BREASTFEEDING MEDICINE
Volume 5, Number 2, 2010

DOI: 10.1089/bfm.2010.9994

ABM Clinical Protocol #22: Guidelines for Management of Jaundice in the Breastfeeding Infant Equal to or Greater Than 35 Weeks' Gestation

The Academy of Breastfeeding Medicine Protocol Committee

A central goal of The Academy of Breastfeeding Medicine is the development of clinical protocols for managing common medical problems that may impact breastfeeding success. These protocols serve only as guidelines for the care of breastfeeding mothers and infants and do not delineate an exclusive course of treatment or serve as standards of medical care. Variations in treatment may be appropriate according to the needs of an individual patient.

Purpose

1. To provide guidance in distinguishing those causes of jaundice in the newborn that are directly related to breastfeeding from those that are not directly related to breastfeeding.
2. To guide monitoring of jaundice and bilirubin concentrations and management of these conditions in order to preserve breastfeeding while protecting the infant from potential risks of toxicity from hyperbilirubinemia.
3. To provide a protocol for hospital and office procedures for optimal management of jaundice and hyperbilirubinemia in the breastfed newborn and young infant.

Biologic Basis for Jaundice in the Newborn

The reader is referred to several comprehensive reviews of bilirubin metabolism and jaundice in the newborn that are listed in the references for a more complete discussion of the biology and pathobiology of jaundice in the newborn.[1–6] Although management of breastfeeding and jaundice varies among the nations, these principles and recommendations apply universally.

Hyperbilirubinemia of the newborn

All newborns have some elevation in unconjugated (indirect-reacting) bilirubin relative to normal adult values ($\leq$1.5 mg/dL; 26 μmol/L). Higher values in unconjugated bilirubin result from a combination of increased production of bilirubin from heme degradation, decreased hepatic uptake and conjugation of bilirubin, and increased intestinal reabsorption of bilirubin.[7] In the first week of life, a significant proportion of all newborns will have total serum bilirubin concentrations greater than 5.0 mg/dL (86 μmol/L); these infants are likely to appear jaundiced. Data indicate that approximately 40% of healthy newborns have a total bilirubin of 5 mg/dL at 24 hours and 7 mg/dL (120 μmol/L) by 36 hours of age[8] (Fig. 1). This normal elevation in unconjugated bilirubin is termed "physiologic hyperbilirubinemia of the newborn."

Breastmilk jaundice

Breastfed infants regularly and with high frequency (two-thirds or more) have unconjugated hyperbilirubinemia that extends into the second and third weeks of life and often up to 8–12 weeks of life.[9,10] In contrast to formula-fed infants, approximately half of all breastfed infants may appear slightly to moderately jaundiced in the second and later weeks of life. This prolongation of physiologic jaundice due to breastfeeding is known as "breastmilk jaundice."[9] The mechanism of breastmilk jaundice in humans is unknown. Research has demonstrated that two-thirds of transitional and mature human milk samples enhance the intestinal absorption of unconjugated bilirubin in rats, presumably because of an unidentified substance in human milk.[9,11] Over time, the jaundice and elevated serum unconjugated bilirubin decline to normal adult values even while breastfeeding continues. The rate of decline is highly variable from infant to infant.

Starvation jaundice of the newborn

It is important to recognize that not all breastfed infants will receive optimal milk intake during the first few days of life; as many as 10–18% of exclusively breastfed U.S. newborns lose more than 10% of birth weight.[12–14] Absence of caloric intake in normal adults, even for as brief a period as 24 hours and with good hydration, results in a small increase in unconjugated hyperbilirubinemia of about 1–2 mg/dL (17–34 μmol/L) above the adult normal total serum bilirubin concentration of 1.5 mg/dL (26 μmol/L).[15–17] In newborns, reduced caloric intake below the *optimal* intake for age, even without absolute starvation, results in greater increases in serum unconjugated bilirubin concentrations because of the normal developmental limitations in bilirubin metabolism and transport that are present in the newborn infant.[18–20]

