

# Parenteral Nutrition in Preterm Infants: ASPEN Guidelines

Parenteral nutrition (PN) is part of standard nutrition care for preterm neonates and infants when estimated energy and nutrient requirements cannot be safely provided via the enteral route immediately after birth. While advances in PN formulations have led to safer admixtures, several questions remain as to how PN may mitigate adverse health outcomes.

This practice tool is reprinted from Robinson DT, Calkins KL, Chen Y, et al. [Guidelines for Parenteral Nutrition in Preterm Infants: The American Society for Parenteral and Enteral Nutrition](#). *JPEN J Parenter Enteral Nutr*. 2023 Sep;47(7):830-858 which systematically evaluated the quality of relevant literature and provided recommendations on key clinical questions pertaining to the clinical practice of providing PN in preterm infants. The following recommendations along with the quality of evidence and strength of recommendation for each question are presented below.

## Twelve Guideline Questions and Recommendations

Questions and Recommendations	Evidence/GRADE
<p><b>Question 1: In preterm infants, compared with later initiation, does early initiation of PN macronutrients improve growth outcomes?</b>            Recommendation: We recommend prompt initiation of PN after birth as soon as appropriate vascular access is obtained. However, few studies evaluated the timing of PN initiation (inclusive of dextrose, AA, and ILE) in preterm infants using growth outcomes that met definitions for inclusion.</p>	Quality of evidence: Very low Strength of recommendation: Strong
<p><b>Question 2: In preterm infants, compared with lower doses of parenteral AA, do higher doses of parenteral AA improve growth outcomes?</b>            Recommendation: We recommend against an initial dose of &gt;3 g/kg/day given that a single trial found an increased rate of sepsis in infants who were prescribed an initiating AA dose of 3.5 g/kg/day. In considering the maximal target dose, we recommend providing parenteral AA at a minimum of 3 g/kg/day and not exceeding 3.5 g/kg/day. This guidance accounts for growth outcomes as well as neurodevelopmental outcomes associated with AA dose as addressed in question 3. Also, current evidence remains limited in distinguishing any benefit—namely, improved growth—comparing a maximum AA dose of 3.5 vs 4 g/kg/day.</p>	Quality of evidence: Low Strength of recommendation: Strong
<p><b>Question 3: In preterm infants, compared with lower doses of parenteral AA, do higher doses of parenteral AA improve neurodevelopmental outcomes?</b>            Recommendation: In considering the maximal target dose, we recommend providing parenteral AA doses at a minimum of 3 g/kg/day without increasing beyond 3.5 g/kg/day. The current evidence remains limited in distinguishing any benefit—namely, improved neurodevelopment—comparing a maximum AA dose of 3.5 vs 4 g/kg/day, and there is the suggestion that exceeding 3.5 g/kg/day may not be without harm.</p>	Quality of evidence: Low Strength of recommendation: Strong
<p><b>Question 4: In preterm infants, compared with lower ILE doses, do higher ILE doses improve growth outcomes?</b>            Recommendation: To improve growth, we recommend daily advancement of ILE to a dose of 3 g/kg/day if using SO-ILE or multicomponent ILE. We strongly emphasize the need for attention to ILE composition when making decisions on ILE dose to ensure the provision of sufficient fatty acids for the purposes of preventing an essential fatty acid deficiency (EFAD). Providing suboptimal ILE doses that are associated with a risk for an EFAD may impair growth and increase the risk for other adverse outcomes.</p>	Quality of evidence: Very low Strength of recommendation: Strong
<p><b>Question 5: In preterm infants, compared with an ILE containing 100% SO as the sole oil source, is altering the ILE composition by reducing the proportion of SO associated with growth outcomes?</b>            Recommendation: At this time, we do not recommend any specific ILE composition for enhanced growth, given there was no evidence of benefit from any particular ILE.</p>	Quality of evidence: Very low Strength of recommendation: Strong
<p><b>Question 6: In preterm infants, compared with a higher dose of macronutrients (AA, dextrose, ILE), does a lower dose of macronutrients reduce incidence of PNALD?</b>            Recommendation: We do not recommend routinely reducing the dose of AA, dextrose, or ILE when providing PN to preterm infants for the purposes of preventing PNALD.</p>	Quality of evidence: Very low Strength of recommendation: Strong

