CHAPTER

3

Impact of Birth Practices on Infant Suck

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For breastfeeding to succeed, the baby must be able to feed (cue, find the breast, attach, suck, swallow, and breathe smoothly); the mother must be producing milk normally and willing to bring her baby to her breast many times a day and night; breastfeeding must be comfortable for both; and the surroundings must support the dyad. If the newborn is unable to breastfeed, if lactogenesis is delayed or impaired, or if the mother is unwilling to bring her baby to her breast many times a day and night, then the baby will be fed a human milk substitute, which increases the risk of sickness and death and undermines the mother's goals. Any practice, intentional or unintentional, that causes or contributes to infant immaturity, birth injury, pharmacological influence, central nervous system function, neuromuscular performance, delayed lactogenesis or adverse breast condition, and/or impaired maternal–infant bonding puts the mother and baby at higher risk of poorer health outcomes.

The effects of immaturity, medications, and mechanical interventions are cumulative and synergistic. There is a paucity of research that addresses any direct relationship of birth practices to breastfeeding outcomes. A 2002 systematic review of unintended effects of epidurals included only two articles that specifically address breastfeeding outcomes (Lieberman & O'Donoghue, 2002). Jordan, Emery, Bradshaw, Watkins, and Friswell (2005) describe the dilemma of establishing cause and effect:

> Because "failure to breastfeed" is not recognized as a possible harmful effect of medication, there are few methodological precedents in this area. The transitory nature and "ordinariness" of "switching to bottle feeding" render the usual algorithms for identifying adverse drug reactions inadequate, inapplicable or even irrelevant. Susceptibility to bottle feeding is often regarded as determined exclusively by socio-cultural factors. (p. 931)

Professional segmentation is a major barrier to accurately evaluating breastfeeding-related outcomes of birth practices, despite the fact that "mothers and babies form an inseparable biological and social unit" (WHO & UNICEF, 2003, p. 3). During pregnancy and breastfeeding, professional specialties tend to focus on either the mother or the baby, but rarely both (Smith & Kroeger, 2010). Obstetricians and anesthesiologists are rarely involved in helping mothers establish successful breastfeeding in the early hours and days postbirth. Pediatricians are rarely involved in decisions regarding labor management and may not even be notified of pregnancy-related complications that affect breastfeeding. Anesthesiologists are even further removed from postbirth and pediatric outcomes than obstetricians. Midwives in many countries provide continuity of care but may lack in-depth education about breastfeeding in general and infant suck issues in particular (Marzalik, 2004). In many places, communication channels are inadequate

between prebirth and postbirth care providers, leaving the establishment of breastfeeding to fall through the cracks. Too often, even when effective communication channels exist between prebirth and postbirth care providers, tools for identifying infant sucking problems are inconsistently applied. The World Health Organization (WHO) addresses this segmentation of care in Every Newborn Action Plan and Ending Preventable Maternal Mortality, passed at the 2014 World Health Assembly (WHO, 2014).

Infant Maturity

Infant maturity is one indicator or trigger of spontaneous onset of labor (Vidaeff & Ramin, 2008; Nommsen-Rivers Dolan, & Huang, 2012). Simply put, when the baby is ready for life outside the womb, labor begins on its own. If compelling medical reasons suggest a significant advantage to inducing labor artificially, then *by definition* the baby is unlikely to be fully mature. Elective induction of labor before 41 weeks of gestation imparts an increased a risk for poor outcomes for mother and baby (Beebe, Beaty, & Rayburn, 2007; Glantz, 2005). Prematurity itself, alone and in combination with other consequences of induction, affects the infant's ability to feed. Prematurity is a well-known complication to breastfeeding initiation for the baby and mother. (See Chapter 7 for more on preterm birth.)

Induction of labor, especially prior to 39 completed weeks of gestation, is associated with an increased risk of infant death (Kramer et al., 2000) and other complications. Medical reasons for induction include prolonged rupture of membranes without labor; postdates (greater than 42 completed weeks of gestation); maternal hypertension; maternal health problems such as diabetes; chorioamnionitis (intrauterine infection); and intrauterine growth restriction. Elective inductions for primigravidas may increase the risk of cesarean surgery. Induction of labor may be performed with drugs (e.g., oxytocin), hormones (e.g., several forms of prostaglandin), mechanical stimulation (e.g., stripping or artificial rupture of membranes), or ingested substances (e.g., castor oil). Artificial rupture of membranes to induce or augment labor increases the risk of intrauterine infection, which is a risk factor for cerebral palsy and a host of other consequences, and it only slightly shortens labor. Induction with oxytocin increases the risk of infant jaundice and is implicated in a rising number of babies with kernicterus, or bilirubin staining of the brain, causing severe neurological impairment and even death (Lawrence & Lawrence, 2016). Bhutani, Donn, and Johnson studied a cluster of babies with kernicterus and found five common risk factors (Bhutani et al., 2005; Johnson, Bhutani, Karp, Sivieri, & Shapiro, 2009):

- Oxytocin use to induce labor
- Vacuum extractor use at delivery
- Less than 38 weeks' gestation
- Large for gestational age (LGA)
- Maternal desire to exclusively breastfeed

Exclusive breastfeeding did not cause these infants' injuries; rather, immature, injured infants were unable to effectively breastfeed and inadequate lactation support resulted in severe underfeeding of vulnerable infants.

Induction of labor is sometimes done for less than compelling medical reasons, resulting in a late preterm or borderline baby with immature or disorganized feeding abilities and a higher risk of readmission to the hospital (Boies, Chantry, Howard, & Vaucher, 2004; Wang, Dorer, Fleming, & Catlin, 2004). Some lactation professionals have reported an impression of a weaker milk ejection after a long induction. Elective induction of labor with prostaglandin E_1 (PGE_1, misoprostol, Cytotec), commonly used to soften the cervix during induction of labor, is inadequately researched for safety and associated with hyper-stimulation of the uterus and increased risk of uterine rupture (Hofmeyr, Gulmezoglu, & Pileggi, 2010). Babies of mothers who received oxytocin during labor were twice as likely to have sucking problems in the first hours and days after birth (Wiklund, Norman, Uvnäs-Moberg, Ransjö-Arvidson, & Andolf, 2009) and less likely to achieve effective sucking within the first hour after birth (Brimdyr et al., 2015).