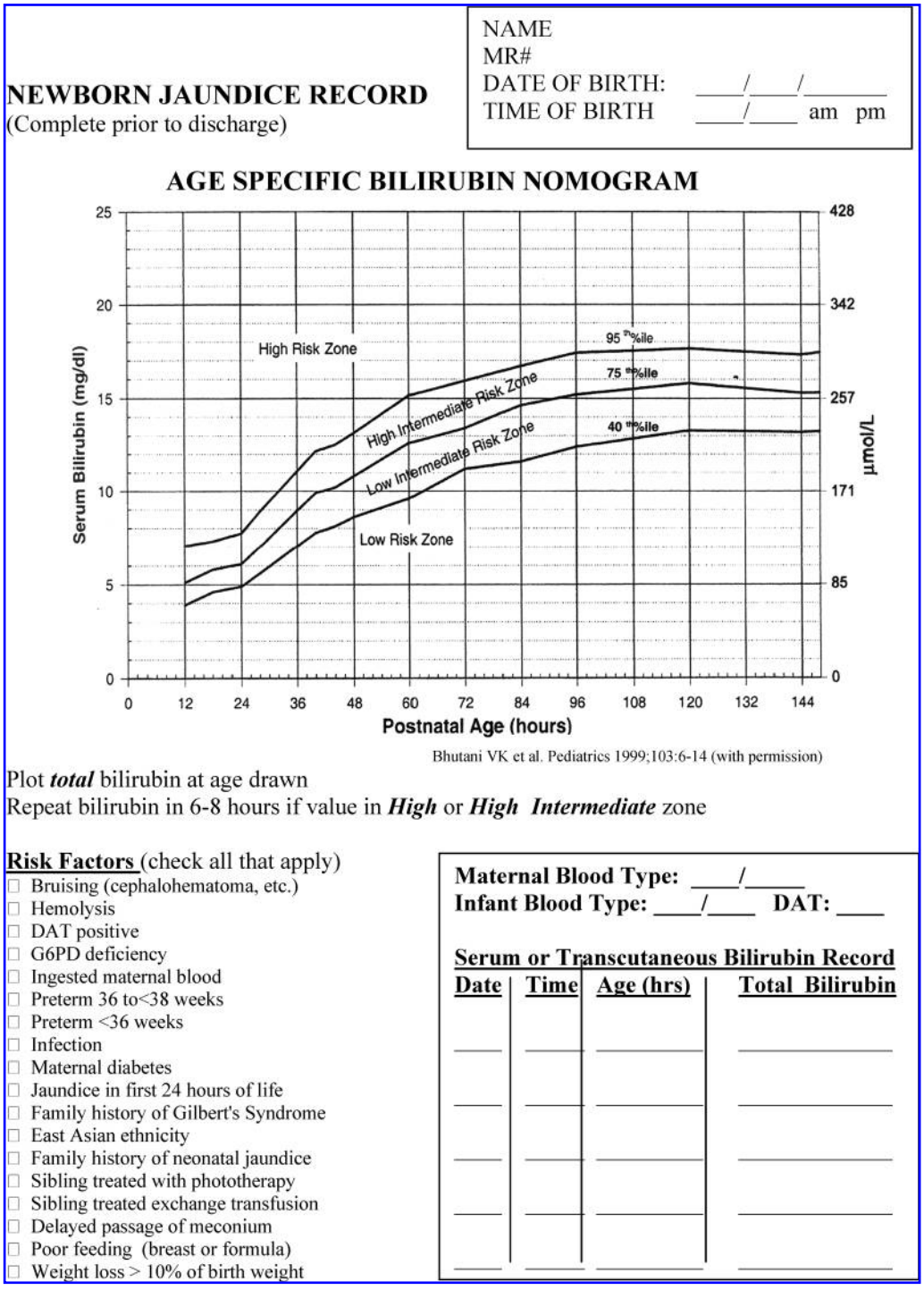

FIG. 1. Newborn jaundice record and age-specific nomogram.

Two studies[21,22] widely quoted in the breastfeeding literature report that when breastfeeding is optimally managed there are no differences in serum bilirubin concentrations in breastfed and formula-fed infants during the first 5 days of life; however, the majority of reports indicate increased serum bilirubin concentrations and greater weight loss in breastfed infants.[23,24] Starvation jaundice of the newborn is more often seen during the first week of life when breastfeeding is being initiated, but it can occur later in the newborn period (first 28 days of life) and even into infancy. The mechanism of starvation jaundice has been shown to be an increase in intestinal absorption of unconjugated bilirubin. After the first 5 days of life, starvation further enhances the normally increased intestinal bilirubin absorption of the breastfed infant, possibly resulting in toxic bilirubin concentrations.

