteria, evaluation of the plan, and revisions as needed. For example, a common occurrence during a 48-hour hospital stay for many newborns and their mothers is an infant with ineffective latch and feeding, with the resulting question: "How long should the infant go before we supplement?" There is no one right answer to this question or situation; it depends on the status of the infant and the availability of skilled intervention. A feeding plan could resemble the sample in Box 5-4 depending on the factors contributing to the problem.

Decision Trees/Clinical Algorithms

Many hospital maternity units and outpatient settings use clinical algorithms (Babic, Kokol, & Stiglic, 1999; Babic, Sprogar, Zorman, Kokol, & Turk, 1999) or decision trees as guidelines, tools for decision support, and strategies to strengthen the intervention choice process. Algorithms can be used by staff nurses as a quick reference for needed interventions and as a tool for determining when to refer to the lactation consultant (Cobb, 2002). The decision trees featured in **Figures 5-25**, **5-26**, **5-27,** and **5-28** are examples of comprehensive and effective breastfeeding and postpartum checklists and flowcharts. Additional algorithms are available in **Appendix 5-2**.

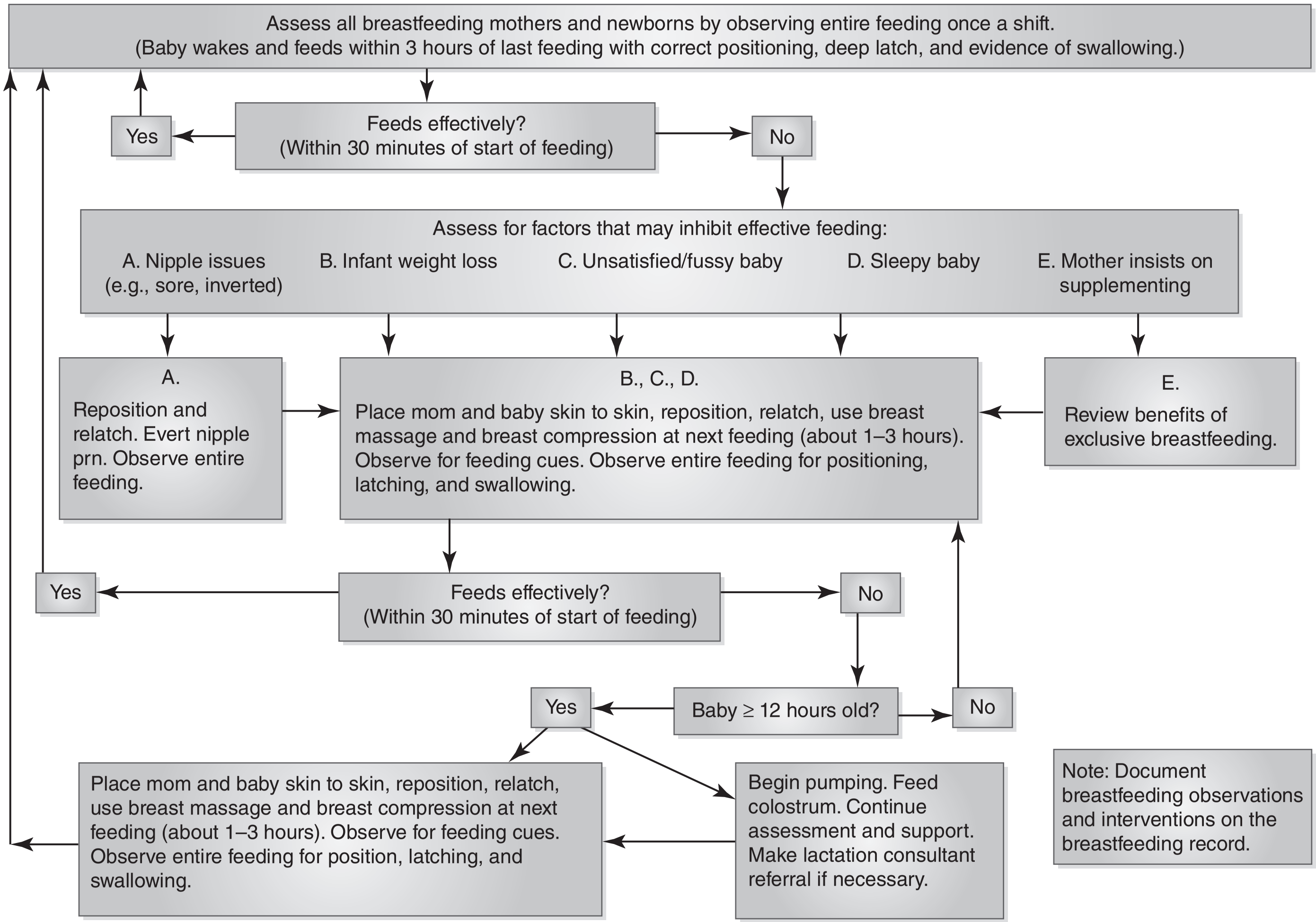


Figure 5-25 Breastfeeding decision tree and checklist. For use with normal newborns of more than 37 weeks' gestational age.
© Presbyterian Hospital of Dallas, 2003. Used with permission.

Checklist

Normal breastfeeding:

- ☐ Baby wakes and breastfeeds about every 1½ to 3 hours.
- ☐ Baby nurses 8–12 times in 24 hours.
- ☐ Baby may have frequent nursing sessions over a 4- to 5-hour period followed by a 4- to 5-hour sleep.
- ☐ Baby wakes more frequently to nurse at night compared to daytime, during the early days.
- ☐ Baby nurses better during quiet alert state.
- ☐ Baby learns to nurse more effectively when kept skin to skin with mom.
- ☐ When feeding cues are observed, place baby skin to skin with mom and offer breast.
- ☐ Avoid pacifier unless requested by mom. Pacifiers are associated with masked feeding cues, fewer breastfeeding sessions per day, lower breastmilk intake, and shorter breastfeeding duration.
- ☐ Rooming-in associated with shorter time to effective latch, increased milk supply, and longer breastfeeding duration.

Signs of milk transfer:

- ☐ Mom has contractions.
- ☐ Mom is thirsty.
- ☐ Mom gets drowsy.
- ☐ Baby switches from non-nutritive suck to long "suck/swallows."
- ☐ Baby has one or more wet diapers and one or more stools during the first 24 hours.
- ☐ Baby has two or more wet diapers and two or more stools during the second 24 hours.
- ☐ Baby has three or more wet diapers and two or more stools during the third 24 hours.
- ☐ Baby has four or more wet diapers and two or more stools during the fourth 24 hours.

Exclusive breastfeeding in the early postpartum period is associated with:

- ☐ Shorter time to effective latch.
- ☐ Greater milk supply and longer breastfeeding duration.
- ☐ Decreased exposure to foreign proteins.

The American Academy of Pediatrics (AAP) recommends exclusive breastfeeding for about 6 months, with the gradual introduction of iron-rich solid foods combined with breastmilk during the second half of the first year. The AAP recommends that breastfeeding continue for at least 12 months and, thereafter, for as long as mutually desired.