When a decision is made to induce labor, regardless of the reason, a cascade of interventions is triggered, which usually includes the following:

- Unnaturally strong, closely spaced uterine contractions that cause increased pressure on the baby's head (presenting part) and leave less time for the infant to recover between contractions
- Increased maternal pain, which triggers a desire/need for more chemical pain relief
- Early and continuous epidural, resulting in maternal immobility, intravenous hydration and even overhydration, a longer and slower labor, increased maternal and infant fever because of the epidural, and reduced maternal and infant endorphins
- High likelihood of assisted delivery by forceps or vacuum-extraction devices, which cause infant pain, bruising, injury, and possibly disruption of central nervous system structures
- Increased risk of cesarean surgery (Kaul et al., 2004)

Thus, when labor is induced, the infant is more likely to be immature, drugged, injured, and possibly separated from the mother at birth. Each of those factors, individually and collectively, impairs the mother–baby dyad, compromises the initiation of breastfeeding, and makes the transition into external gestation (Montagu, 1986) more challenging.

Chemicals and Drugs: Direct Effects on Sucking, Swallowing, and/or Breathing

All drugs administered to a pregnant woman or a woman in labor reach the fetus. This is not a new issue. Five decades ago, Virginia Apgar introduced a scoring system for newborn conditions to evaluate anesthetic treatment of laboring women and urged caution on the use of labor anesthetics (Apgar, 1953). The Apgar score measures **a**ctivity (muscle tone), **p**ulse (heart rate), **g**rimace (reflex irritability), **a**ppearance (skin color), and **r**espiration (breathing). However, Apgar scores do not measure an infant's feeding ability. Low Apgar scores at 5 minutes correlate with significant infant neurological compromise, which impacts feeding ability.

Drugs administered during labor appear in umbilical cord blood within a few seconds to a few minutes (Loftus, Hill, & Cohen, 1995). Labor anesthetics and narcotics are chosen for their effect on sensory nerves, with an effort to find drugs that do not affect motor nerves and have the least likely effect on the infant. "An ideal anesthetic for childbirth blocks only those nerves subserving pain, leaving all other functions intact. No current drug or technique has that degree of selectivity. Among available methods, however, a properly managed epidural anesthetic comes closest" (Caton, Frolich, & Euliano, 2002, p. 3). Although various combinations of drugs have been studied, no single protocol or combination is consistently used, reported, or evaluated for breastfeeding outcomes.

Narcotics and anesthetic drugs given by intravenous injection have long been known to depress respiratory function, thereby compromising the infant's ability to coordinate sucking, swallowing, and breathing (Nissen et al., 1995). Regardless of the route of administration, the effects on the infant are dose related. Drugs given by epidural versus intravenous injection (IV) require a larger absolute dose for efficacy. The pediatric half-life of some narcotics is far longer than the maternal half-life; therefore, the drugs continue to affect the infant long after the mother has metabolized the drugs. For example, the pediatric half-life of bupivacaine and mepivacaine is 8.1 hours and 9 hours, respectively. The half-life of fentanyl is dose related and can be up to 18 hours or more. Drugs are cleared via infant metabolism, taking about five half-lives for approximately 97% of the drug to clear. Sepkoski, Lester, Ostheimer, and Brazelton (1992) documented the effects of bupivacaine using the Neonatal Behavioral Assessment Scale, reporting that deficits in motor organization (sucking) and orientation (cueing) were dose related and persisted for at least 30 days. Measurement ceased at 30 days, so the duration of any potential negative effects remains unknown.

When narcotic pain relief is administered, especially via epidural injection, other drugs are commonly used as well. Synthetic oxytocin is often administered to augment contractions and speed up labor, and it interferes with both the mother's and baby's emerging innate behaviors (Jonas et al., 2009; Jonas, Nissen, Ransjö-Arvidson, Matthiesen, & Uvnäs-Moberg, 2008).

There is mounting evidence that narcotics, especially those administered into the epidural space, affect the infant's neurobehavior, including the ability to suck, swallow, and breathe in a coordinated manner. Ransjö-Arvidson et al. (2001) documented that "several types of analgesia given to the mother during labor may interfere with the newborn's spontaneous breast-seeking and breastfeeding behaviors and increase the newborn's temperature and crying" (p. 5). Radzyminski (2005) correlated low neurobehavioral scores with poorer breastfeeding behaviors. Baumgarder, Muehl, Fischer, and Pribbenow (2003) reported that "labor epidural anesthesia had a negative impact on breast-feeding in the first 24 hours of life even though it did not inhibit the percentage of breast-feeding attempts in the first hour" (p. 7). In other words, the babies had the *opportunity* to breastfeed but were *unable* to latch and suck.

Direct evidence that narcotics compromise breastfeeding is accumulating. Jordan et al. (2005) reported that "intrapartum fentanyl may impede establishment of breastfeeding, particularly at higher doses" (p. 927). Beilin et al. (2005) reported that among experienced breastfeeding mothers, dose-related administrations of fentanyl were associated with stopping breastfeeding before 6 weeks. Wiklund et al. (2009) reported that infants exposed to epidural anesthesia were

nearly four times less likely to suckle the breast in the first 4 hours after birth and were nearly half as likely to be exclusively breastfed at hospital discharge. Brimdyr and colleagues (2015) conducted a rigorous video ethnographic study at Loma Linda Medical Center in California, which is a designated Baby-Friendly Hospital™. They reported that babies exposed to epidural fentanyl, born vaginally to low-risk mothers and placed skin-to-skin on their mothers' bodies immediately after birth, were significantly less likely to achieve sucking during the first hour after birth than babies not exposed to fentanyl. The authors concluded that the combined effects of synthetic oxytocin and fentanyl significantly decreased the likelihood of a baby suckling while skin-to-skin during the first hour after birth. This finding is profoundly important, because sucking within the first hour is a core indicator of normal neuromuscular behavior of newborns (Dumas et al., 2013; Widström et al., 2011).

Labor pain medications also affect the mother's lactation status. Lind, Perrine, and Li (2014) reported that "mothers who received labor pain medications were more likely to report delayed onset of lactation (DOL), regardless of delivery method" (p. 168). In a sample of 2,586 women, 23.4% experienced DOL, defined as "milk coming in" $>$ 3 days after delivery. The highest rates of DOL occurred in women who underwent an emergency cesarean section with an epidural plus another medication. For more than half of this group of women, their milk did not "come in" until after 3 days (72 hours). Their fears of "not making enough milk" were valid.

