Feeding Problems in the Late Preterm Infant

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Prematurity is the major determinant of neonatal mortality and morbidity. Much of the neonatal nutrition literature has focused on the management of very low birth weight infants, a group of infants usually less than 33 weeks gestation [1]. Much less attention has been paid to nutritional management issues in preterm infants at higher gestations.

Replacing near-term with late preterm is useful, because it better reflects the higher risk for complications of preterm birth experienced by this subgroup of preterm infants. This article reviews nutritional issues that exist from the 239th day (34 0/7 weeks gestation) and ending on the 259th day (36 6/7 weeks gestation) since the first day of the mother’s last normal menstrual period.

The 34- to 37-week neonate presents a nutritional challenge to health care providers beginning from the decision where the appropriate level of care should be provided immediately following birth. Triage of the late preterm may vary among hospitals; some infants may be directly admitted to a newborn nursery whereas others may be cared for in the neonatal intensive care units. Additionally, such differences in initial care are more apparent for infants in the 34 to 35 week strata compared with the 36 to 37 week strata.

A recent study [2] selecting infants from the previously published Moderately Premature Infant Project [3,4] with gestational ages at the lower end of the 34 0/7 to 36 6/7 week range included only infants admitted to neonatal ICUs (NICUs) in the same hospitals of their birth. They found striking variations in nutritional practices, which might have influenced rates of weight gain [2]. About 17% of infants received total parenteral nutrition (TPN), but the range was 5% to 66%. Likewise, there was a range in the type of formula recommended at discharge [2]. Although nearly half (46%) of
infants were discharged with advice to be fed with a formula containing more than 20 calories per ounce, this practice ranged from 4% to 72%.

Late preterm infants are born only a few weeks early, and most often they are only slightly smaller than full-term infants; however, these late preterm infants have a wide spectrum of nutritional needs. The needs may vary from timely lactation support in the inpatient and outpatient setting to providing TPN for the late preterm infant receiving inhaled nitric oxide for respiratory failure.

Breast-feeding the late preterm infant

The advantages of breast milk feeding for premature infants appear to be even greater than those for term infants. Establishing breastfeeding in the late preterm infant, however, is frequently more problematic than in the full-term infant. Because of their immaturity, late preterm infants may be sleepier and have less stamina. They may have more difficulty with latch, suck, and swallow; more difficulty maintaining body temperature; increased vulnerability to infection; greater delays in bilirubin excretion, and more respiratory instability than the full-term infant. The sleepiness and inability to suck vigorously often is misinterpreted as sepsis, leading to unnecessary separation and treatment. Alternatively, the late preterm infant may appear deceptively vigorous at first glance. Physically large newborns often are mistaken for being more developmentally mature than their actual gestational age. (Remember the 3.84 kg baby born at 40 weeks was 3.0 kg at 36 weeks of gestation.) Late preterm infants are more likely to be separated from their mother as a result of the infant being ill or requiring a screening procedure such as evaluation for sepsis, intravenous placement for antibiotics, and phototherapy.

Mothers who deliver near but not at term are more likely to deliver multiples, or they may have a medical condition such as diabetes, pregnancy-induced hypertension, prolonged rupture of membranes, chorioamnionitis, oxytocin induction, or a cesarean section delivery that may affect the success of breast-feeding. Any one or a combination of these conditions places these mothers and infants at risk for difficulty in establishing successful lactation or for breast-feeding failure.

The potential maternal and infant problems place the late preterm breast-feeding infant at increased risk for hypothermia, hypoglycemia, excessive weight loss, slow weight gain, failure to thrive, prolonged artificial milk supplementation, exaggerated jaundice, kernicterus, dehydration, fever secondary to dehydration, rehospitalization, and breast-feeding failure. In places where early discharge is the norm, these infants will be sent home soon after delivery. Discussion and parental education become crucial in the proper management of breast-feeding.

