

Chapter: 11 Enteral Nutrition

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General Guidelines

- Follow feeding protocols appropriate for infant's birth wt.
- Standardized feeding practices have been associated with earlier attainment of full enteral feeding, reduced rates of morbidities, including NEC, and optimized feeding practices can improve growth and neurodevelopmental outcomes.
- Early introduction of small volume or "trophic" feedings, ranging from 10-20 mL/kg/day, should be considered for all VLBW infants, even when critically ill or labile following birth. Not harmful and no increased incidence of NEC.
- Maternal breast milk is the preferred source of nutrition. Colostrum is administered in the order it was pumped as oral immune therapy (OIT), 0.05 mL- 0.5 mL to the buccal cavity every few hours, and is used as available for the earliest enteral feedings.
- When own mother's breast milk (EBM) is not available, donor breast milk (DBM) should be used for infants born <2000g or < 34 weeks. Furthermore, any infant whose parent/caregiver/s intend to provide human milk may receive DBM.
- Nutritional needs of the preterm infant exceed those amounts in human milk, particularly for protein, calcium and phosphorus. Human milk fortifiers are used to correct these nutritional inadequacies.
- Soy formulas are not recommended for preemies due to poor availability of calcium and phosphates.
- Feeding intolerance can present with frequent episodes of emesis or green bilious emesis. Any infant demonstrating these symptoms should have an immediate abdominal exam. An abdominal X-ray should be obtained if any abnormal findings are found on exam.

Benefits of Colostrum

- Colostrum is secreted during the early days post-birth when paracellular pathways between the mammary epithelium are open and permit transfer of high molecular weight components.

- Compared to mature milk colostrum has high content of lactoferrin, Oligosaccharides, secretory IgA, anti-inflammatory cytokines, growth factors, soluble CD14, antioxidants and other protective components
- Initial feedings of colostrum stimulate rapid growth in the intestinal mucosal surface area, facilitate the endocytosis of protein and induce many digestive enzymes.
- OIT has been associated with reduced rates of sepsis, transfers IgA and lactoferrin to the infant, and may contribute to the infant's microbiome.

Growth Goals

- The overall goal for preterm infant nutrition is to mimic in-utero growth.
- Preterm growth charts in EMR: Fenton (boys and girls) – 2013
 - Weight, length and Head circumference for age
 - Hover plot point for exact % and Z score
- First goal: regain birth weight after initial diuretic phase within 7-14 days of life.
- Growth phase goal: once infant is gaining after initial diuresis, goal is to at least maintain wt for age % / Z score. The average grams /day wt gain required to at least maintain metrics in growth phase will vary depending on age and gender. Additional wt gain or “catch up growth” may or may not be prescribed. Overall growth goals should be individualized based on medical course and nutritional history.
- Contact NICU RD for individualized goals if growth concerns.

Recommended enteral energy and protein intakes

Infant age (wk.)	Energy goals (kcal/kg/d)	Protein goals (g/kg/d)
Preterm < 34 0/7	110-150	3.5-4.5
Late preterm 34 0/7-36 6/7	120-135	3-3.2
Term > 37 0/7	105-120	2-2.5

NICU Feeding Protocol

1. Provide colostrum as soon as it is available, ideally within 2 hours of birth.
2. Initiate trophic feeds on day of life 1-2 in infants without GI anomalies
3. If sufficient colostrum is not available after a minimum of 24 hours, consider using Donor EBM.
4. Calculate feeding volume with birth weight until infant surpasses birth weight after initial diuretic phase.
5. Use HMF to fortify human milk.
6. Schedule every 3 hour feeds.

Advance feedings per the birth weight based tables below:

500 g BW Infants

Feeding Day	Total Daily Feeding Volume	Comments
1	10 mL/ kg/day	
2	10 mL/kg/day	
3	20 mL /kg/day	
4	20 mL/ kg/day	
5	40 mL/ kg/day	
6	60 mL /kg/day	
7	80 mL/ kg/day	
8	100 mL/kg/day	
9	100 mL /kg/day	Fortify to 24 cal/oz
10	120 mL/kg/day	Consider removing IV access
11	140 mL/kg/day	
12	150-160 mL/ kg/day	

01- 1000 g BW INFANTS

Feeding Day	Total Daily Feeding Volume	Comments
1	10 ml/kg/day	
2	20 ml/kg/day	
3	40 ml/kg/day	
4	60 ml/kg/day	
5	80 ml/kg/day	
6	100 ml/kg/day	
7	100 ml/kg/day	Fortify to 24 cal/oz
8	120 ml/kg/day	Consider removing IV access
9	140 ml/kg/day	
10	140-160 ml/kg/day = GOAL	