Interaction of starvation jaundice and breastmilk jaundice

Poor breastfeeding with inadequate caloric intake during the first days of life increases intestinal bilirubin absorption because of relative starvation.[17–19] Poor intake also delays emptying of meconium, a reservoir of considerable unconjugated bilirubin, and enhances transfer of bilirubin from meconium into the infant's circulation.[25] This enlarges the circulating bilirubin pool in the infant, as reflected in higher than normal serum unconjugated bilirubin concentrations.[7] With the appearance of mature breastmilk at the end of the first week of life, the factor that enhances intestinal bilirubin absorption will return greater amounts of bilirubin than normal back into the infant's circulation. This results in abnormally increased serum unconjugated bilirubin concentrations in the second and third weeks of life, and beyond, which potentially may be toxic. Attention to optimizing breastfeeding management may mitigate against the development of late exaggerated serum bilirubin concentrations in normal infants.[17,18]

Kernicterus and bilirubin encephalopathy

Concern about unconjugated hyperbilirubinemia derives from the potential risk for a type of brain damage known as "kernicterus" or "bilirubin encephalopathy" when markedly elevated levels of unconjugated bilirubin exceed the binding capacity of serum albumin and bilirubin crosses the blood–brain barrier to enter neurons in the basal ganglia and cerebellum.[26–31] Management guidelines have been developed that provide guidance on treatment of hyperbilirubinemia to protect infants against the development of bilirubin encephalopathy. These are discussed below.[2,4]

Management of Jaundice

Prevention of potentially toxic serum bilirubin concentrations

Not all exaggerations of unconjugated hyperbilirubinemia in breastfed infants can be prevented, but close follow-up of the breastfeeding neonate to insure against excessive weight loss from birth and adequate weight gain in the first month[14,28,32] assures the detection and intervention for potentially toxic serum bilirubin concentrations.[26,33] The following measures are recommended to keep serum bilirubin concentrations in the normal, safe range while maintaining exclusive breastfeeding:

1. Early initiation.
   a. Initiate breastfeeding as early as possible, preferably in the first hour after birth.[34,35] Even with infants born by cesarean delivery, breastfeeding can be started in the first hour.
2. Exclusive breastfeeding should be encouraged.
   a. It is unnecessary to test the infant's ability to swallow or avoid aspiration. Feeding anything prior to the onset of breastfeeding delays the establishment of good breastfeeding practices by the infant and delays establishment of adequate milk production, increasing the risk of starvation and exaggerated hyperbilirubinemia.
   b. Breastfeeding infants should not be supplemented with water, glucose water, or formula. (See the section on treatment of hyperbilirubinemia for use of supplementation in the infant with excessive serum bilirubin concentrations.)[36–41] Supplementation with expressed breastmilk, banked human milk, or formula (in that order of preference) should be limited to infants with at least one of the following:[42,43]
      i. A clear indication of inadequate intake as defined by weight loss in excess of 10% after attempts to correct breastfeeding problems.[12,14]
      ii. Failure in milk production or transfer adjusted for duration of breastfeeding and documented by pre- and post feeding weights after attempts to increase milk production and milk transfer.
      iii. Evidence of dehydration defined by significant alterations in serum electrolytes, especially hypernatremia, and/or clinical evidence of significant dehydration (poor skin turgor, sunken fontanelle, dry mouth, etc.).
3. Optimize breastfeeding management from the beginning.
   a. Assure ideal position and latch from the outset by having a healthcare provider trained in breastfeeding management (nurse, lactation consultant, lactation educator, midwife, or physician) evaluate position and latch,[44,45] providing recommendations as necessary.
4. Education on early feeding cues.
   a. Teach the mother to respond to the earliest cues of infant hunger, including lip smacking, hand movements toward the mouth, restlessness, and vocalizing.[46,47] Infants should be put to the breast before the onset of crying. Crying is a late sign of hunger and often results in a poor start to the breastfeeding episode.
5. Identification of at-risk mothers and babies.
   a. Both maternal (e.g., diabetes, Rh sensitization) and infant-related (e.g., bruising, prematurity, ABO disease) health factors (see Fig. 1) may increase the likelihood of an infant developing significant hyperbilirubinemia. These factors can be additive with starvation jaundice and/or breastmilk jaundice and produce even higher bilirubin levels than would otherwise be seen. When such risk factors are identified it is prudent to seek lactation consultation in the early hours after delivery to assure optimal breastfeeding management. In certain instances (e.g., sleepy baby, premature infant, mother–baby separation) mothers may benefit from interventions such as early instructions in manual or pump stimulation of breasts to optimize milk supply and prevent delayed secretory activation of the breasts (lactogenesis II).
   b. Late preterm infants are at increased risk for severe hyperbilirubinemia because their greater risk of breastfeeding difficulties[48] often results in starvation jaundice in combination with higher levels of bilirubin because of the delay in the maturation of the liver's capacity for bilirubin conjugation. If the 35–37-week premature infant manifests poor breastfeeding behavior or inadequate weight gain, consideration should be given to providing small amounts of expressed breastmilk, donor milk, or supplemental formula after each breastfeeding until weight gain is established to avoid starvation jaundice in these infants.[49]

