



Enteral Nutrition – Neonatal - Inpatient Clinical Practice Guideline

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Executive Summary

Guideline Overview

This guideline contains recommendations for initiating, advancing, and fortifying enteral nutrition and supplementation and management of feeding intolerance in neonatal patients.

Key Revisions (2021)

1. For surgical neonates, initiate EN at 10 mL/kg until establishes tolerance, then advance by 10 mL/kg/d until 50 mL/kg. Once tolerating 50 mL/kg, advance by 25 mL/kg/ to 100 mL/kg. Once tolerating 100 mL/kg/d:
 - a. Preterm Infants: advance by 20-30 mL/kg/d to initial goal volume of 140 to 160 mL/kg/d
 - b. Term Infants: advance volume to goal of 140-160 mL/kg/d
2. For surgical neonates, fortification of human milk will occur as follows:
 - a. If born preterm and <2 kg, fortify at 100 mL/kg/d.
 - b. Term infants: once goal volume has been achieved and needing additional calories for age-appropriate growth
3. It is suggested infants with <20 cm bowel remaining are started on continuous feedings due to concern for malabsorption and to promote intestinal adaptation.

Key Practice Recommendations

1. Initiation of Enteral Nutrition: ideally initiate within the first 1-2 days of life and when medically stable to promote gut maturation and motility.
2. Human milk is the preferred feeding for all infants, unless contraindicated.
3. Advancement of Enteral Nutrition: advance by 20-40 mL/kg/day depending on birth weight, gestational age, and medical status to an initial EN goal volume of 140-160 mL/kg/day.
4. Fortification of Human Milk: fortification of human milk is recommended for all infants born < 1500 kg and for some born <2000 kg. Fortification of human milk will occur at 100-120 mL/kg/day using the appropriate fortifier for premature infants and will occur at 150 mL/kg/day for surgical infants.
5. Oral Feedings: recommend order a speech therapy consult for initiation and advancement of oral feedings. Begin oral feedings as clinically able and based on patient's gestational age and maturity.
6. Vitamin and Mineral Supplementation: start supplementation for preterm infants once full enteral nutrition has been achieved and at least 2 weeks of age.

Introduction

The purpose of this guideline is to provide a standardized approach to enteral nutrition (EN) initiation, advancement, and fortification in the Neonatal Intensive Care Unit (NICU) to optimize growth and development. Providing sufficient nutrition to support growth is crucial during the transition from parenteral nutrition (PN) to EN, especially protein intake, since total nutrient requirements fluctuate during this time and can lead to extrauterine growth failure. Feeding intolerance is a common problem for patients in the NICU due to immature GI function, intestinal dysmotility, and illness. A standardized approach to EN has been shown to improve growth outcomes, feeding tolerance, promote earlier achievement of full EN, decrease reliance on PN, and can reduce morbidities associated with prematurity such as necrotizing enterocolitis (NEC).

Recommendations

1. Initiation and Advancement of Enteral Nutrition (EN)

- a. Ideally initiate EN within the first 1-2 days of life and when medically stable to promote gut maturation and motility.¹⁻⁵ (*UW Health Class I, LOE B*)
- b. EN is contraindicated with the following^{1,2,6}: (*UW Health Class IIa, LOE C*)
 - Hemodynamic instability or impaired GI perfusion (i.e. large PDA, hypotension etc)
 - High dose pressor support
 - Hypoxic ischemic encephalopathy (moderate-to-severe)
 - Severe metabolic acidosis
 - GI anomaly or bowel obstruction
 - NEC
 - Post-operative ileus
 - It is suggested to hold EN during blood transfusions to reduce incidence of transfusion-associated NEC, especially for infants < 34 weeks PMA.⁷
- c. EN is not necessarily contraindicated when a patient has an umbilical line catheter.
 - Typically do not advance feeding volume past 40 mL/kg/day with umbilical artery line.
- d. Initiate EN according to gestational age, birth weight and medical status. (*UW Health Class I, LOE B*) See appropriate EN feeding pathway for further details (**Tables 1-4**).^{1-3,5,8-12}
- e. EN should be initiated using bolus feedings, especially with human milk, to minimize fat loss and adherence to tubing.^{2,19-21} (*UW Health Class IIa, LOE C*)
- f. It is suggested to initiate EN using a continuous infusion for neonates with <20 cm bowel remaining due to concern for dumping and to promote intestinal adaptation.^{13,15,16,18,22,36}
- g. For Infants <29 weeks, initiate bolus feedings every 2 hours for the first 2 weeks of life then transition to every 3 hour bolus feedings.
- h. For surgical neonates initiate EN within 12 to 24 hours after NG-tube output is clear & NG-tube has been removed.^{13-18, 36} (*UW Health Class IIa, LOE B*). It is not necessary for the patient to have a bowel movement prior to initiating EN.

Table 1: EN Pathway for Neonates < 1000 g birth weight

Day of Feeding	Feeding Volume (mL/kg/day)	Comments
Day 1	10	Use human milk (maternal or donor). Initiate feedings every 2-3 hours.
Day 2	10	
Day 3	20	
Day 4	20	
Day 5	40	
Day 6	60	
Day 7	80	Add LPF (0.5 mL/25 mL)
Day 8	100	
Day 9	120	
Day 10	120	Fortify to 24 kcal/oz using Prolacta 4+
Day 11	140	
Day 12	140-160	Initial goal

Table 2: EN Pathway for Neonates 1000 - 2000 g birth weight

Day of Feeding	Feeding Volume (mL/kg/day)	Comments
Day 1*	20	Use human milk (maternal or donor). Initiate feedings every 3 hours. *May maintain volume at 20 mL/kg/day for 2 days for those < 1500 g
Days 2-4	Advance by 30-40 mL/kg/d	If cueing, may nipple above
Days 4-6	100-120	Fortify human milk to 24 kcal/oz with HMF x 24 hours Do not increase feeding volume on fortification day
Days 6-8	140-160	Initial goal

Table 3: EN Pathway for Neonates > 2000 g birth weight *

Initiation Rate	When to Advance	Advancement Rate
20 mL/kg/day	If tolerated, advance every 24-48 hours	30-40 mL/kg/day May advance ad lib if infant is PO feeding.