Intravenous fluids are administered to prevent supine hypotension when an epidural is placed during labor, before a planned cesarean section, or when some labor complications arise. It has long been speculated that IV fluids given to the mother are associated with breast edema, which causes difficulty in breastfeeding (Cotterman, 2004). Edema in the lactating breast appears to constrict the milk ducts, which reduces milk flow, and the swelling from edema makes it harder for the newborn to latch and transfer colostrum (Wambach & Riordan, 2016). A prospective, longitudinal observational cohort pilot study with repeated measures and within-subjects design was conducted by Kujawa-Myles, Noel-Weiss, Dunn, Peterson, and Cotterman (2015), who concluded, "The findings demonstrate that mothers . . . who received IV fluids in labor and postpartum had higher levels of breast edema" (p. 1). Intravenous hydration is associated with excess weight loss in newborns, leading to excess formula supplementation (Chantry et al., 2010). This association was verified by Noel-Weiss, Woodend, Peterson, Gibb, and Groll (2011), who reported that "Timing and amounts of maternal IV fluids appear correlated to neonatal output and newborn weight loss" (p. 4). They recommend delaying the baseline measurement of infant weight until 24 hours after birth (Noel-Weiss et al., 2011). Maternal IV hydration is also associated with infant hypoglycemia, hyponatremia, and jaundice (Singhi, 1988; Singhi, Chookang, Hall, & Kalghatgi, 1985).

When the mother has an epidural catheter in her back, her mobility is restricted, causing her to remain supine, which further retards the progress of labor and is associated with increased fetal malpresentation with resultant abnormal pressures on the infant skeleton and longer labor (Lieberman, Davidson, Lee-Parritz, & Shearer, 2005). The risk of instrument use and cesarean surgery is increased (Cheng, Shaffer, & Caughey, 2006), resulting in increased risk to the infant of abnormal mechanical pressures and injury.

Epidural drugs reduce the infant's ability to cope with pain. Epidural drugs inhibit maternal β-endorphins produced during labor (Goland, Wardlaw, Stark, & Frantz, 1981) and the levels of

β-endorphins in colostrum and milk (Zanardo et al., 2001). Skin-to-skin contact and breastfeeding are comforting (Gray, Miller, Philipp, & Blass, 2002; Gray, Watt, & Blass, 2000), and human milk itself is analgesic (Shah, Aliwalas, & Shah, 2006). Therefore, the infant's ability to suck is compromised by epidural drugs, the pain-relieving components in milk are reduced, and the baby is more likely to be separated from the mother because of poor feeding. The likely result is an infant who suffers more pain and is unable to relieve that pain through normal breastfeeding.

Physics and Forces: Mechanical Effects of Birth Practices and Procedures

Normal birth requires molding of the fetal skull with associated shifting of the four segments of the occiput, both parietal bones, and three segments of each temporal bone (Netter, 1989). The parietal bones override the basilar portion of the occiput and the two halves of the frontal bone, allowing the fetal head to rotate and descend through the maternal pelvis (**Figure 3-1**).

The hypoglossal nerve (XII) controls tongue movement, including the patterns necessary for latching and sucking. In the infant, cranial nerve XII lies in the space between segments of the occipital bone that later fuse to form the hypoglossal canal in adults. Disruption of the occipital segments could lead to nerve entrapment of the hypoglossal nerve(s), which in turn could cause or contribute to ineffective, mispatterned, and/or disorganized contraction patterns in the tongue muscle group. During cesarean surgery, the surgeon's hands lift on the condylar segments, possibly disrupting the cranial base and altering alignment and function of the hypoglossal nerve, which could affect milk transfer (Evans, Evans, Royal, Esterman, & James, 2003).

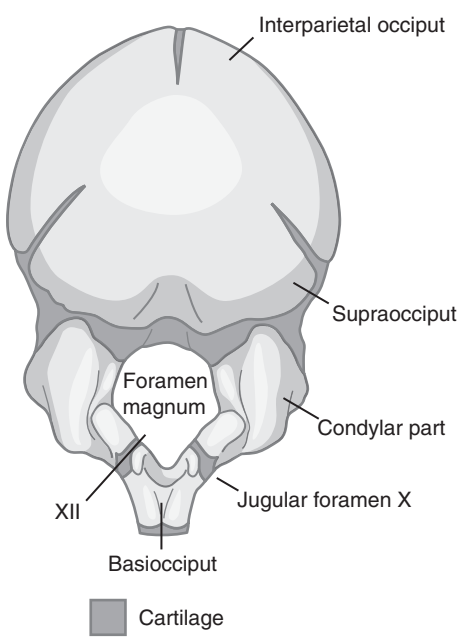

Figure 3-1 External view of occiput at birth.

Three cranial nerves and the jugular vein pass through the jugular foramen, which lies between the occipital segments and the temporal bones:

- Glossopharyngeal nerve (IX), with sensory fibers in the posterior palate and tongue, which, among other functions, triggers the gag response
- Vagus nerve (X), with sensory fibers to the heart, lungs, trachea, bronchi, larynx, pharynx, gastrointestinal tract, and external ear; and motor fibers to the larynx, heart, lungs, trachea, liver, and gastrointestinal tract
- Spinal accessory nerve (XI) innervates the trapezius and sternocleidomastoid (SCM) muscles, which stabilize the infant's head and maintain airway patency
- Jugular vein, affecting venous return and fluid balance in the cranium

Mechanical analysis of the forces of labor on the fetal skull confirms clinicians' observations of the effects of molding (Lapeer & Prager, 2001). After birth, sucking and crying help expand the cranial vault and allow the bones to gradually move back into alignment during the first 1–2 weeks postbirth (Ward, 2003).

Cranial asymmetry of the occipital, temporal, and/or parietal bones is often accompanied by disrupted alignment of the cranial base (Frymann, 1966). In the first 1–3 days of life, cranial asymmetry is associated with primiparity, assisted delivery, and long labor. Early posterior cranial flattening or other unusual head shapes can progress to deformational plagiocephaly (asymmetry without suture fusing). Cranial asymmetry is more common in males, twins, and on the right side, and it may be associated with torticollis (shortening of the SCM muscle). Cephalohematoma is a well-known risk factor for posterior deformational plagiocephaly. Multiple births and uterine constraints have been reported as risk factors for plagiocephaly but not for true synostosis (premature fusion of the sutures) (Peitsch, Keefer, LaBrie, & Mulliken, 2002).

Excessive pressure to the fetal head, which can be caused by uterine tetany, forceps delivery, or excessive external fundal pressure, can increase fetal intracranial pressure (Amiel-Tison, Sureau, & Shnider, 1988). The use of a vacuum extractor substantially increases the amount of force applied to the occipital segments and entails a documented risk of complications. Hall et al. (2002) reported that "data strongly suggests that success of breastfeeding is associated with events in the first two weeks of life, if not the first 3 to 5 days" (p. 659). Vacuum vaginal delivery was a strong predictor of early cessation of breastfeeding (Hall et al., 2002). The Federal Drug Administration (FDA) 1998 Public Health Advisory warns of increased risk for two major life-threatening complications: subgaleal hematoma (subaponeurotic hematoma) and intracranial hemorrhage (brain bleeds) (U.S. FDA, 1998).