Most of the acute problems encountered in the newborn are managed on the postpartum floor in the first few hours and days after parturition;
however, there are times that an infant’s condition deteriorates in the interval between discharge and the first office visit. Therefore, timely evaluation of the late preterm infant after discharge is critical. Just as many hospitals are becoming breast-feeding friendly, the outpatient office or clinic needs to be not only supportive of the breast-feeding mother, but also able to assist mothers with uncomplicated problems or questions related to breast-feeding. In addition, it is essential to be able to refer mothers and infants in a timely manner to a trained lactation professional for more complicated breast-feeding problems. A lactation referral should be viewed with the same medical urgency as any other acute medical referral.

Specific protocols for managing breast-feeding are beyond the scope of this article. Resources are available including protocols from the Academy of Breastfeeding Medicine [5–7].

**Feeding problems in late preterm infants**

A recent study demonstrated that 27% of all late preterm infants had a clinical condition whereby intravenous fluid was given, compared with only 5% of all term infants [8]. Various clinical problems including hypoglycemia and poor feeding precipitated this treatment [8]. This same study also linked delayed discharge home with more clinical problems in late preterm infants than in term infants. Feeding problems were the dominant reason for delay in discharge [8]. Given that immature infants are less able to achieve effective sucking and swallowing, this is not entirely unexpected. In the author’s clinical experience, many late preterm infants require repeated assistance and support before achieving consistent, nutritive breast-feeding; initially, supplementation with expressed breast milk or formula often is required.

Successful enteral feeding of these infants demands creativity and flexibility. An infant may need multiple feeding methods during the transition to oral feedings. The team approach, including input of the nutritionist, nurse, occupational therapist, speech pathologist, lactation consultant, and physician can facilitate choosing successful feeding regimens for infants at different stages in their development and clinical course.

**Nutritional considerations**

*Nutrition in respiratory disease*

Respiratory distress, defined as sustained distress more than 2 hours after birth accompanied by grunting, flaring, tachypnea, retractions, or supplemental oxygen requirement, was observed more often in late preterm infants (28.9% versus 4.2%) than in term newborns [8]. The rate of occurrence of any form of respiratory distress increases dramatically among infants born at less than 37 weeks [9,10]. In addition, compared with babies with a gestational age of 38 to 40 weeks, babies born at 37 weeks were five times
as likely, and babies born at 35 weeks, nine times as likely, to have respiratory distress [11].

Therefore, TPN may become an important therapy in late preterm infants. TPN usually is indicated when a sufficient nutrient supply cannot be provided enterally to prevent or correct malnutrition. Until full enteral feeding can be established, these preterm infants can be supported with TPN. In the late preterm infant with respiratory disease, the indication for TPN is critical illness. Infants with a functioning gastrointestinal system should begin enteral feeds as soon as clinically possible in combination with TPN.

For the late preterm infant with respiratory disease, energy balance during the first several days usually is equated to absorption of sufficient energy to match energy expenditure. Most studies show that energy expenditure of nongrowing low birth weight infants (less than 2500 g birth weight) is 45 to 55 cal/kg/d [12–14].

These infants are very capable of catabolizing amino acids. Parenteral protein including about 2 g/kg/d can be initiated immediately and with regimens delivering as few as 35 cal/kg/d result in positive nitrogen balance [15,16]. Protein intakes of 2.5 to 3.0 g/kg/d will achieve similar weight gain as a term infant fed human milk if these infants require longer periods of exclusive TPN [17].

The most controversial nutrient to be considered in the late preterm infant with respiratory disease is the use of intravenous lipids (IVL). Two different populations within the group of late preterm infants with respiratory disease emerge for this discussion: those without increased pulmonary vascular resistance (PVR) and those with signs consistent with persistent pulmonary hypertension (PPHPN) or increased PVR.

Concerns have been raised regarding the possible adverse effect of IVL on pulmonary function [18], especially in premature neonates and those with acute lung injury. A potential hazard of hyperlipidemia resulting from failure to clear infused lipid is the adverse effect on gas exchange in the lungs. This was demonstrated in adult volunteers after a large dose of soybean emulsion [19]. Preterm neonates randomized to different lipid infusion rates, however, did not demonstrate any effect on alveolar–arterial oxygen gradient or arterial blood pH [20]. Similarly, the author found no difference in oxygenation in preterm infants randomly assigned to modest doses of lipids (0.6 to 1.4 g/kg/d) over the first week of life. These infants had received surfactant and were on intermittent mechanical ventilation [21].