If there is a compelling clinical indication for supplementation, quantity should mimic the average intake of a breastfed baby:

Age in Hours	Amount/Feed	24-Hour Total*
<24	4–5 cc	1 oz
<48	15–20 cc	3–4 oz
<72	30 cc	8 oz
<96	60 cc	16 oz

*Based on 8 feedings/day

Figure 5-25 *(continued)*

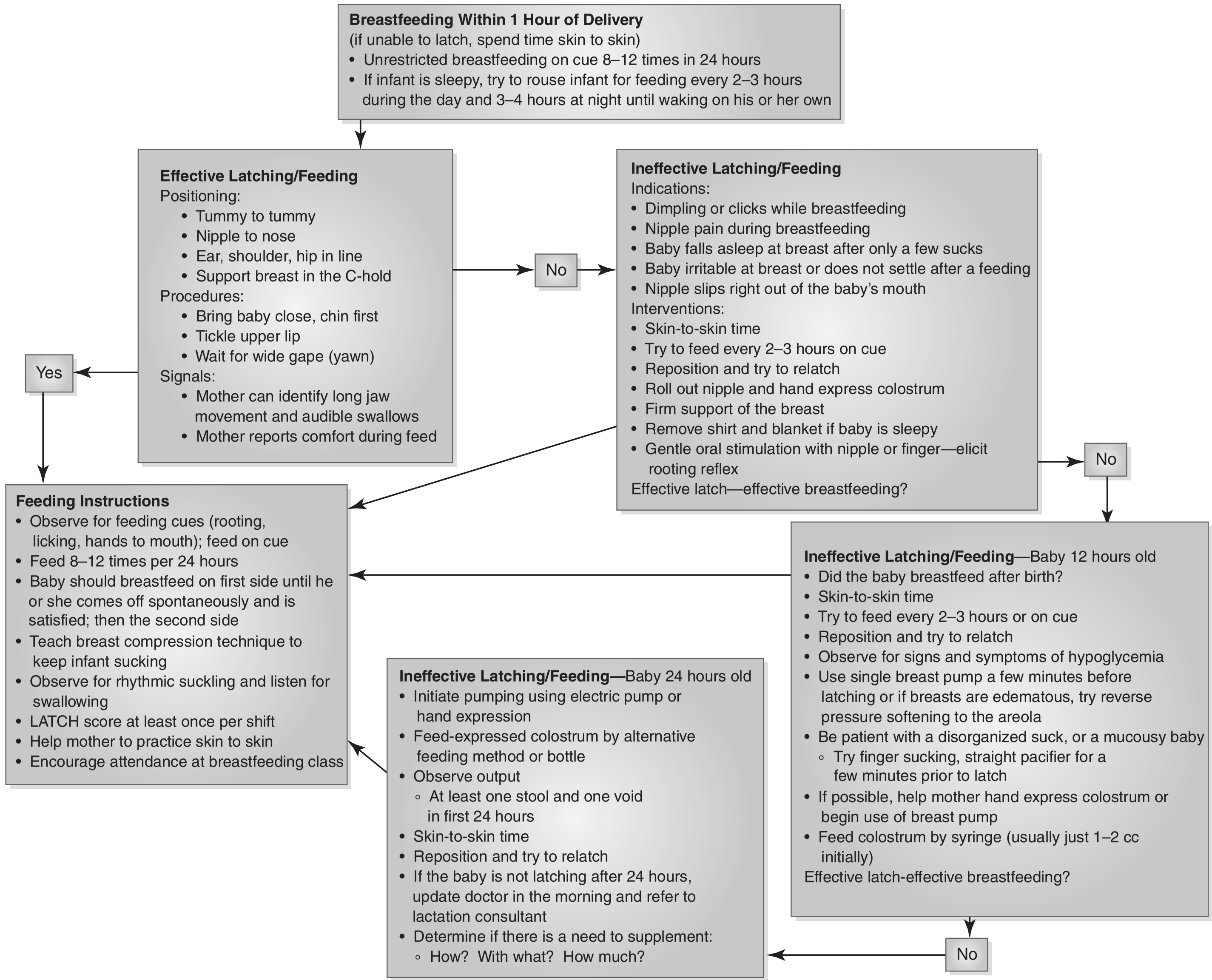


Figure 5-26 Breastfeeding guidelines for the first 24 hours through discharge for a healthy 37+ week infant.
Reproduced with permission from Winchester Hospital, Winchester, Massachusetts.

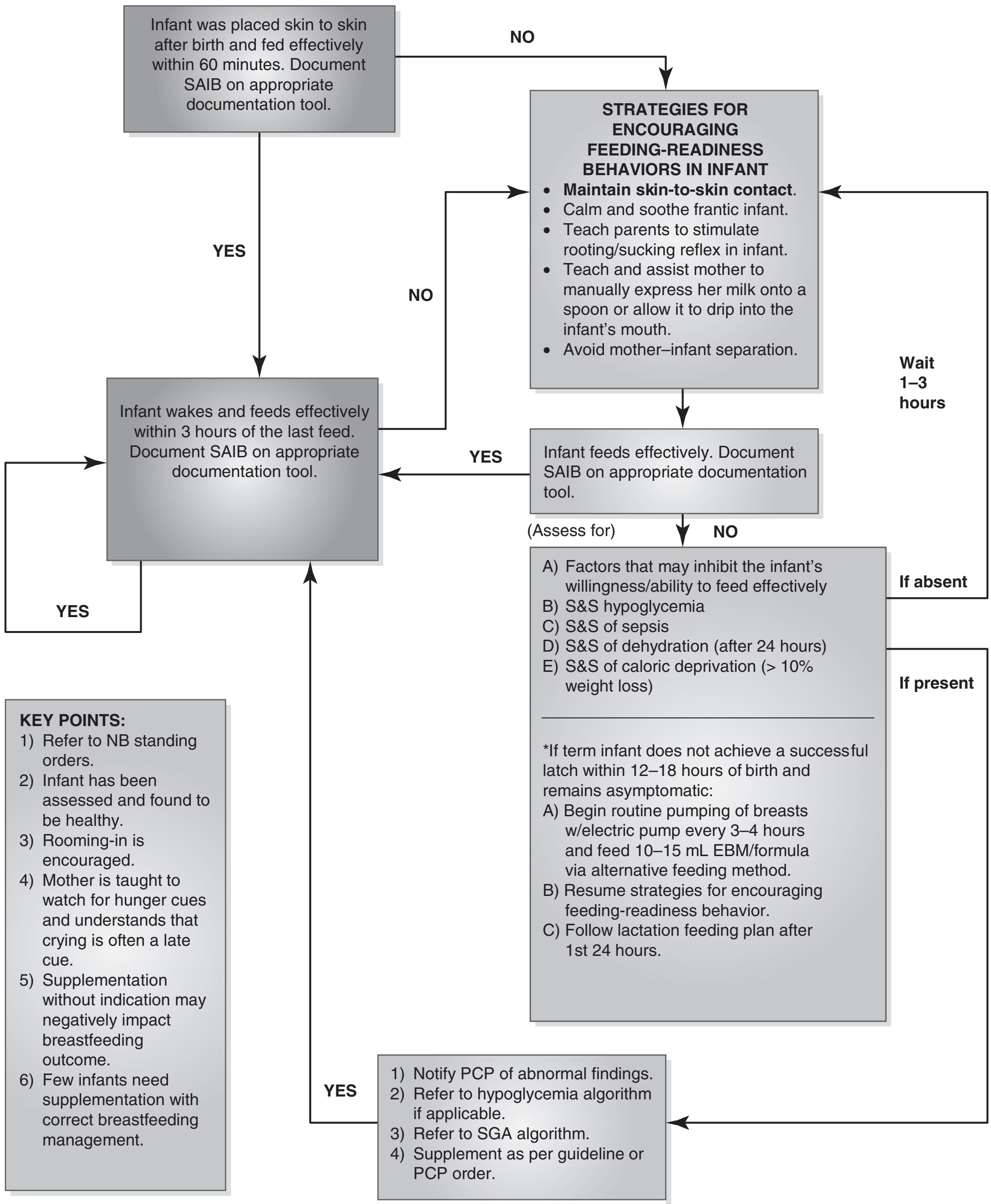


Figure 5-27 Breastfeeding flowchart for the term infant.
Elliot Hospital, Manchester, New Hampshire. Used with permission.