Babies with poor suck may have cranial, postural, and/or jaw asymmetry. Wall and Glass (2006) reported that of 11 babies with mandibular asymmetry and torticollis seen in a Seattle lactation clinic, "10 of the 11 mothers had complications of labor and birth, including prolonged labor in 6 cases, resulting in 1 forceps-assisted birth and 4 Cesarean births" (p. 329).

More definitive research on the effect of mechanical (physical) forces of labor on the infant's ability to suck, swallow, and breathe needs to be conducted. Asymmetry in any part of the infant's body, especially the head and neck, may be one indication of significant abnormalities that contribute to poor suck.

Birth Injuries and Insults

Injuries to the baby's head, face, or upper body can interfere with the baby's ability to suck, swallow, and breathe comfortably. Lacerations can occur during forceps use or cesarean surgery; forceps or vacuum extractors can cause significant bruising and even wounds; and mechanically difficult births are associated with cranial and facial asymmetry. Stellwagen, Hubbard, Chambers, and Jones (2008) studied asymmetries in newborns, reporting that "moderate facial asymmetry was associated with a longer second stage of labour, forceps delivery, a bigger baby and birth trauma. Moderate cranial and mandibular asymmetries were associated with birth trauma. More than one significant asymmetry was found in 10% of newborns" (p. 829). Wall and Glass reported that facial asymmetry and torticollis are associated with impaired sucking ability in newborns (2006).

Instrument delivery with forceps causes lateral compression of the parietal and three segments of each temporal bone. Forceps use can cause bruising and nerve damage to the sides of the infant's cranium, causing the jaw to deviate to the paralyzed side when the mouth is open (Tappero & Honeyfield, 1993). Bruising from instruments can increase risk for jaundice and even kernicterus. Treatment for jaundice leads to separation from the mother, and formula supplementation often interferes with breastfeeding. A baby with bruises or lacerations on the head may be unable to feed in positions that put pressure on the wounded areas.

Suctioning an otherwise vigorous term baby is associated with oral aversion, injury to the posterior oropharynx, removing normal, immunologically important mucus, and failing to prevent meconium-aspiration pneumonia, even in babies born through meconium-stained amniotic fluid (Vain et al., 2004). Current research strongly recommends wiping the newborn's nose and mouth instead of suctioning (Kelleher et al., 2013) even when the amniotic fluid is stained with meconium (American Congress of Obstetricians & Gynecologists, 2007). However, if suctioning is medically necessary, the procedure can compromise early sucking.

Circumcision, especially if performed without analgesia and/or before breastfeeding is well established, causes significant infant pain and interferes with mother–infant interactions (Howard, Howard, & Weitzman, 1994; Marshall et al., 1982). No studies have specifically investigated breastfeeding outcomes of infant circumcision.

Brachial plexus injuries cause the infant significant pain, especially when they are held in certain positions and postures that mothers might unknowingly adopt during breastfeeding (Blair & Smith, 2007; Mollberg, Hagberg, Bager, Lilja, & Ladfors, 2005). Cephalhematoma; head, shoulder, arm, or facial fractures; dislocation of triangular cartilage of the nasal septum; nerve injuries; subgaleal hemorrhage; intracranial bleeding; and other physical injuries to the infant are more common in mechanically difficult births, instrument-assisted births, and cesarean births. Poor feeding may be a sign of intracranial hemorrhage (Avrahami, Frishman, & Minz, 1993).

Consequences of Separation

In utero, the fetus is literally bathed—internally and externally—in the mother's body and receives food, oxygen, flavors from family foods, food preferences, oxygen, immunities unique to the family, comforting touch, random passive movement, sound, and even visual stimulation. The mother is the baby's entire environment. The baby swallows *and* breathes amniotic fluid, which matures the lungs and provides protein and tactile experiences in the gut. Some babies suck their fingers, which may be practice for coordinating suck, swallow, and breathe patterns later.

At birth, the baby's internal and external environment drastically and permanently changes. Suddenly, sound and light are unmediated; the baby must coordinate sucking, swallowing, and breathing to obtain food and air; and the entire skin surface is bombarded by new, often harsh, sensations. The skin elements with the largest representation in the sensory cortex of the brain are the hands and especially the thumbs, lips, tongue, pharynx, and feet—precisely those body parts that are involved when a baby crawls to the breast and latches on after childbirth (Montagu, 1986). Now the baby is in a condition of "exterogestation" (Montagu, 1986)—maturing outside the womb. The closer the external environment is to the internal environment, the more the baby stabilizes and can turn his or her attention to growth and development. A normal baby

placed in skin contact with the mother immediately after birth can crawl to the breast and begin breastfeeding in as little as 5 minutes, or at least within the first hour or so (Bullough, Msuku, & Karonde, 1989). The infant moves through nine distinct stages in the first hours after birth (Widström et al., 2011). If the infant is separated during this sequence, smooth transitioning to sucking may be disrupted (Crenshaw et al., 2012).

Immediate and sustained skin-to-skin contact is so central to establishing breastfeeding that the Baby-Friendly Hospital Initiative (BFHI) includes close physical contact in step 4 and step 7 (WHO & UNICEF, 2009). A 2003 Cochrane review found statistically significant and positive effects of early skin-to-skin contact on the following factors: breastfeeding at 1 to 3 months postbirth (odds ratio 2.15); breastfeeding duration (mean weighted difference 41.99); maintenance of infant temperature in the neutral thermal range (odds ratio 12.18); infant blood glucose (mean weighted difference 11.07); (less) infant crying (odds ratio 21.89); and summary scores of maternal affectionate love touch during an observed breastfeeding within the first few days postbirth (standardized mean difference 0.73) (Moore, Anderson, & Bergman, 2007).

There is no research justifying the separation of a healthy mother and baby, yet this is a very common practice. Separating an infant from its mother, even for procedures as allegedly benign as weighing and measuring, disrupts the infant's sucking response (Righard & Alade, 1990, 1992). Separating the mother and baby postbirth stresses both (Almeida et al., 2010; Bergman, Linley, & Fawcus, 2004; Meaney et al., 1995) and is actually painful for the infant (Jacobson & Bygdeman, 1998). Separation instantly and permanently raises stress hormones, including salivary cortisol. The separated baby experiences the trauma of hyperarousal and dissociation (protest–despair) simultaneously (Bergman et al., 2004). Thus, separated babies are more stressed, and separated mothers also are more stressed. Breastfeeding is comforting for both mother and baby.