Treatment of excessive hyperbilirubinemia

The reader is advised to carefully read and utilize the American Academy of Pediatrics (AAP) Clinical Practice Guideline on Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation and the 2009 update to the guideline.[2,4]

When efforts to prevent the rise of serum bilirubin concentrations into potentially toxic ranges in the breastfed infant have failed, several treatment options are available. These management options may be combined. All modes of treatment are compatible with continuation of breastfeeding.

Recognizing that phototherapy for neonatal hyperbilirubinemia, depending on the care setting, may result in mother–infant separation, physicians may opt to institute supplementary feedings at levels of bilirubin lower than those recommended for phototherapy in the AAP Guideline. In other settings it may be possible to conduct phototherapy in the mother's room, and such therapy may be less disruptive to the breastfeeding process than supplemental feedings. Such decisions should be individualized taking into account the specific clinical setting and indications for therapy with the goal of keeping mother and baby together, preserving and optimizing breastfeeding while delivering the required therapy to effectively treat the condition. Options include phototherapy, temporary supplementation with special formula, and temporary interruption of breastfeeding and replacement feeding with infant special formula.

Because the parents may associate breastfeeding with the development of jaundice requiring special treatment or hospitalization, they may be reluctant to continue breastfeeding. Healthcare providers should offer special assistance to these mothers to insure that they understand the importance of continuing breastfeeding and know how to maintain their milk supply if temporary interruption is necessary.

Guideline. The AAP Clinical Practice Guideline on Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation (Fig. 2) provides guidance about levels of total serum bilirubin (TSB) at which treatment is recommended.[2,4] Treatment levels are adjusted for a number of risk factors such as prematurity and hemolysis. The guidelines apply to the breastfed infant as well as the formula-fed infant. There is no evidence to support allowing serum bilirubin levels in the breastfed infant to rise above the recommended limits, even when the apparent cause of the hyperbilirubinemia is either breastmilk jaundice or starvation. The reader is referred to the AAP guideline[2,4] for specific detailed information about bilirubin measurement by serum and transcutaneous methods and treatment including indications for exchange transfusion.[2,4] The following information is meant to supplement the information offered in the AAP Guideline.

Treatment options

1. Phototherapy. Phototherapy can be used while continuing full breastfeeding, or it can be combined with either supplementation or temporary interruption of breastfeeding with replacement feeding.[2,4,50] When serum bilirubin concentrations have already exceeded the phototherapy indication level, especially when rising rapidly, it is best to start phototherapy and not rely