For the late preterm infant with increased PVR and respiratory disease, however, it appears a more prudent approach with IVL should be taken. Significant concerns have been raised because of the high polyunsaturated fatty acid content (PUFA) of lipid emulsions as excessive omega 6 (linoleic acid, 18:2\(\omega 6\)) acids are required substrates for arachidonic acid pathways, which lead to synthesizing prostaglandins and leukotrienes (Fig. 1). It is speculated that IVL infusion may enhance thromboxane synthetase activity,
which increases thromboxane production [22]. The prostaglandins may cause changes in vasomotor tone with resultant hypoxemia [18,23,24]. In addition, the production of hydroperoxides in the lipid emulsion also might contribute to untoward effects by increasing prostaglandin levels [25–27].

Although there is no firm evidence of the effects of lipid emulsions in infants with severe acute respiratory failure with or without pulmonary hypertension, it appears prudent to avoid high dosages in these patients. The author’s opinion is to provide those with respiratory diseases without increased PVR lipid at a dosage to prevent essential fatty acid deficiency. For those with elements of PPHN, avoidance of lipids during the greatest lability and critical stages of their illness should be considered. Once more stable, hopefully within 48 hours, IVL at a modest dosage can be initiated.

### Nutrition in late preterm infants after discharge

The establishment of feeding guidelines in these infants is complicated by the range of chronologic and gestation-corrected ages of near preterm infants at the time of hospital discharge. The strategy after discharge also is impacted by whether these infants have developed chronic conditions that may impact feeding and long-term growth. The first year of life may provide an important opportunity for human somatic and brain growth to compensate for earlier deprivation for these late preterm infants who suffered critical illness.

Generally speaking, the 34- or 35-week late preterm infant is a candidate for a nutrient-enriched strategy after discharge. The 36- or 37-week late preterm infant who has an uncomplicated neonatal course probably does not require nutrient enrichment after discharge.
Preterm infants generally are discharged from the hospital on standard term formula, specialized postdischarge formula, or unfortified breast milk. Nutrient-enriched postdischarge formulas that provide 22 kcal/oz have been marketed in the United States since the mid-1990s. The formulas provide levels of nutrients between those of preterm and term infant formulas. The main differences between the formulas are a higher protein content (approximately 1.9 versus 1.4 g/dL), a modest increase in energy (22 versus 20 kcal/oz), and additional calcium, phosphorous, zinc, trace elements, and vitamins in the postdischarge formulas. Because they are fortified with iron and vitamins, no other supplements are needed.

Few studies have compared the growth of infants fed term formula versus the postdischarge formulas. The available evidence, however, indicates that catch-up growth is increased with the feeding of the enriched formulas.

Provision of enriched feedings after hospital discharge may be particularly beneficial for infants who have a chronic condition such as broncho-pulmonary dysplasia (BPD), which often is associated with growth failure. A study randomly assigned preterm infants with BPD to a 90 kcal/dL formula but with differing protein-to-energy ratio (0.026 versus 0.017). Infants fed the enriched formula had significantly greater nitrogen retention at 38 weeks postmenstrual age. At 3 months corrected age, the infants fed the enriched formula had greater length and lean mass. Energy intakes and volumes of formula were similar; however, protein and mineral intakes were greater with formula enriched with protein and minerals. The authors concluded that in infants recovering from BPD, growth failure is related to inadequate nutrient intake and not to malabsorption of nutrients.

Summary

Important differences in clinical outcomes become apparent when hospital courses of late preterm infants are compared with those of full-term infants. Differences in feeding issues and strategies mirror those differences in outcomes.

Late preterm infants may masquerade as term infants on the basis of their relatively large size and mature, chubby appearance. This masquerading infant, however, may be at risk for breast-feeding failure with dehydration and feeding difficulties delaying discharge. The critically ill late preterm infant requires unique considerations with TPN and a nutrient-enriched postdischarge strategy.

References


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