In addition to alterations in oral motor functioning when separation occurs, separated babies cry more (Christensson, Cabrera, Christensson, Uvnäs-Moberg, & Winberg, 1995). Crying increases risks of postbirth intracranial bleeds (Anderson, 1989). Symptoms of intracranial bleeds in term newborns include hypotonia or hypertonia, disturbed swallowing, disturbed sucking, transient apnea, and tremor or jerks (Avrahami, Amzel, Katz, Frishman, & Osviatzov, 1996). Separation also increases the risk of postpartum hemorrhage in the mother, as reported by Saxton, Fahy, Rolfe, Skinner, and Hastie (2015).

Radiant electronic warmers separate the infant from the mother, have inconsistent temperature regulation, expose the infant to hospital-borne pathogens, destabilize the infant (Bergman et al., 2004), and are less effective in keeping the infant warm than direct skin-to-skin contact on the mother's body. Furthermore, when a baby is in an electronic warmer, he or she is not breastfeeding.

As harmful as separation is to the mother and baby individually, separation also impedes breastfeeding. Babies need to be physically close to their mother to breastfeed. Physical proximity, especially skin-to-skin contact, results in more episodes of breastfeeding, faster maternal response to the baby's feeding cues, normal sucking patterns, thermal co-regulation, immune protection for the infant, and more. The baby's mouth and the mother's nipple need to be physically connected many hours a day and night for breastfeeding.

Mobbs, Mobbs, and Mobbs (2015) have exquisitely documented the evolutionary importance of the maternal nipple to the baby: oral–tactile imprinting for emotional development by

the term *mother in the mouth*. They report that "Imprinting and subsequent latchment is a primary stage of emotional and neurobehavioral development in which the infant recognizes its mother through oral tactile memory for continuing evolutionary survival" (p. 34). Separating the mother and baby disrupts this key imprinting. All other oral objects ("decoys") are clearly not the same as the maternal nipple, even if other objects can deliver milk. Breastfeeding by definition involves the baby's mouth and the mother's breast.

Ball, Ward-Platt, Heslop, Leech, and Brown (2006) conducted a randomized trial of infant sleep locations on a postnatal ward and concluded that "suckling frequency in the early postpartum period is a well-known predictor of successful breastfeeding initiation. Sleeping newborn babies in close proximity to their mothers (bedding-in) facilitates frequent feeding in comparison with rooming-in." (p. 1005). Safe bed sharing facilitates maternal rest (Quillin & Glenn, 2004; Doan, Gardiner, Gay, & Lee, 2007; Doan, Gay, Kennedy, Newman, & Lee, 2014), infant rest and recovery (Christensson et al., 1992), and breastfeeding (Blair, Heron, & Fleming, 2010; McKenna, Ball, & Gettler, 2007). Conversely, separation stresses mothers and infants and compromises breastfeeding. Separation also compromises brain development and early parent–infant interactions, with long-term consequences (Swain, Lorberbaum, Kose, & Strathearn, 2007). Breastfeeding and bed sharing are so closely interrelated that McKenna and Gettler propose the new term "breastsleeping" to describe the unique physiological, biological, and emotional mutually reinforcing behaviors in the breastfeeding mother–baby dyad (McKenna & Gettler, 2015).

Recovery from and Resolution of Birth-Related Infant Problems

The three most important and effective strategies to help an infant recover from birth-related insults are (1) skin-to-skin contact, (2) skin-to-skin contact, and (3) more skin-to-skin contact. Skin-to-skin contact between baby and mother does not preclude or replace treatment of any injuries. "Healthy infants should be placed and remain in direct skin-to-skin contact with their mothers immediately after delivery until the first feeding is accomplished. . . . Delay weighing, measuring, bathing, needle-sticks, and eye prophylaxis until after the first feeding is completed" (Gartner et al., 2005, p. 498). Virtually all nonemergency procedures can be done with the baby resting on the mother's body or lying supine next to her in her bed. Let the mother and baby get to know one another without interruption (Morrison, Ludington-Hoe, & Anderson, 2006). Staff and family should fully support the mother's cues and requests for privacy or companionship, food and drink, warmth, and so on. Nursing staff should specifically discourage anyone other than the mother (including other hospital staff) from handling, holding, feeding, or otherwise removing the baby from the mother's arms or bed. Safety should be assured for mother and baby, of course, by unobtrusive and careful observation from a short distance. Nothing should be introduced into the baby's mouth other than the mother's breast until many weeks—preferably 6 months—after the baby's first effective breastfeed. The BFHI steps 4, 6, 7, 8, and 9 address these strategies in detail (see **Box 3-1**).

Mother and baby should remain together throughout the recovery period, even after cesarean surgery or other operative procedures, with breastfeeding on cue 24 hours a day (BFHI steps 4, 7, 8, and 9). The baby's first deep sleep after birth is about 60 minutes long (Bergman, 2013), followed by alternating wakefulness and sleep, and for the next day or two, with very

Box 3-1 Ten Steps to Successful Breastfeeding

1. Have a written breastfeeding policy that is routinely communicated to all healthcare staff.
2. Train all healthcare staff in skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Help mothers initiate breastfeeding within half an hour of birth.
5. Show mothers how to breastfeed and how to maintain lactation even if they should be separated from their infants.
6. Give newborn infants no food or drink other than human milk, unless medically indicated.
7. Practice rooming-in; allow mothers and infants to remain together 24 hours a day.
8. Encourage breastfeeding on demand.
9. Give no artificial teats or dummies to breastfeeding infants.
10. Foster the establishment of breastfeeding support groups and refer mother to them on discharge from hospital.

Reproduced from World Health Organization & UNICEF. (2009). *Baby-friendly hospital initiative: Revised, updated and expanded for integrated care*. Geneva, Switzerland: Author.

frequent breastfeeding sessions. Before the moment of birth, the baby received nourishment continually through the umbilical cord and intermittently by sucking and swallowing amniotic fluid. Colostrum is thick, almost gel-like, and is released in relatively small quantities that are easier to manage during the first days of coordinating sucking, swallowing, and breathing. As the mother and baby adapt to external gestation with frequent unrestricted breastfeeding, the dyad's mutual breastfeeding dance continues to improve and mature.

However, some babies are too immature, injured, drugged, and/or otherwise compromised to feed effectively. In that case, follow three rules:

1. Feed the baby.
2. Support the mother's milk supply.
3. Keep the dyad together while the baby's problems are identified and resolved.

Smith's ABC protocol may be useful (**Figure 3-2**). The number 1 rule is always "Feed the baby." The number 2 rule is "Try the easy solutions that do not involve equipment first." The following is a sequential, three-step strategy. Stop when the mother and baby decide that successful breastfeeding has been achieved. The goal is staying at or returning to step 1, effective feeding directly at the breast. Many of the BFHI Ten Steps to Successful Breastfeeding are integrated into this protocol.