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Questions and Recommendations	Evidence/GRADE
<p><b>Question 7a: In preterm infants, compared with an ILE containing 100% SO as the sole oil source, does a reduction in SO using any multicomponent-oil ILE reduce the incidence of PNALD?</b>                      Recommendation: For the purpose of preventing PNALD in preterm infants, we do not recommend any specific ILE composition. We found no evidence of reduced PNALD risk with any specific ILE, whether it contains 100% SO as the sole oil source or a multicomponent-oil ILE with or without FO.</p>	<p>Quality of evidence: Low                      Strength of recommendation: Strong</p>
<p><b>Question 7b: In preterm infants, compared with an ILE containing 100% SO as the sole oil source, does reducing SO using a multicomponent-oil ILE that includes FO reduce the incidence of PNALD?</b>                      Recommendation: For the purposes of preventing PNALD in preterm infants, we do not recommend the use of any specific ILE, whether it contains 100% SO as the sole oil source or a multicomponent-oil ILE that includes FO. As identified in secondary analyses, further study is needed to evaluate the potential for an ILE containing FO and its association with ROP severity.</p>	
<p><b>Question 8: In preterm infants, does reducing the dose of ILE reduce levels of unbound bilirubin?</b>                      Recommendation: We are unable to recommend any specific ILE dose for the purpose of reducing unbound bilirubin levels. We suggest further research utilizing clinical trials is needed to address this question.</p>	<p>Quality of evidence: Very low                      Strength of recommendation: Strong</p>
<p><b>Question 9: In preterm infants, does a reduced dose of ILE reduce the risk of sepsis?</b>                      Recommendation: We recommend against a dose reduction of ILE to prevent sepsis.</p>	<p>Quality of evidence: Very low                      Strength of recommendation: Strong</p>
<p><b>Question 10: In preterm infants, does providing parenteral micronutrients improve growth outcomes and reduce the risk for morbidities?</b>                      Recommendation: Given the paucity of available data from clinical trials, we recommend that micronutrient provisions, including calcium and phosphate prescribing, be in accordance with doses advised in consensus guidelines such as those provided by ASPEN and ESPGHAN.<sup>1-3</sup></p>	<p>Quality of evidence: Very low                      Strength of recommendation: Strong</p>
<p><b>Question 11: In preterm infants, compared with customized PN solutions, are standardized PN solutions associated with growth outcomes?</b>                      Recommendation: Given the absence of clinical trials to evaluate this question, we do not recommend use of standardized PN solutions for routine care of preterm infants. This recommendation does not address or dissuade use of premade PN solutions generally utilized for the first 24 hours after birth (commonly referred to as “starter” or “stock” PN), which are useful given their immediate availability at all hours.</p>	<p>Quality of evidence: Very low                      Strength of recommendation: Strong</p>
<p><b>Question 12: In preterm infants, does the use of insulin improve growth outcomes?</b>                      Recommendation: We recommend against the routine use of insulin for the purposes of improving growth outcomes in hospitalized preterm infants.</p>	<p>Quality of evidence: Very low                      Strength of recommendation: Strong</p>

Abbreviations: AA, amino acid; ASPEN, American Society for Parenteral and Enteral Nutrition; EFAD, essential fatty acid deficiency; ESPGHAN, European Society for Paediatric Gastroenterology Hepatology and Nutrition; FO, fish oil; GRADE, Grading of Recommendations Assessment, Development and Evaluation; ILE, lipid injectable emulsion; PN, parenteral nutrition; PNALD, PN-associated liver disease; ROP, retinopathy of prematurity; SO, soybean oil.

**References:**

1. Vanek VW, Borum P, Buchman A, et al. A.S.P.E.N. position paper: recommendations for changes in commercially available parenteral multivitamin and multi-trace element products. *Nutr Clin Pract.* 2012;27(4):440-491.
2. Domellof M, Szitanyi P, Simchowicz V, Franz A, Mimouni F, ESPGHAN/ESPEN/ESPR/CSPEN Working Group on Pediatric Parenteral Nutrition. ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition: iron and trace minerals. *Clin Nutr.* 2018;37(6 Pt B):2354-2359.
3. Boullata JI, Gilbert K, Sacks G, et al. A.S.P.E.N. clinical guidelines: parenteral nutrition ordering, order review, compounding, labeling, and dispensing. *JPEN J Parenter Enteral Nutr.* 2014;38(3):334-377.

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