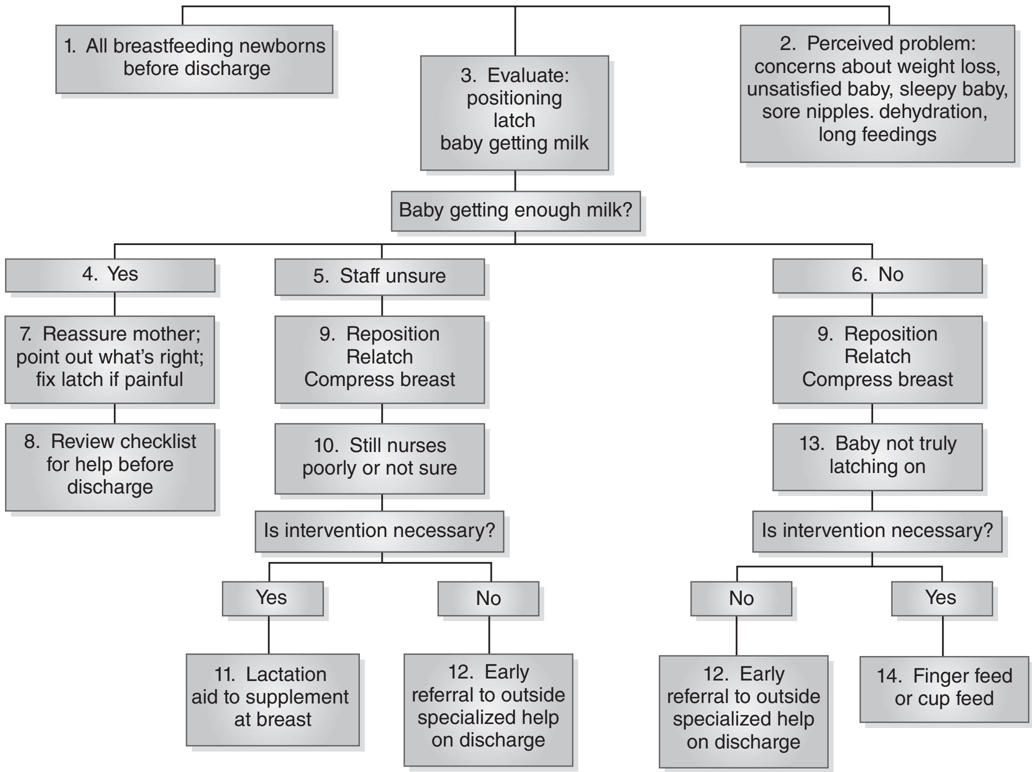


Figure 5-28 Immediate-postpartum decision tree.

Data by Jeannette Crenshaw for the Lamaze International Breastfeeding Support Specialist Training Program from: Newman, J. (1996). Decision tree and postpartum management for preventing dehydration in the breastfed baby. *Journal of Human Lactation, 12,* 129–135. Used with permission.

Problem of Hypoglycemia

Hypoglycemia is a common metabolic concern in the newborn infant and represents a continuum of blood glucose concentration, falling immediately after delivery and rising thereafter. Hypoglycemia is not a single number. Transient hypoglycemia in the first 3 hours after birth is normal with spontaneous recovery. Although breastfeeding in the first hour after birth is very important to the course of lactation, feeding a normal healthy newborn in the first hour after birth does not cause the blood glucose levels to rise (Sweet, Hadden, & Halliday, 1999). However, Chertok, Raz, Shoham, Haddad, and Wiznitzer (2009) found that infants of mothers with gestational diabetes who were breastfed immediately following birth had a significantly lower rate of borderline hypoglycemia than those not fed in the early postpartum period. They also had significantly higher mean blood glucose levels compared with those not breastfed immediately after delivery, and also had a mean blood glucose level that was higher than those infants who were formula fed for their first feed. An infant who misses this opportunity at breast does not require supplementation, nor does a healthy full-term breastfeeding infant require routine blood glucose monitoring (Adamkin & Committee on Fetus and Newborn, American Academy of Pediatrics, 2011). Adaptation in normal circumstances progresses in a pattern.

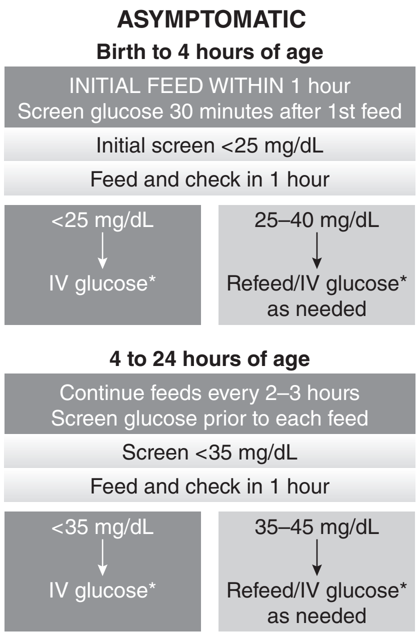
Physiological Adaptation After Birth

- The brain derives almost all of its energy from glucose.
- During gestation, glucose is stored in the fetus as glycogen, mostly in the liver but also in cardiac and skeletal muscle.
- Delivery terminates the glucose supply obtained from the mother in utero.
- Hepatic breakdown of the stored glycogen is triggered within minutes of the umbilical cord being cut by a surge in glucoregulatory hormones:
  - Increased epinephrine.
  - Increased insulin.
  - Increased norepinephrine.
  - Increased catecholamines.
  - Increased glucagon.
  - Increased corticosteroids.
  - Net effect is mobilization of glycogen and fatty acids.
- Liver glycogen stores are 90% depleted by 3 hours and gone by 12 hours (Hagedorn & Gardner, 1999).
- Activities that maintain glucose homeostasis are collectively called counter-regulation and consist of:
  - Glycogenolysis: the mobilization and release of glycogen from body stores to form glucose.
  - Gluconeogenesis: the production of glucose by the liver and kidneys from noncarbohydrate substrates such as fatty acids and amino acids.
  - Rate of glucose production is 4–6 mg/kg/min.
  - 3.7 mg/kg/min are needed to meet the energy requirements of the brain.
  - Approximately 70% of energy requirement is provided by glucose oxidation; the rest is provided by alternative fuels.
- Production of alternative brain fuels such as ketone bodies and lactate:
  - The lowest blood glucose values typically occur between 1 and 2 hours after birth (World Health Organization, 1997).
  - After 12 hours, the infant depends on glucose made from milk components (20–50%) and gluconeogenesis to maintain blood glucose (galactose, amino acids, glycerol, lactate) as well as free fatty acids from fat stores and milk.
  - Sixteen percent of infant's body weight is fat.
  - Breastmilk is more ketogenic (promotes production of ketones as an alternate brain fuel) than formula. Newborns convert energy stored in ketone bodies to high-energy phosphates. Ketone bodies provide fuel particularly to brain, heart, and skeletal muscle during the immediate newborn period of lower blood glucose levels.
  - Breastfed infants produce ketones as an adaptive mechanism. This may explain the healthy breastfed newborn with relatively low blood sugar who remains asymptomatic.
  - Lactate provides a useful source of cerebral fuel in most hypoglycemic infants, and those hypoglycemic babies with low plasma lactate concentrations may be at an increased risk for neurological side effects (Harris, Weston, & Harding, 2015).