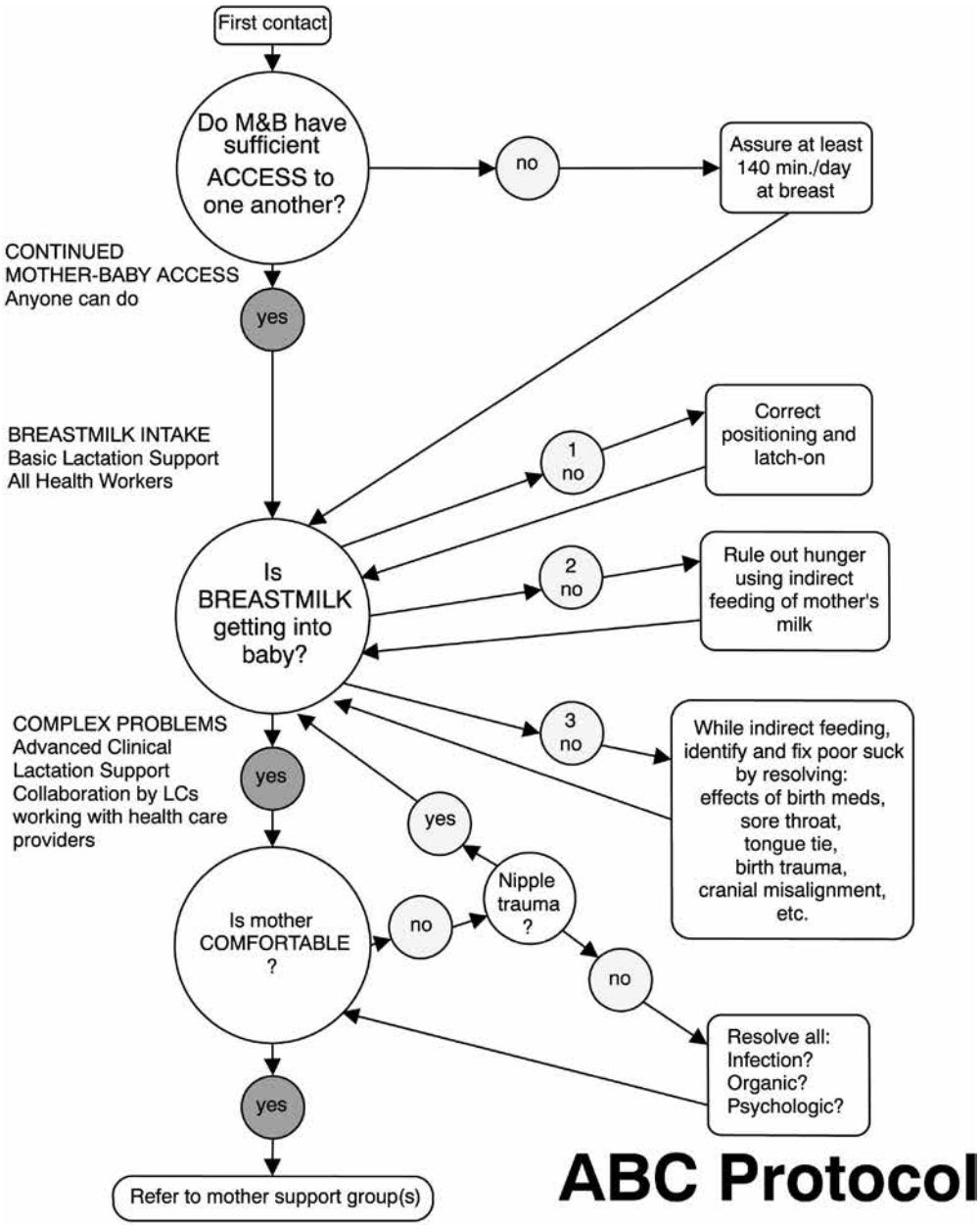

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Figure 3-2 Smith's ABC protocol.™

Step 1: Feed the Baby at the Breast (1–3 Days)

Goal: Rule out behavioral issues and minor mechanical issues. The first step is working with mother and baby together.

First, assure that enough time is spent at the breast (BFHI steps 4, 7, 8). If the baby isn't near the food, she or he can't eat! To obtain enough calories, the baby should be at the breast for a minimum of 140 minutes per 24 hours, or an average of about 11 minutes per hour (De Carvalho, Robertson, Friedman, & Klaus 1983; Kent et al., 2006). Many babies cluster feedings into 10- to 30-minute sessions, using one or both breasts, every 1 to 2 hours (Bergman, 2013). Do not expect the newborn to sleep more than about 1 to 2 hours at a stretch in the first 6 months (La Leche League International, Wiessinger, West, Smith, & Pittman, 2014). Other patterns are common; the total time at the breast matters.

Warning signs:

- There are consistently fewer than 8 feedings per 24 hours.
- The feedings are consistently less than 5–10 minutes per breast.
- Mother removes the baby from the breast at a predetermined time.
- Any pacifier is used.
- Mother is worried that the baby isn't getting enough milk.

What to do: Get the baby to the breast!

- Keep mother and baby in nearly constant skin-to-skin contact for 24–48 hours.
- Maximize the amount of time the baby is at the breast, as continuously as possible.
- Stop all pacifier and bottle (artificial nipple) use. Pacifiers keep the baby away from the breast. All sucking should be at the breast.

Warning: If the mother will not or cannot bring the baby to the breast frequently for any reason, the baby is at immediate risk of inadequate caloric intake. Follow rule 1: feed the baby—with any reasonable source of nutrition, by any method—while addressing this issue. Breastfeeding is impossible without frequent breast contact. That's why it's called *breast*feeding.

Second, assure adequate milk transfer. The baby can be near food but not actually eating. Audible swallowing should be heard during most of the feed at a rate of about one swallow per second, with pauses between bursts of swallows (Riordan, Gill-Hopple, & Angeron, 2005).

Warning signs:

- There are consistently fewer than 8 or more than 16 feedings per 24 hours.
- Feedings are *consistently* shorter than 5 minutes or longer than 30 minutes (Kent et al., 2006).
- There is rapid sucking with little or no swallowing most of the time.
- Baby sucks 3–4 times, falls asleep, *stays at the breast*, and repeats this pattern.
- Mother's nipple is creased, cracked, flattened, or painful after feeding.
- Breast fullness does not change (soften) as a result of feeding.

What to do: Make sure milk is getting from the mother to the baby!