*Those patients that are small for gestational age (SGA), intrauterine growth restriction (IUGR), high acuity, receiving PN for >2-4 weeks, suboptimal growth, or limited ability to tolerate adequate feeding volume may benefit from EN pathway for Neonates 1000-2000 g birth weight.

Table 4: EN Pathway for Surgical Neonates

Day of Feeding	Feeding Volume (mL/kg/day)	Comments
Day 1	10	Use human milk (maternal or donor). Initiate continuously if <20 cm bowel remaining Stay at 10 mL/kg/d until establishes tolerance
Day 2	20	
Day 3	30	
Day 4	40	
Day 5	50	Begin advancing by 25 mL/kg/d
Day 6	70	
Day 7	90-100	Preterm Infants <2 kg: Fortify feedings to 24 kcal/oz at 100 mL/kg
Days 8-9	Goal 140-160	Term Infants: Advance to goal volume Okay to bottle feed above if cueing Preterm Infants: Advance by 20-30 mL/kg/d to goal volume

2. **Human milk is the preferred feeding for all infants.**^{1-3,5,6,12,15,18,22-24} (*UW Health Class I, LOE A*)
 - a. Use maternal human milk if available and is not contraindicated. (*UW Health Class I, LOE A*) It is suggested to use colostrum first, followed by transitional milk, then mature milk.
 - b. All infants with birth weight < 2000 g are eligible for use of donor human milk.^{2,12,15,22,24,25} (*UW Health Class I, LOE A*). Additional criteria for donor human milk includes:
 - History of NEC or other GI anomalies
 - Congenital heart disease
 - Post-surgical nutrition
 - Significant feeding intolerance
 - Malabsorption syndromes
 - Failure to thrive
 - Absent or insufficient lactation
 - Immunodeficiency disorders
 - Illness in mother requiring temporary interruption of breastfeeding
 - Neonates that are <1 week old and the mom has initiated pumping at the delivery hospital, but there is no milk available yet. The baby may use donor human milk for up to 7 days.
 - Other indications per clinician's discretion. Must consult RD for infants ≥ 2 kg to ensure appropriate usage.
 - c. Length of time that donor human milk will be used is to be determined by the medical team.
 - Once the infant has reached 34 weeks PMA, weaning from donor milk should be considered.
 - Weaning off donor human milk should occur at least 1 week prior to discharge. (*UW Health Class I, LOE C*)
 - d. Use appropriate infant formula for those patients who do not have sufficient supply of human milk available, do not qualify for donor human milk, or do not have consent signed for use of donor human milk.^{2,12,17,26}
 - Infants < 2000 g birth weight should use preterm formula when human milk is not available. (*UW Health Class I, LOE B*)
 - Initiate using full strength formula since dilution of formula has not been shown to reduce incidence of NEC and only decreases total nutrient intake. (*UW Health Class IIa, LOE C*)
 - The use of soy formulas is contraindicated for premature neonates due to poor calcium and phosphate availability.² (*UW Health Class III, LOE B*)
3. **Fortification of Human Milk**^{2,3,5,9,12,29, 36} (*UW Health Class I, LOE B*)
 - a. Fortification of human milk is recommended for all infants born <1500 kg and/or < 32 weeks gestation and for some born between 32-36 weeks gestation.
 - b. For premature neonates, fortification of human milk will occur at 100-120 mL/kg/day using the appropriate fortifier.
 - c. For surgical neonates, fortification of human milk will occur once goal volume of 150 mL/kg/day, or otherwise specified fluid volume, has been achieved. It is suggested that premature neonates requiring intestinal surgery fortify human milk at 100-120 mL/kg/day to optimize nutrient intake and promote growth while transitioning off PN.

- d. Prolacta is a human milk-based fortifier that should be considered for those born with birth weight < 1250 g.^{24,30} Consult with RD when Prolacta is being considered for those > 1250 g birth weight
 - Start fortification with Prolact+4 and advance as needed to support growth.
 - Consider transitioning off Prolacta after 4 weeks of exclusive human milk diet or when > 34 weeks PMA.
- e. Similac Human Milk Fortifier Hydrolyzed Protein Concentrated Liquid (HMF HP CL) is a casein hydrolysate, human milk fortifier that should be used for those born with birth weight between 1250-2000 g to support growth.
 - Fortify to 24 kcal/oz for 24 hours. It is not necessary to fortify to 22 kcal/oz first unless feeding intolerance is suspected.
- f. It is recommended to not advance feeding volume on the same day that human milk is being fortified.

4. Oral Feedings^{2,12}

- a. It is encouraged to order a speech therapy consult for initiation and advancement of oral feedings.
- b. Begin oral feedings as clinically able and based on patient's gestational age (usually between 32 to 34 weeks GA) and respiratory status.
- c. For neonates (both surgical and non-surgical) waiting for EN initiation, use human milk for oral cares.
- d. Once patient is taking > 75% goal volume through oral intake, consider transition to cue-based oral feeding schedule.

5. Vitamin and Mineral Supplementation^{2,11,12,35}

- a. Start vitamin and/or mineral supplementation on preterm infants when on full feeds and at least 2 weeks of age.

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