A number of conditions or situations that put an infant at risk for hypoglycemia are as follows and are generally associated with clinical signs in the newborn. In these situations, it is generally assumed that infants are already being monitored and glucose measurements are being performed:

Preterm (AGA)	Discordant twin	Postmaturity
Preterm (SGA)	LGA	Hyperinsulinemia
Full term (SGA)	Asphyxia	Cold stress
Congestive heart failure	Sepsis	Rh disease
Erythroblastosis fetalis	Polycythemia	Microphallus or midline defect
Respiratory distress	Maternal glucose IV	Maternal epidural
Endocrine disorders	Inborn errors of metabolism	Diabetic mother
Maternal toxemia	Intrapartum fever	

(Depuy, Coassolo, Som, & Smulian, 2009)



Target glucose screen ≥45 mg/dL prior to routine feeds

*Glucose dose = 200 mg/kg (dextrose 10% at 2 mL/kg) and/or IV infusion at 5–8 mg/kg per min (80–100 mL/kg per d). Achieve plasma glucose level of 40–5 mg/dL.

Figure 5-29 Screening and management algorithm for newborns with hypoglycemia.

~~Data from Adamkin, D. H., & Committee on Fetus and Newborn. (2011). Clinical report: Postnatal glucose homeostasis in late-preterm and term infants. *Pediatrics, 127*, 575–579. Used with permission.~~

Adamkin and the Committee on Fetus and Newborn, American Academy of Pediatrics (2011) therefore recommend that as a practical approach to hypoglycemia in the newborn, "at-risk" infants include those who are SGA, LGA, born to diabetic mothers, or are late preterm and should be managed according to the approach outlined in **Figure 5-29**. Blood glucose concentration should only be measured in term infants who have clinical manifestations or who are known to be at risk.

Schaefer-Graf and colleagues (2002) studied risk factors for hypoglycemia in LGA newborns of nondiabetic mothers. The antenatal 1-hour glucose test given during pregnancy was shown to be predictive of hypoglycemia in the newborn. An incremental risk of newborn hypoglycemia was seen with increasing 1-hour oral glucose tolerance test values with hypoglycemia rates of 2.5%, 9.3%, 22.0%, and 50% that were associated with maternal 1-hour glucose values of < 120, 120–179, 180–239, and > 240 mg/dL, respectively. Infants of mothers with high values may benefit from increased vigilance and placement in an at-risk category.

Signs and symptoms of hypoglycemia are subtle, nonspecific, and variable (**Box 5-9**). Jitteriness is a very common and usually benign finding in

Box 5-9 Signs and Symptoms of Hypoglycemia

- Abnormal cry
- Abnormal eye movements
- Apathy
- Apnea
- Cardiac arrest
- Congestive heart failure
- Cyanosis
- Diaphoresis
- Exaggerated reflexes
- Hypothermia
- Hypotonia
- Irregular breathing
- Irritability
- Jitteriness
- Lethargy
- Poor suck
- Refusal to feed
- Seizures
- Tachypnea
- Temperature instability
- Tremors
- Vasomotor instability (pallor)
- Vomiting

otherwise healthy full-term infants (D'Harlingue & Durand, 1991). In a study of 102 infants described as jittery, sucking on the clinician's finger stopped the jitteriness in 80% of infants. Of the other infants whose jitteriness did not stop, five were hypoglycemic and the rest were hypocalcemic (Linder et al., 1989). Nicholl (2003) recommended that if an infant appears jittery, first allow the infant to suck on a finger. The infant could also be put to breast to see if sucking would reduce the jitteriness. If the jitteriness remains, blood glucose and calcium should be measured, with blood glucose concentrations less than 1.5 mmol/L (< 27 mg/dL) being addressed immediately.

Problems With Glucose-Level Measurements

Whole blood glucose-level measurements are generally 10–15% lower than the corresponding plasma values. The normal blood glucose range for newborns during the first week is 27–108 mg/dL (1.5–6 mmol/L). The optimal method for measuring plasma glucose is the hexokinase, glucose oxidase, or dehydrogenase (enzymatic) method performed in a laboratory, but this method is often too slow for timely treatment. Therefore "point-of-care" devices are often used for measuring whole blood glucose concentration in the newborn nursery or neonatal intensive care units. Point-of-care glucose monitoring systems need to be accurate, precise, and versatile (Sirkin, Jalloh, & Lee 2002). Reagent strips and bedside machines will, on average, wrongly identify hypoglycemia in one of four infants who are, in fact, normoglycemic (World Health Organization, 1997). Low-birth-weight, low hematocrit, and parenteral feeding decrease the accuracy of point-of-care devices (Bellini, Serra, Risso, Mazzella, & Bonioli, 2007). Anemia falsely raises and polycythemia falsely depresses glucometer readings. Most current point-of-care glucometers are sufficient only for initial screening, and their values need to be confirmed with laboratory measurements and clinical assessment of the infant (Ho, Yeung, & Young, 2004; **Box 5-10**). Future improvements on glucose monitoring include subcutaneous microdialysis for long-term monitoring in the neonatal intensive care unit (Baumeister, Rolinski, Busch, & Emmrich, 2001) and near infrared spectroscopy (Gabriely et al., 1999) as a noninvasive method of glucose screening for all infants. It is important that devices used to measure neonatal glucose levels be specifically evaluated for use in this population.

There are a number of considerations when interpreting glucose measurements and choosing a course of action:

- Chemical reagent strips (e.g., Dextrostix) were not designed for use with a neonate but for use with adult diabetics.
- These methods usually underestimate blood glucose by ± 5–15 mg/dL, especially in the lower ranges.
- Laboratory follow-up and confirmation of glucose levels are necessary before treatment.
- Hematocrit should be considered because decreased glucose readings occur with a high hematocrit. Other conditions and substances can also affect glucose readings, such as altitude, hypoxia, and partial pressure of arterial oxygen.
- Use of maternal glucose intravenously (seen in older studies) contributed to the risk of hypoglycemia in the infant.
- Repeated heelsticks/venipunctures increase stress hormone response from pain and decrease blood glucose levels.
- Squeezing the heel causes hemolysis, which interferes with the assay, producing falsely low values (blood samples must be free flowing).
- Blood should be transported in a tube that contains a glycolytic inhibitor such as fluoride. This is because a long delay in laboratory processing of the blood sample can result in a falsely low concentration as red blood cells metabolize the glucose in the plasma.
- There is currently no point-of-care device or instrument that is reliable enough and accurate enough in the low range of blood glucose levels to qualify it as the sole method for newborn hypoglycemia screening.