- Assure deep attachment (grasp) to the breast.
- Assure good alignment of the baby's body.
- Assure that the baby is sucking and swallowing properly.

When to go to step 2:

- Corrected positioning *does not* result in audible swallowing.
- Corrected positioning *does not* eliminate nipple compression or pain.
- Baby pulls away from breast, screams, or cannot stay at the breast.
- Baby does not come off the breast spontaneously with obvious satiety.

Step 2: Feed the Baby Expressed Milk Indirectly (Not at the Breast; 1–3 Days) (BFHI Steps 5 and 6)

Goal: Continue to feed the baby while correcting short-term suck problems.

Because direct breastfeeding is not yet effective, indirect feeding of the mother's own expressed milk while establishing lactogenesis is the next step. Poor sucking results in inadequate milk intake for the baby and causes milk retention, engorgement, and a subsequently lowered milk supply in the mother. Hunger may cause a poor or disorganized sucking response, resulting in a self-fulfilling vicious circle. Step 2 breaks this cycle by assuring adequate calories for the baby while maintaining or increasing the mother's milk production. The feeding method used in step 2 should correct early interferences and/or avoid compromising future direct breastfeeding. A disorganized suck caused by hunger may resolve in 2–5 days if artificial nipples are completely avoided and sufficient calories are consumed; feeding at the breast can then begin again.

First, get milk. To increase the milk supply, *remove milk from the breast more frequently and thoroughly*. Hand expression is the most effective method of milk expression in the first 48 hours; after that, using a hospital-grade electric breast pump with a double collection kit and manually expressing milk before and after pumping is recommended (Morton et al., 2009; Ohyama, Watabe, & Hayasaka, 2010). Collect milk in a pattern similar to how a normal baby would feed: Start within the first hour after birth or when it becomes obvious that the baby is not feeding effectively for at least 140 minutes per 24 hours, or about every 2 hours during waking hours and at least once or twice at night. When the breasts begin to feel full, express again. At each session, collect until the milk flow ceases, or at least past one let-down response (Meier et al., 2008). If the mother feels milk dripping or leaking at any time, *collect milk immediately*.

Warning signs:

- The milk volume does not increase in 2–5 days of determined pumping or expressing.
- Nipple or breast pain occurs or continues.
- The mother is taking hormonal contraceptives.
- The mother has had surgery on her breasts.

What does not matter (for milk production):

- The mother's fluid intake, food quality, or food quantity.
- Telling the mother to rest and relax.

Second, feed the baby with an open cup or anything other than an artificial teat (nipple). The goal is to provide calories while permitting or encouraging normal wavelike tongue movements. Feed the baby with a small open cup, spoon, or dropper (Collins et al., 2004; Howard et al., 2003). The use of a feeding tube device placed at the breast is not effective in step 2 because feeding tube devices placed at the breast do not remove milk from the breast. If a baby cannot get milk out of a breast filled with milk, it is unlikely she or he can get milk out of a tube placed at the breast.

Third, keep attempting to breastfeed the baby. After giving 1–2 ounces of milk (5–15 mL for babies younger than 3 days of age) by an alternate method, try breastfeeding. Placing the baby skin to skin on the mother's unclothed upper torso with the mother in a semi-reclining position often triggers breast-seeking behavior and self-attachment. Help the mother and baby achieve meticulous latch and positioning, preferably without touching the mother or baby (Colson, Meek, & Hawdon, 2008; Fletcher & Harris, 2000). Breastfeeding should be comforting and is desirable even if few calories are obtained. Monitor the baby's weight, stools, and urine with accurate equipment.

When to go to step 3:

- Breastfeeding causes nipple pain, compression, or damage.
- Baby continues to be unable to attach and feed from the breast.
- Baby's suck does not improve after 2–5 days of increased calories.
- Baby has a difficult time feeding from alternate devices.

Step 3: Find Out Why the Baby Cannot Obtain Milk at the Breast

Goal: Identify and fix the cause of the underlying suck problem.

Continue to feed the baby with mother's milk, using any feeding device that accomplishes effective, nonstressful feeding. Follow the number 1 rule: feed the baby. Consider *volume* of milk first, then *type* of milk, then feeding *method*. Denying a baby food to improve the suck is unjustified. Babies must receive adequate and appropriate caloric support while oral motor problems are solved. Help the mother maintain her milk supply in the most efficient manner. Because the baby's feeding problem has persisted despite previous strategies, further investigation is needed to identify whether this baby has a disorganized or dysfunctional suck. Disorganized and dysfunctional suck patterns are not corrected by using artificial nipples. An artificial nipple (teat) should be used only as a last resort for feeding. Many parents are at the last resort stage if step 3 becomes necessary.

Step 3 includes complete and careful medical evaluation and close followup by the baby's primary care provider. Breastfeeding does not cause sucking problems. However, sucking problems jeopardize the baby's nutritional status. Virtually all infant problems, including poor oral motor responses, are exacerbated by inadequate nutrition. Ineffective or inappropriate feeding

practices may further compromise undernourished babies with feeding problems. In nearly all situations, human milk is best even if direct feeding at the breast is not possible or must be modified. Maintaining the mother's milk supply is usually the easiest part of managing step 3 problems. The lactation consultant can continue to help the mother maintain a good milk supply and preserve and enhance whatever at-breast feeding is possible.

The reasons and remedies for suboptimal sucking responses in otherwise healthy babies are poorly studied. The underlying causes of poor sucking patterns may have long-term consequences to the baby that are unrelated to feeding. The following possibilities are areas to be explored in cooperation and collaboration with the entire healthcare team:

1. *Effects of labor medications:* Narcotic analgesia, epidural anesthesia, and general anesthesia can affect the baby's sucking and alertness for several hours to several weeks after birth.
   a. *To identify:* A history of maternal labor medication for pain relief is present (Smith & Kroeger, 2010).
   b. *Remedy:* Time is required. If the baby cannot suck well, hand express and use an effective breast pump to maintain the milk supply, starting within 6 hours after birth. Feed the milk to the baby using an alternate nonteat method until the effects of the medication have worn off. There should be noticeable improvement within 1 week, even if total resolution takes longer. If there is no improvement, seek further evaluation.
   c. *Cost:* Pump rental and patience are required.
2. *Sore throat from suctioning or intubation:* Vigorous suctioning or intubation may cause swelling or result in soreness in the mouth and/or throat. Some babies will react by biting, clenching their gums, and/or guarding their airway with strong tongue tip elevation.
   a. *To identify:* A history of suctioning or intubation is present.
   b. *Remedy:* Time and gentle, respectful oral experiences are required. A suctioned baby may not want anything in his or her mouth for a while, not even a breast. Cup feeding is usually the preferred strategy. Do not use pacifiers, fingerfeeding, or artificial nipples in this situation.
   c. *Cost:* Pump rental and patience are required.
3. *Head insult or injury during birth:* The use of forceps or vacuum extraction, prolonged pushing, excessive or persistent molding, or cephalohematoma may cause head pain and motor inhibition.
   a. *To identify:* A history of events during delivery and immediately postpartum is present.
   b. *Remedy:* Time, gentle patience, and posture changes are required. Treat the baby as if she or he has a severe headache. Keep the sore side or area up and higher than the baby's heart. Reduce sensory input by reducing noise and music, light, touch, and excessive motion. Maximize skin-to-skin contact upright against a parent's bare chest in a quiet, darkened place. If the baby can nurse effectively in one position, use

it frequently without trying for variety! Cool cloths on the baby's head may help. Some clinicians suggest judicious use of infant pain relief medications. Cup feeding of pumped milk may be more comfortable for the baby than feeding directly at the breast.