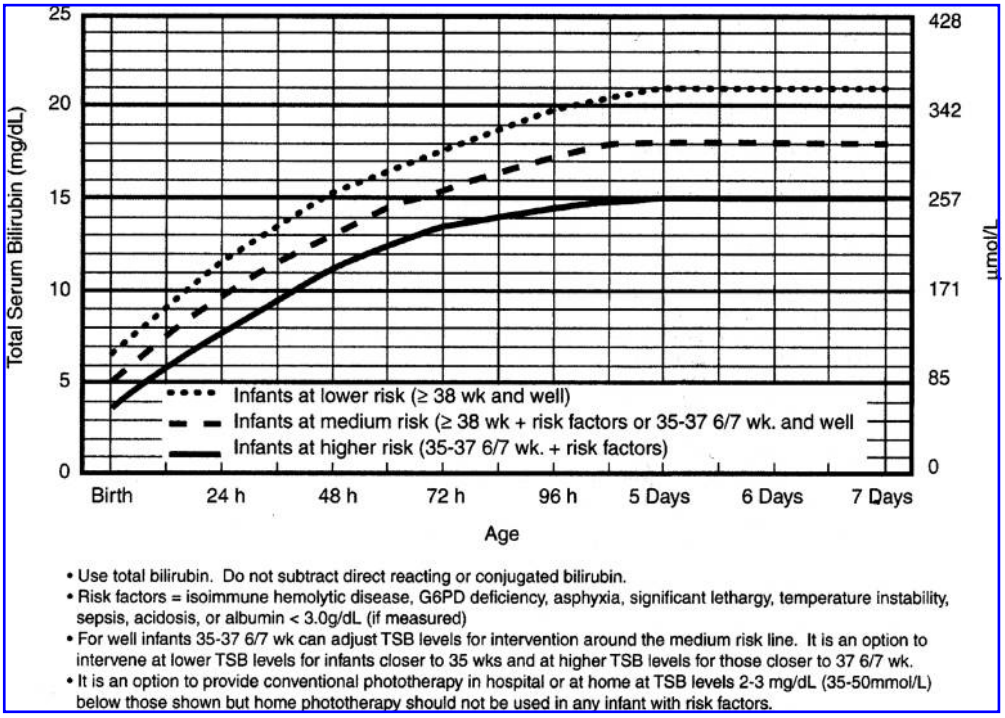

FIG. 2. Guidelines for phototherapy in hospitalized infants ≥35 weeks' gestation. Note that these guidelines are based on limited evidence and that the levels shown are approximations. The guidelines refer to the use of intensive phototherapy, which should be used when the TSB level exceeds the line indicated for each category. G6PD, glucose 6-phosphate dehydrogenase. Reproduced with permission from American Academy of Pediatrics.[4]

only on supplementation or temporary interruption of breastfeeding alone because these will be slower in achieving the desired reduction.[51] Phototherapy is best done in the hospital and in the mother's room or a pediatric room where mother and baby can stay together so that breastfeeding can be continued. Interruption of phototherapy for durations of up to 30 minutes to permit breastfeeding without eye patches does not alter the effectiveness of the treatment.

Although phototherapy increases insensible water loss to some degree, infants under phototherapy do not routinely require intravenous fluids. They may be indicated in cases of infant dehydration, hypernatremia, or inability to ingest adequate milk. The routine provision of intravenous fluids is discouraged, however, as they may inhibit thirst and diminish oral intake.

Breastfeeding infants who are readmitted from home for phototherapy should be admitted to a hospital unit in which the mother can also reside so that breastfeeding can continue without interruption.

Home phototherapy is possible, but discouraged, especially for infants with risk factors.[2,4] Home phototherapy may be appropriate for the rare infant with breastmilk jaundice who requires phototherapy in the second or third weeks of life if the serum bilirubin is rising slowly or is stable and if there are no additional risk factors for kernicterus.

2. Alternatives to phototherapy. Phototherapy for neonatal hyperbilirubinemia may result in mother–infant separation in some settings and thus adversely affect the establishment and ultimate long-term success of breastfeeding. There is some uncertainty about exact levels at which treatment of hyperbilirubinemia is justified, and clinicians must use their judgment as to when to institute a specific therapy taking into account the care setting, individual maternal and infant health factors, risks of the infant developing severe hyperbilirubinemia, and family preferences. When TSB levels are close to AAP treatment thresholds (2–3 mg/dL or 34–51 μmol/L below) with appropriate risk adjustments (Fig. 2), supplementation or replacement feeding with formula is reasonable in addition to or instead of phototherapy, if it can be done in a way that is supportive of breastfeeding and the baby can be followed closely. Infants must be followed closely to ensure that the bilirubin levels are improving appropriately with supplemental feedings. Bilirubin measurements should be undertaken every 4–6 hours. Phototherapy should be instituted if serum bilirubin levels reach AAP threshold levels adjusted for risk factors and infant age.
   a. Supplementation of breastfeeding. Cow's milk-based formulas have been shown to inhibit the intestinal absorption of bilirubin.[11] Therefore, supplementation of breastfeeding with small amounts of infant formula can be used to lower serum bilirubin levels in breastfeeding infants.[42] Hydrolyzed protein formulas (elemental formulas) have been shown to be more effective than standard infant formulas in preventing intestinal absorption of bilirubin.[52] Hydrolyzed formulas are preferred because they are less likely to induce milk allergy or intolerance and may not be viewed by the parents as "switching to formula."