Diwakar and Sasidhar (2002) demonstrated that term breastfed infants have their own distinct plasma glucose levels, which tend to show little significant variation between 3 and 72 hours of age.

Box 5-10 Glucose Screening Techniques and Equipment

Sampling techniques and their effect on glucose values when using bedside screening tools:

- Once in the sample tube, red blood cells continue to metabolize glucose.
- Bedside tools measure whole blood glucose concentrations, which can be 15% lower than plasma concentrations (which is where blood glucose is measured in a laboratory).
- Blood samples that are allowed to sit at room temperature for long periods of time may result in a glucose concentration drop of 18 mg/dL per hour.
- To avoid sampling errors, blood samples should be transported quickly to the laboratory, put on ice, or placed in a tube containing a glycolytic inhibitor.
- The infant's heel should be warmed to prevent venous stasis in heelstick samples that can lead to falsely low glucose values.

Screening Equipment

- Bedside or "point-of-care" glucose screening devices are commonly used as a rapid screening tool for neonatal hypoglycemia.
- One class of these devices is photometers that rely on reflectance-based technology to read reagent strips.
- The Dextrostix reagent strips were commonly used for many years to screen for neonatal hypoglycemia, despite the fact that this product was never intended to be used on neonates, as stated on the package insert, and that the results were inaccurate below 50 mg/dL. They were removed from the market in 1997.
- Meloy, Miller, Chandrasekaran, Summitt, and Gutcher (1999), in a study on the Accu-Check III reflectance meter, documented that the machine could correctly identify neonatal hypoglycemia only 76% of the time.
- More accurate and reliable equipment is available that utilizes electrochemical techniques or quantitative analysis, such as glucose oxidase meters.
- Even with reliable bedside screening devices, operational threshold values should be validated by laboratory analysis.

Modified from Cornblath, M., & Ichord, R. (2000). Hypoglycemia in the neonate. *Seminars in Perinatology, 24,* 136–149; Cowett, R. (1999). Neonatal hypoglycemia: A little goes a long way [Editorial]. *Journal of Pediatrics, 134,* 389–391; Meloy, L., Miller, G., Chandrasekaran, M., Summitt, C., & Gutcher, G. (1999). Accuracy of glucose reflectance testing for detecting hypoglycemia in term newborns. *Clinical Pediatrics, 38,* 717–724; National Association of Neonatal Nurses. (1994). *Neonatal hypoglycemia guidelines for practice.* Petaluma, CA: Author; Noerr, B. (2001). State of the science: Neonatal hypoglycemia. *Advances in Neonatal Care, 1,* 4–21; Thomas, C., Critchley, L., & Davies, M. (2000). Determining the best method for first-line assessment of neonatal blood glucose levels. *Journal of Paediatrics and Child Health, 36,* 343–348.

Prelacteal feeds were unnecessary, and satisfactory glucose levels were maintained even when infants remained unfed for up to 6 hours of age. Blood glucose concentrations tend to be lower during the first 24 hours. However, Hoseth, Joergensen, Ebbesen, and Moeller (2000) reported that with frequent effective breastfeeding, normal, healthy, full-term infants with no risk factors, who showed the lowest blood sugar levels at 1 hour of age, 1.4 mmol/L (25.2 mg/dL) to 1.9 mmol/L (28.7 mg/dL), developed no clinical signs of hypoglycemia. Defining hypoglycemia as a specific number does not take into account the multiple variables affecting blood glucose levels in the newborn. If a number such as 40 mg/dL were chosen as the cutoff point for treatment, this value could produce as much as a 20% incidence of diagnosis of hypoglycemia in full-term infants (Sexon, 1984).

Rather than a specific number, the concept of operational thresholds has been suggested to refine diagnosis and better handle glycemic changes in the newborn. Operational thresholds (i.e., blood glucose levels at which clinical interventions should be considered) have been delineated by Cornblath and colleagues (2000). These threshold values described for surveillance and intervention are different and should be separated from the targeted therapeutic values, which should be in the range of 72–90 mg/dL (4–5 mmol/L) (Kalhan & Peter-Wohl, 2000). They delineate a range of blood glucose values based on parameters that account for the status and age of the infant (**Table 5-5**).

Term Infant

- Healthy full-term infants from normal pregnancy and delivery who have no clinical signs do not require routine monitoring of glucose concentrations (Adamkin & Committee on Fetus and Newborn, American Academy of Pediatrics, 2011; Eidelman, 2001).

Breastfed Term Infant

- These infants tend to have lower concentrations of blood glucose than formula-fed infants but higher concentrations of ketone bodies.
- Breastfed infants who lose the most weight have the highest ketone bodies concentration.
- Provision of alternative fuels is a normal adaptive response to low nutrient intake during the establishment of breastfeeding.
- Breastfed infants may well tolerate lower plasma glucose levels without any significant clinical manifestation or sequelae.

Infant With Abnormal Clinical Signs

Symptomatic infant

- Plasma glucose should be measured.
- If the value is less than 45 mg/dL (2.5 mmol/L), clinical intervention should be started.

At-risk infants

- At-risk infants should be screened before any symptoms manifest (Wight, 2006).
- At-risk infants should be fed by 1 hour of age and screened 30 minutes after the feeding.
- Routine measurements should occur as soon as possible after birth, either on admission to the unit or within 30–60 minutes after birth.
- Screening should occur every 30 minutes for infants being treated for hypoglycemia and before feeding or any time there are abnormal signs.
- Plasma glucose of less than 36 mg/dL (2.0 mmol/L) requires close surveillance.

Table 5-5 Neonatal Hypoglycemia and Operational Thresholds for Clinical Intervention

Age	Threshold Glucose Infant Parameters	Postbirth Values for Intervention
Asymptomatic		
Full or near-term (34–37 weeks)	1st 24 hours	< 30–35 mg/dL
Healthy	After 24 hours	< 40–50 mg/dL
Full enteral feedings		
No risk factors		
Ill Infant		
Low-birth-weight	1st 24 hours	< 45–50 mg/dL
Preterm	After 24 hours	< 40–50 mg/dL
Sepsis		
Asphyxia		
Respiratory distress syndrome		
Symptomatic Infant		
Signs of hypoglycemia	Any age	< 45 mg/dL
Any gestational age		
At-Risk Infant		
Infant of diabetic mother	Any age	< 36 mg/dL
Sepsis		
Asphyxia		
Small for gestational age (SGA)		
Hyperinsulin		
Endocrine disorders		
Metabolic disorders		
Infants with glucose levels	Any age close monitoring	IV glucose therapy and < 20–25 mg/dL

Modified from Noerr, B. (2001). State of the science: Neonatal hypoglycemia. *Advances in Neonatal Care, 1,* 4–21; Cornblath, M., & Ichord, R. (2000). Hypoglycemia in the neonate. *Seminars in Perinatology, 24,* 136–149.