c. *Cost:* Pump rental and patience are required.

4. *Oral structural problems, especially tongue-tie (ankyloglossia):* See Chapter 8 for more information about ankyloglossia.
   a. *To identify:* Use a validated assessment tool. Visual clues include a heart-shaped or square-tipped tongue or a tongue that cannot extend past the lower lip without curling or denting. Functional clues include absent or reverse tongue peristalsis, the tongue tip cannot rise to the palate, the mother's nipples are creased and cracked across the tip or have unhealed wounds on the tip, or the baby cannot obtain milk at the breast.
   b. *Remedy:* Evaluation and treatment by a qualified healthcare professional is required. The professional will release the frenulum (perform a frenotomy; see Chapter 9) with sterile scissors and immediately have the baby put to the breast. A frenotomy can be done within hours of the baby's birth. Maternal comfort and infant sucking effectiveness are often improved immediately and continue to evolve over several days.
   c. *Cost:* Medical or dental outpatient surgical treatment is required, which may be covered by insurance.
5. *Misalignment of cranial bones during birth that does not spontaneously resolve in 1–2 weeks* (Frymann, 1966): A mechanically difficult birth may cause pressure on cranial sensory and motor nerves as they pass through the foramen between the infant's skull bones and sutures, which in turn can affect sucking, swallowing, and digestion. The vagus nerve can also be affected.
   a. *To identify:* Signs include gagging, weak suck, abnormal tongue movements, facial asymmetry (Wall & Glass, 2006), postural asymmetry, head molding persisting past 1 week, arching, plugged tear ducts, baby's inability to turn the head both ways easily, and palpable ridges along cranial suture lines.
   b. *Remedy:* Evaluation and treatment by a doctor of osteopathy, physical therapist, pediatric chiropractor, cranial-sacral therapist, or another qualified provider trained in manipulative techniques on infants is required. These therapeutic modalities are subtle, gentle, and have produced remarkable results (Fraval, 1998) (see Chapter 13).
   c. *Cost:* The cost varies and may be covered by insurance.
6. *Other medical or health problems in the baby:* Other medical or health problems may include cardiac abnormalities, neurological problems, severe allergies, fungal or other mouth infections, metabolic abnormalities, and other congenital issues. Some providers suggest that feeding behavior is the first thing to go wrong when a severe problem is developing in a baby. Always stay in close collaboration with the baby's primary care provider whenever step 3 becomes necessary.

The following is a summary of the protocol:

Step 1: Direct breastfeeding; keep mother and baby together (steps 4, 6, 7, 8, 9).

- Assure sufficient time at the breast (quantity issue).
- Assure effective feeding at the breast (quality issue).

Step 2: Indirect feeding of the mother's own milk; keep mother and baby together (steps 5, 6).

- Maintain or increase the mother's milk production.
- Feed the baby in a way that encourages proper tongue movements.
- Continue attempts to breastfeed directly.

Step 3: Find out why the baby cannot feed at the breast; keep mother and baby together.

- Continue indirect feeding with the mother's milk while causes and remedies are investigated.
- Support the mother's milk supply, her efforts, and her motivation.
- Collaborate with other providers.

Summary of Recovery from and Resolution of Birth-Related Infant Problems

Obviously, babies have to be born. The best way to prevent complications arising from birth practices is to minimize the use of interventions. A normal birth usually leads to normal breastfeeding. Complications during pregnancy, labor, and birth do occur, and properly used interventions can be life saving for the mother and/or baby. Even when they are necessary and properly used, interventions can have a profound negative effect on the infant, the mother, and the course of breastfeeding. The rate at which interventions are used is the chief concern, not the interventions themselves. The WHO and other health-policy bodies have published research-based data on the recommended rates of medically necessary interventions. In many places, local rates of induction, cesarean surgery, and epidural use far exceed medically necessary rates.

The Every Newborn Action Plan launched by the WHO in 2014 includes criteria for a 10-point Woman-Friendly Birthing Facility, which is now being developed and piloted:

1. Offers to all birthing women the opportunity to eat, drink, walk, stand, move and adopt her preferred positions in labor.
2. Has clear nondiscriminatory policies on HIV-positive women, as well as family planning and youth services
3. Provides privacy during labor/delivery
4. Choice of birthing partner
5. Culturally competent care
6. No physical, verbal, emotional, or financial abuse
7. Affordable costs. Free obstetric care if possible. Fees should be reasonable and posted. Inability to pay is not a reason to deny care.
8. No routine in practice such as routine episiotomy, induction, etc.

9. Encourage, counsel, and educate staff to provide non-pharmaceutical and pharmaceutical pain relief
10. Promote skin-to-skin mother–baby contact, encourage holding and breastfeeding babies as soon as possible, and provide combined care (World Health Organization, 2014).

Lamaze International developed six Lamaze Healthy Birth Practices, each of which is fully supported by abundant research. The organization believes that the care practices, adapted from the WHO, promote, support, and protect nature's plan for birth:

1. Labor begins on its own
2. Freedom of movement throughout labor
3. Continuous labor support
4. No routine interventions
5. Nonsupine (e.g., upright or side-lying) positions for birth
6. No separation of mother and baby after birth with unlimited opportunity for breastfeeding (Lamaze International, 2015).

Regardless of what happens during childbirth, lactation consultants have a key role in helping mothers and babies establish breastfeeding. Lactation consultants are trained and skilled in observing, assisting, and monitoring the mother–baby dyad as they move along the continuum from internal gestation to exterogestation. Lactation consultants play an important role in documenting and bearing witness to the mother and baby outcomes that may be affected by birth interventions and in aiding the mother–baby dyad to overcome early and/or negative consequences of birth practices.

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