   Excessive amounts of formula should be avoided so as to maintain frequent breastfeeding and preserve maternal milk production at a high level. If the mother is not producing adequate milk or infant weight loss (>10%) or hydration indicate inadequate milk production or milk transfer to the infant, then larger quantities of formula should be offered to insure adequate caloric intake.

   Regardless of which breastmilk substitute is chosen, supplementation of breastfeeding should be achieved by cup or use of a supplemental nursing device simultaneously with each breastfeeding. Nipples/teats and bottles should be avoided where possible.[42]

   b. Temporary interruption of breastfeeding. Interruption of breastfeeding for 24–48 hours with full formula feeding will generally lower serum bilirubin concentrations more rapidly than supplementation, especially in the rare case with extreme exaggeration of breastmilk jaundice. In infants less than 5 days of age, interruption of breastfeeding and replacement feeding with formula may not be as effective as the use of phototherapy.[51] Risk factor adjustments of serum bilirubin concentrations for the start of this therapy should be used as they would be for phototherapy. The use of hydrolyzed protein formula is recommended for its greater efficacy.[52] With temporary interruption of breastfeeding, it is critical to maintain maternal milk production by teaching the mother to effectively and frequently express milk manually or by pump. The infant needs to return to a good supply of milk when breastfeeding resumes, or poor milk supply may result in a return of higher serum bilirubin concentrations. If temporary interruption fails to promptly reduce bilirubin concentrations or bilirubin levels continue to rise, then phototherapy needs to be considered.

Post-treatment follow-up and evaluation

Infants who have had any of the above treatments for excessive hyperbilirubinemia need to be carefully followed with repeat serum bilirubin determinations and support of breastfeeding because suboptimal breastmilk intake may result in recurrence of hyperbilirubinemia.

Encouragement to continue breastfeeding is of the greatest importance since most of the parents of these infants will be fearful that continued breastfeeding may result in more jaundice or other problems. They can be reassured that this is not the case. Even those infants with breastmilk jaundice who required treatment will not have sufficient rise in bilirubin with continued breastfeeding to require further intervention.[9]

Summary and Conclusions

Jaundice and some degree of hyperbilirubinemia are normal and expected aspects of newborn development. Breastfeeding is also a normal and expected aspect of infancy and childhood.[53] Managing the confluence of jaundice and breastfeeding in a physiologic and supportive manner to ensure optimal health, growth, and development of the infant is the responsibility of all healthcare providers. A complete understanding of normal and abnormal states of both bilirubin and breastfeeding is essential if optimal care is to be

provided and the best outcome achieved for the child. These guidelines provide a template for this management, but it remains with the healthcare providers to use these guidelines with judgment and to adjust the guidelines to the individual needs of each infant.

Research Needs

These recommendations are based on the most current research and clinical experience available. There are many opportunities for research to improve understanding of the basic physiology, biochemistry, and clinical management of jaundice in the breastfed infant. Understanding of the specific mechanism of bilirubin absorption in the intestine and the chemical composition of the component(s) in human milk that enhance bilirubin absorption are needed. With this knowledge it might be possible to design management of the breastfed infant with hyperbilirubinemia that would allow uninterrupted breastfeeding while reducing serum bilirubin concentrations to safe levels. Although not specific to the breastfed infant, there is need to more fully understand the mechanism(s) by which bilirubin enters areas of the brain and causes neuronal death. With this knowledge, more specific levels of risk for kernicterus might be defined.

Acknowledgments

This work was supported in part by a grant from the Maternal and Child Health Bureau, U.S. Department of Health and Human Services. The committee is indebted to Dr. Jeffrey Maisel and Dr. Thomas Newman for their expert review of earlier drafts of this protocol.

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