- Intervention is required if plasma glucose remains below this level, if the level does not increase after a feed, or if abnormal clinical signs develop.
- At very low glucose concentrations, less than 20–25 mg/dL (1.1–1.4 mmol/L), IV glucose infusion should aim to raise levels above 45 mg/dL (2.5 mmol/L).
- The therapeutic objective of 45 mg/dL is different from the threshold for intervention—36 mg/dL (2.0 mmol/L).

Breastfeeding Management

Breastfeeding protocols and caretaking activities during the hours after delivery should be designed to proactively reduce the likelihood of inducing hypoglycemia. Chertok and colleagues (2009) studied the effects of breastfeeding immediately after delivery compared with later initiation of breastfeeding on neonatal glucose levels of term infants born to mothers with gestational diabetes. The study also compared the glycemic levels of infants who breastfed with those who received formula for their first feed. The results showed that infants who were breastfed right after delivery had a significantly lower rate of borderline hypoglycemia than those not breastfed in the early minutes after birth. Infants breastfed immediately after birth had significantly higher mean blood glucose levels compared to infants who were not breastfed early. Breastfed infants additionally had a significantly higher mean blood glucose level compared to those who were fed formula for their first feed. Early breastfeeding when the infant is swallowing colostrum helps facilitate glycemic stability in infants, especially in those born to diabetic mothers. The clinician is well advised to see that effective breastfeeding takes places as soon as possible after delivery and ensure that the infant is swallowing colostrum at this time. Prevention activities also include the following:

- Breastfeed frequently, on cue, before sustained crying occurs, and avoid long intervals between feedings.
- Infants separated from their mothers have lower body temperatures, cry more, and have decreased blood glucose levels (Christensson et al., 1992; Durand et al., 1997). Christensson and colleagues (1992) reported that newborn infants separated from their mothers had blood sugar levels that were 10 mg/dL lower than infants kept in skin-to-skin contact at 90 minutes after birth. Environmental stress, such as hypothermia, can increase the energy demands of a newborn, which could exceed the infant's capacity to generate energy substrate (Kaplan & Eidelman, 1985). Walters, Boggs, Ludington-Hoe, Price, and Morrison (2007) demonstrated that healthy term infants placed skin to skin within 1 minute of birth had temperatures that rose and blood glucose levels in a satisfactory range (43–85 mg/dL), even in infants who had not fed before the study's glucose measurement at 60 minutes after birth (43–118 mg/dL).
    - Keep the infant in skin-to-skin contact with the mother during the early hours after birth. Skin-to-skin care heats the infant's entire body (peripheral and trunk) rather than just the trunk, which occurs under a radiant warmer (Christidis et al., 2003). This avoids the possibility of chilling during the early hours as does delaying the infant bath.
    - Keep the mother and infant together (even at night).
    - Do not allow the infant to cry.
    - Immediately respond to any cries.
- There is a normal dip in blood glucose in the first 1 to 4 hours after birth.
    - Avoid giving sugar water by mouth because it is metabolized rapidly, often before the infant can mount effective counter-regulatory activities. This may cause rebound hypoglycemia.
    - Avoid testing blood sugar during this time with reagent strips (in asymptomatic, low-risk infants).
    - Provide unlimited access to the breast and ensure colostrum/milk transfer.
- Feed expressed colostrum if the infant is unable to latch or feeds poorly. There do not appear to be any significant differences between glucose values for infants fed expressed colostrum versus

Figure 5-30 Newborn nursery hypoglycemia clinical algorithm.
Maine Medical Center.

formula supplementation (Tozier, 2013). Colostrum supplementation when necessary preserves exclusive breastfeeding, maintains acceptable levels of blood glucose, and reduces the risk for sensitizing infants to cow's milk protein and diabetes. **Figure 5-30** is a hypoglycemia algorithm that supports exclusive breastfeeding and the use of colostrum as a supplement.

- Infants with risk factors for hypoglycemia should be fed frequently.
  - The protein and fat in colostrum provide substrates for gluconeogenesis.
  - Colostrum and breastmilk enhance ketogenesis.

- Colostrum increases gut motility and gastric emptying time, causing rapid absorption of nutrients.
- If the infant is unable to latch or effectively transfer colostrum, have the mother hand express colostrum into a spoon and spoon-feed it to the infant (using a pump often results in little to no colostrum being retrievable to feed to the infant, because it sticks to the sides of the bottle). If the mother is unable to express colostrum and has expressed colostrum prenatally, use this to spoon feed the infant.
- Consider using an evidence-based hypoglycemia protocol to protect breastfeeding and appropriately manage hypoglycemia in the breastfed infant. The Academy of Breastfeeding Medicine developed a clinical protocol to use as a guideline for obtaining blood glucose levels in neonates who are at risk for developing hypoglycemia and to delineate appropriate interventions (Wight, Marinelli, & Academy of Breastfeeding Medicine, 2014). The Academy of Breastfeeding Medicine's clinical management is based on four basic principles:
    1. Monitoring those infants at highest risk
    2. Confirming that plasma glucose concentration is low and indeed responsible for the clinical manifestations present
    3. Demonstrating that the symptoms have responded after glucose therapy with restoration of the blood glucose to normoglycemic levels
    4. Observing and carefully documenting all of the above

Adamkin and the Committee on Fetus and Newborn, American Academy of Pediatrics (2011) have provided an algorithm and practical guidelines for managing hypoglycemia in the newborn. Lacking a specific concentration of glucose that can discriminate normal from abnormal glucose levels, this guideline recommends early identification of the at-risk infant and interventions to prevent unwanted problems. Nowhere in this guideline is infant formula recommended as a supplement to breastfeeding or as a means to treat low blood glucose concentrations in breastfed infants. A simplified and streamlined hypoglycemia algorithm (**Figure 5-31**) uses breastfeeding as the first-line treatment for newborn hypoglycemia and may be readily accepted by hospital staff, unlike more complicated algorithms (Csont, Groth, Hopkins, & Guillet, 2014).

Antenatal colostrum expression and/or colostrum expression during the early stage of labor is sometimes done by diabetic mothers in anticipation of the possible need to supplement the newborn for hypoglycemia (Tozier, 2013). The colostrum is stored in feeding syringes in the patient's refrigerator or placed on ice to be used during the early hours post birth if necessary. Some concerns about this practice have been raised by Forster and colleagues (2011) regarding increased admissions of newborns with hypoglycemia to the special care or neonatal intensive care nursery, decreased duration of pregnancy, and increased requirement for IV glucose. However, these same authors reported that the amount of colostrum obtained ranged between 5 mL and 310 mL depending on the number of expressions and the length of time between the start of expressing milk and the birth of the infant. Most women had a positive experience and would express antenatally again if the practice was proven beneficial. In a thorough review of the literature on antenatal colostrum expression, it was concluded that in the absence

