The Present Challenges of Parenteral Nutrition in Preterm Infants and Children

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Abstract

The goal of pediatricians involved in the nutritional management of preterm infants is to mimic intrauterine growth and to obtain a functional outcome comparable to that for infants born at term. Appropriate administration of nutrients in the first few days to weeks of life will reduce the growth restriction that is frequently observed. Existing guidelines advise providing preterm infants with both amino acids and lipids from birth onward. Despite this knowledge, many hospital units do not comply with these guidelines. Further improvement of the quality of the composition of parenteral solutions for both neonates as well as older children should be the subject of further research.


The goal of pediatricians involved in the nutritional management of preterm infants is to mimic intrauterine growth and to obtain a functional outcome comparable to that for infants born at term, as stated by the Committee on Nutrition from the European Pediatric Society of Gastroenterology, Hepatology, and Nutrition (1). After preterm birth, survival, growth, and development are dependent on the nutritional supply of amino acids, fat, and carbohydrates. In utero, the fetal amino acid uptake exceeds the amount that is necessary for net protein accretion, which indicates that the human fetus oxidizes amino acids to generate energy (2–4). Fear of providing excess amino acids to preterm infants is therefore not justified. Therefore, many very-low-birth-weight infants received only glucose or small amounts of amino acids during the first few days of life, resulting in large protein and energy deficits subsequently accompanied by weight loss. Retrospective data indicate that initial suboptimal management might have detrimental implications for future neurocognitive development (5).

Recently it has become clear that preterm infants, with their limited nutritional reserves and limited capacity for full enteral feeding, need administration of supplemental or total parenteral nutrition (depending on how much enteral feeding can be provided) soon after birth. Amino acids are needed for tissue growth and they can be used as an energy source, just as in utero. Several studies have demonstrated that the administration of 1.0–2.5 g amino acids/(kg body weight · d), starting within a few hours of birth, can reverse a negative nitrogen balance into a positive balance, thus leading to anabolism (6–11). More recent studies demonstrated that the nitrogen balance can be improved further by administration of amino acids up to 3.6 g/(kg · d) (12–14) when provided with additional energy. Despite this knowledge, many hospital units do not comply with the existing guidelines, which advise providing preterm infants with both amino acids and lipids from birth onward, as is shown in this issue of the Journal (15). Rigo and Senterre (16) showed that appropriate administration of nutrients in the first few days to weeks of life will reduce the growth restriction that is frequently observed.

What Needs to Be Done Next?

Further improvement of the quality of the composition of parenteral solutions for both neonates as well as older children (17) should be the subject of further research. The composition of the lipid emulsion might affect infection rate (18) or associated liver disease (19), whereas the quality of the amino acid solution can be further improved by using stable-isotope techniques (20–22). Long-term effects of nutrition on neurodevelopment have been difficult to prove because nutrition is only one of the many variables determining neurodevelopment. Disease itself might also negatively affect nutritional intake, and,
on average, the time receiving total parenteral nutrition is usually limited to periods of less than a few weeks. The goal of early appropriate amino acid and fat administration is to promote anabolism and a normal cellular development. This is not always reflected by weight gain, which is affected by other factors, i.e., fluid status. To date, studies investigating the effect of high-dose parenteral amino acid administration to preterm infants have not exceeded 2 y of follow-up. Most of these studies on long-term development (5,23,24) indicate that the first few days or weeks of life might provide a critical window, but those studies are small or do not have a prospective, randomized design, which does not allow firm conclusions to be drawn. Furthermore, long-term growth and development are affected by many other factors, including environment, indicating that large numbers of infants are needed in studies addressing the effect of a short intervention in the first week of life. Recent studies show promising short-term effects, but long-term consequences (>2 y) of randomized nutritional interventions should be the standard on which we should change our policies.

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Literature Cited