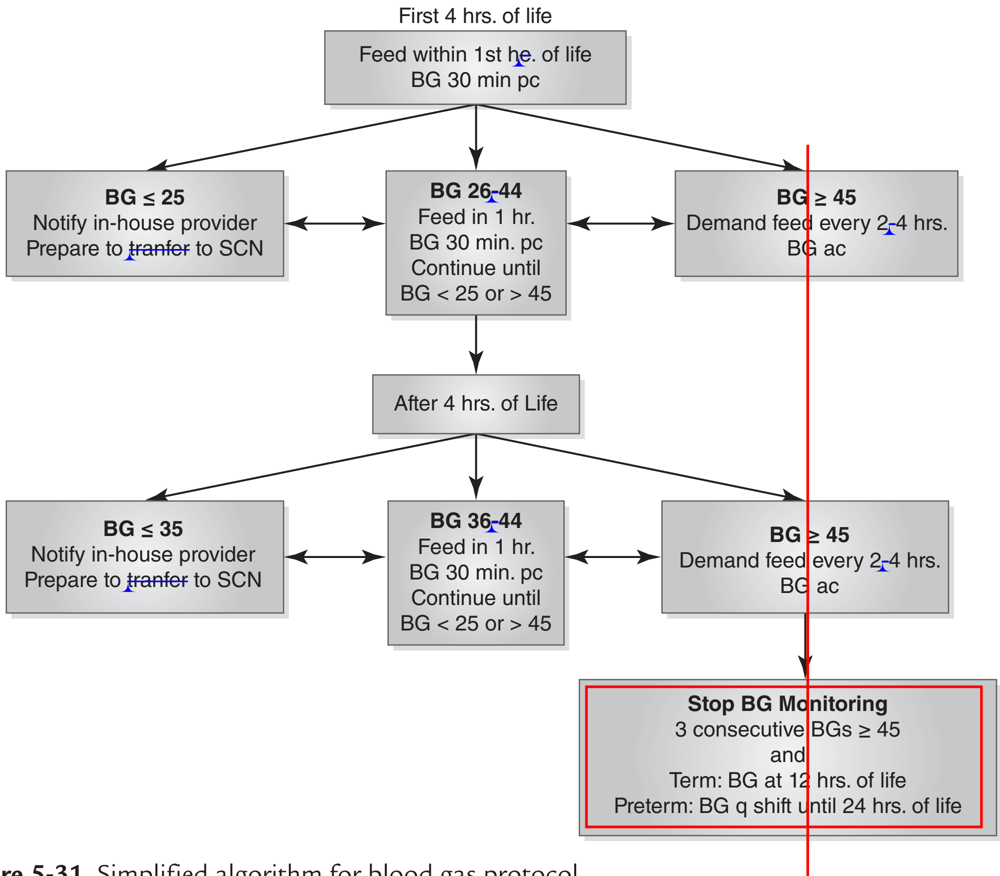


Figure 5-31 Simplified algorithm for blood gas protocol.

Csont, G. L., Groth, S., Hopkins, P., & Guillet, R. (2014). An evidence-based approach to breastfeeding neonates at risk for hypoglycemia. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 43*, 71–81.

of clear evidence to the contrary, prenatal expression of colostrum and the benefits of early colostrum feeding should outweigh the unsupported risks of teaching antenatal colostrum expression (Chapman, Pincombe, & Harris, 2013).

SUMMARY: THE DESIGN IN NATURE

Individual infants and their unique circumstances can present a challenge to breastfeeding that many mothers may not have anticipated. Birth trauma is not limited to the infant. Up to 34% of mothers have reported experiencing a traumatic delivery. The impact of this trauma can lead mothers down two very different breastfeeding paths. Some mothers are determined to persevere with breastfeeding to make up for a devastating childbirth, whereas others meet impediments to breastfeeding that cause sufficient distress for them to abandon breastfeeding attempts (Beck & Watson, 2008).

Clinicians may need to use their years of experience and tap into their knowledge base to initiate and preserve breastfeeding in difficult situations. Nature has programmed infants to be anatomically, physiologically, and metabolically competent to feed at the breast and consume mother's milk, but anatomy, perinatal events, and unforeseen circumstances may interfere with this process. Infants were born to be breastfed, but sometimes nature presents a different path that requires carefully selected interventions to reach the goal of an infant at the breast or breastmilk being provided to the infant.

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ADDITIONAL READING AND RESOURCES

The Academy of Breastfeeding Medicine has developed protocols on common clinical issues, including the one on hypoglycemia referenced in this chapter, as guidelines for the care of breastfeeding infants and their mothers. Full-text versions of all the Academy of Breastfeeding Medicine's protocols are available at http://www.bfmed.org/Resources/Protocols.aspx.

Infant Sleep Resources

Heinig, M. J., Banuelos, J., Goldbronn, J., & Kampp, J. (2009). FitWIC baby behavior study. UC Davis Human Lactation Center, Department of Nutrition. Retrieved from http://www.nal.usda.gov/wicworks/Sharing_Center/gallery/FitWICBaby.htm

Clinical Algorithms

University of North Carolina Lactation Program, http://www.mombaby.org/index.php?c=2&s=30&p=623

Lee, K. G. (2008). Breastfeeding and the premature infant. In D. Brodsky & M. A. Ouellette (Eds.), *Primary care of the premature infant* (pp. 61–69). Philadelphia, PA: Saunders. https://www.preemietoolkit.com/pdfs/Nutrition_and_Feeding/Algorithm_For_Breastfeeding_The_Late_Preterm_Infant.pdf

Massachusetts Breastfeeding Coalition Lactation management for mobile platforms, http://massbreastfeeding.org/index.php/2009/breastfeeding-management/

BreastFeeding Inc.
Nipple and breast pain algorithm, http://www.breastfeedinginc.ca/product.php?prodID=42

Nursery at Lucile Packard Children's Hospital, Stanford School of Medicine, http://newborns.stanford.edu/Breastfeeding/

In Utero Drug Exposure

Neonatal Drug Withdrawal guidelines from the American Academy of Pediatrics, Sample Withdrawal Scoring Sheet—from Lucile Packard Children's Hospital, and a video clip of neonatal abstinence syndrome, http://newborns.stanford.edu/InUteroDrugs.html

Appendix 5-1

Summary Interventions on Nipple Shield Use

SITUATIONS FOR WHICH SHIELD USE IS COMMONLY ADVISED

Latch Difficulty

- Nipple anomalies (flat, retracted, fibrous, inelastic)
- Mismatch between small infant mouth and large nipple
- Infant from heavily medicated mother
- Birth trauma (vacuum extraction, forceps)
- Oral aversion (vigorous suctioning)
- Artificial nipple preference (pacifiers, bottles)
- To transition an infant from bottle to breast
- Infant with weak or disorganized suck (slips off nipple, preterm, neurological problems)
- Infant with high or low tone
- Delay in putting infant to breast

Oral Cavity Problems

- Cleft palate
- Channel palate (Turner syndrome, formerly intubated)
- Bubble palate
- Lack of fat pads (preterm, SGA)
- Low-threshold mouth
- Poor central grooving of the tongue
- Micrognathia (recessed jaw)

Upper Airway Problems

- Tracheomalacia
- Laryngomalacia

Damaged Nipples

- When all else fails and the mother states she is going to quit breastfeeding

INSTRUCTIONS FOR SHIELD USE

- Choose an appropriately sized shield.
- Drip expressed milk onto the outside of the teat to encourage the infant to latch.
- Warm the shield to help it stick.
- Apply the shield (may moisten the edges to help it adhere better) by turning it almost inside out.
- Hand express a little milk into the teat if necessary.
- Use a periodontal syringe to pre-fill the teat if the mother is unable to express colostrum or milk into the teat.
- Use alternate massage to help drain the breast.
- Tubing can be placed inside or outside of the shield for supplementation.
- Check the infant's latch with the shield: The mouth must not close on the shaft of the teat.
- Check that the infant is not just sucking on the tip of the teat.
- Some mothers may need more than one shield.
- Some mothers may need to pump after each feeding.
- Mothers should carefully check their breasts for plugged ducts and areas that are not draining well.
- If yeast is present on the areola, the shield should be boiled; otherwise, the shield should be washed in hot soapy water after each use, rinsed thoroughly, and air dried.
- Perform an infant weight check about every 3 days until the mother's milk supply is stable and the infant is gaining well.

CONSERVATIVE NIPPLE SHIELD GUIDELINES

Action	Rationale
Recommend a nipple shield if the clinical situation warrants it.	Not all special situations require a shield. Shield use may preserve breastfeeding in selected situations.
If a nipple shield is required during the initial hospital stay, wait at least 24-36 hours before introducing a shield, feeding the infant by spoon with expressed colostrum. For preterm and other special situations, shields could be introduced for persistent special issues.	Allow the infant to imprint on the maternal nipple first.
For healthy term infants, delay shield use if possible until after the mother and infant have been discharged home.	Some infants may latch and feed better following discharge, removing the need for a shield.
Recommend that the mother make an appointment with an IBCLC for continued follow-up.	Professional follow-up is required for assessing and monitoring any ongoing problems or issues that necessitated shield use.

Recommend an appropriately sized and shaped shield as the situation warrants. Start with a medium size shield. Use a larger one if the shield pinches, the maternal nipple is large, or there is pain. Use the smallest shield that gives the best results. A cut-out shield may be prudent for early use to allow olfaction to guide the infant to the breast. A cherry shaped shield may be helpful if the infant has difficulty latching to the conical shield.	Clinicians may need to try a number of different shields in order to secure the best fit and outcome.
Advise the mother to warm the shield under hot water prior to application, turn it almost inside out to apply, hand express colostrum or milk into the teat, or use a periodontal syringe to preload the teat with milk.	Warming helps the shield adhere better and promotes milk ejection. Proper application allows the maternal nipple to be drawn into the shield's teat. Milk in the teat provides immediate availability so that infants with a weak suck do not become fatigued while initiating milk flow.
Have the mother massage and compress the breast periodically during the feeding.	This may prevent milk stasis, plugged ducts, and mastitis.
Pump following feedings if milk production is low or the risk for a compromised milk supply is high.	Milk production must be monitored to assure an abundant supply and that the shield is not contributing to milk supply reduction.
Check to make sure that the shield is properly applied, that the infant is latched appropriately and is transferring milk, and that the mother knows how to clean the shield. Recommend frequent weight checks.	Shield use should not reinforce improper latching. Milk transfer monitoring is important to assure proper infant weight gain and an abundant milk supply.

Appendix 5-2

Additional Clinical Algorithms

FPO

Figure 5-32 Full-term newborn weight loss for breastfeeding babies.

Used with permission of ~~Cambridge Health Alliance, Cambridge, Massachusetts~~.

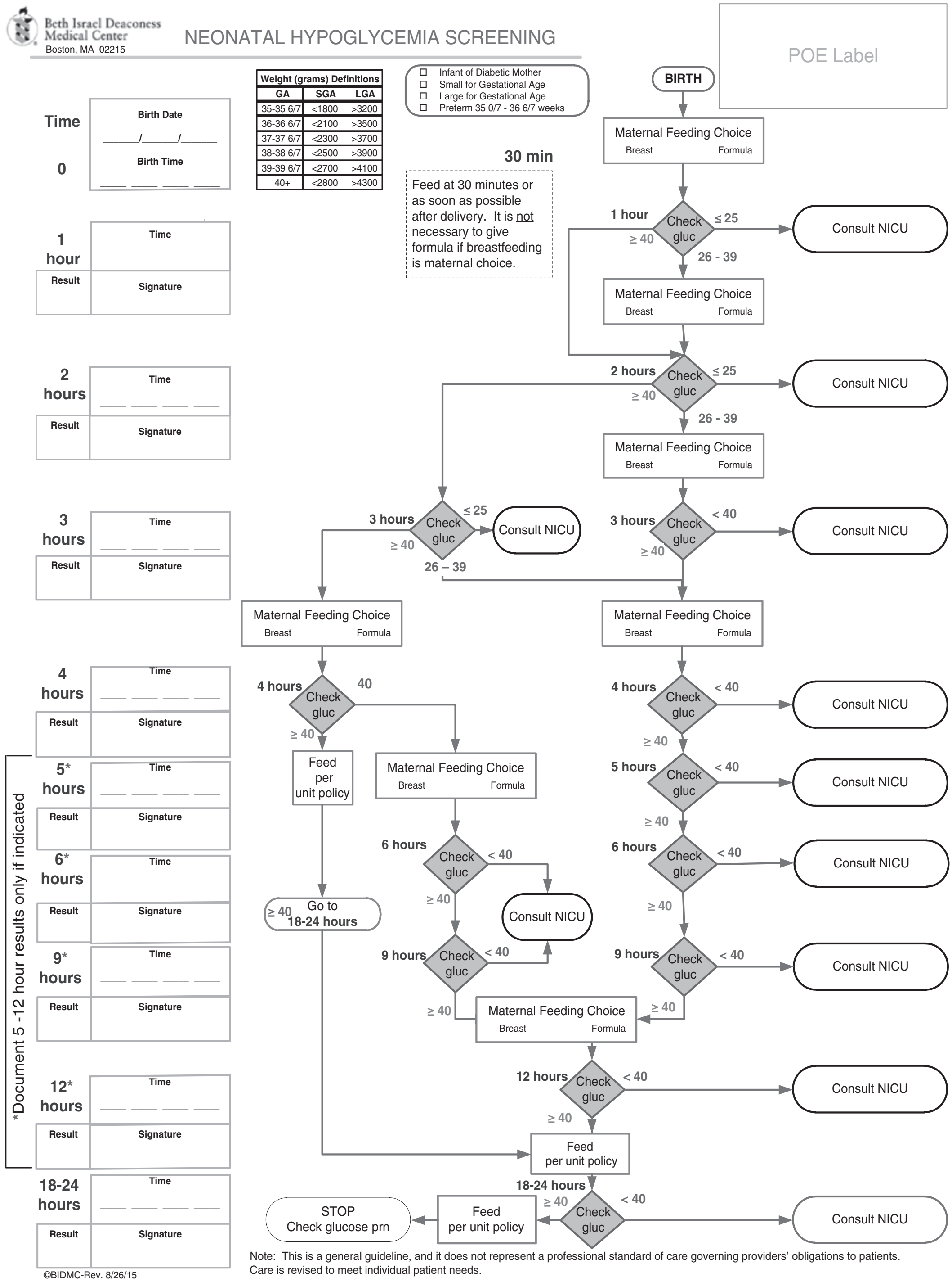

Figure 5-33 Neonatal hypoglycemia screening.

Used with permission: Courtesy of Beth Israel Deaconess Medical Center, Boston, Massachusetts, and Anna Jaques Hospital, Newburyport, Massachusetts.