001 - 2000 g BW INFANTS

Type	Volume	Comments
Trophic feeds	20 ml / kg/day x 1-2 days	
Post trophic feeding progression	Increase by 30 -40 ml / kg/day	-If cueing, may nipple above
Fortification	Fortify to 24 cal/ oz once tolerating 100-120 ml /kg/day	-Do not increase feeds on fortification day -May consider d/c IV fluids/nutrition when feeds at least 100 ml / kg/day
Goal feeds	140 -160 ml / kg/day	

Donor Human Milk:

- Criteria for use:

All infants born < 34 weeks, < 2000 g bw or with provider concern for gut perfusion.

ANY infant outside of criteria if their parent/s intend to provide breastmilk

- If sufficient colostrum is not available after 24 hours, consider using DBM.
- Signed consent is required.
- Criteria for considering discussion with parents about discontinuation of DBM
 - Infant is 34 weeks or 1 week old, whichever comes later
 - At provider's discretion in the setting of poor growth
 - Parent/Caregiver's feeding plans for post – discharge should be considered.

liquid Protein Fortifier (LPF)

- Extensively hydrolyzed liquid protein (1 g protein = 6 ml or 0.167 gm/ml)
- Purpose is to achieve goal protein intake and used primarily in VLBW, fluid restricted or donor human milk fed infant.
- LPF is part of feeding order dosed @ 0.5 ml / 25 ml (standard dose) or 1 ml / 25 ml. This will add 0.5-1.0 gm. of protein /150ml of feeds

Feeding Practice: Special Considerations

Transfusions: PRBCs transfusion when patient has stable hemodynamics.

- Stop feeds 2-3 hours before starting transfusion
- Transfuse over 3 hours, maintain NPO
- Hold feeds for 2-3 hours after end of transfusion
- Restart at same feeding volume
- Patient **should not miss > 2 feeds** due to transfusion

Timing pharmacotherapy for treatment of PDA

- No need to reduce or withhold advancing feeds

How to restart feeds (Stopped for any reason)

Duration of NPO	Starting Volume of Feeds	Fortification	Feeding Advance
<24 hr.	Same as last feed	Same as last feed	Continue per protocol
24-72 hr.	50% of last feed	Same as last feed	To full previous volume in 24-48 hr.* Continue per protocol
4-7 days	50% of last feed	Unfortified	Feeding protocol using current wt.
>7 days	Beginning of feeding protocol using current weight	Unfortified	Per feeding protocol

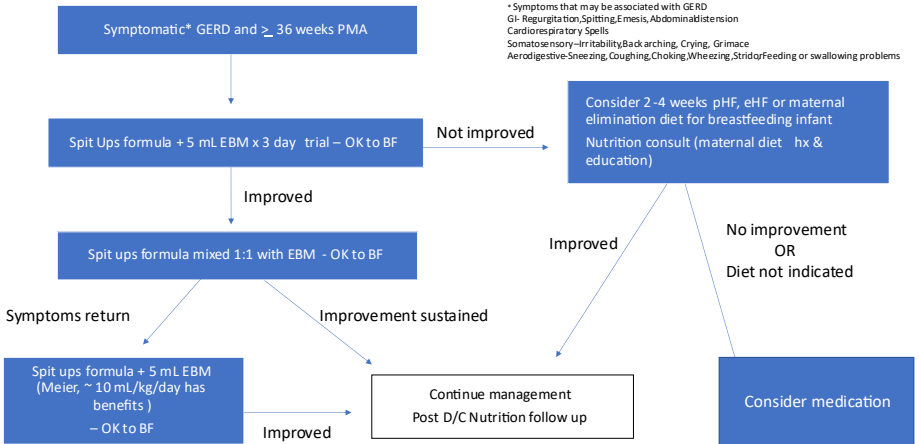
*Fortification may be delayed if necessary

Transitioning to homegoing nutrition plan

- Consider transitioning to homegoing nutrition plan once infant is taking > 50% orally with no other significant barriers to discharge.
- NICU RD may assist with involving parents in decision making about homegoing nutrition plan that involves fortification of breastmilk or formula.
- Parent/Caregiver/s who plan on breast feeding should be encouraged to offer the breast as often as they are available and infant is cueing.
- When available, a homegoing nutrition plan should be copied and pasted from NICU clinical nutrition note into D/C summary for the pediatrician.

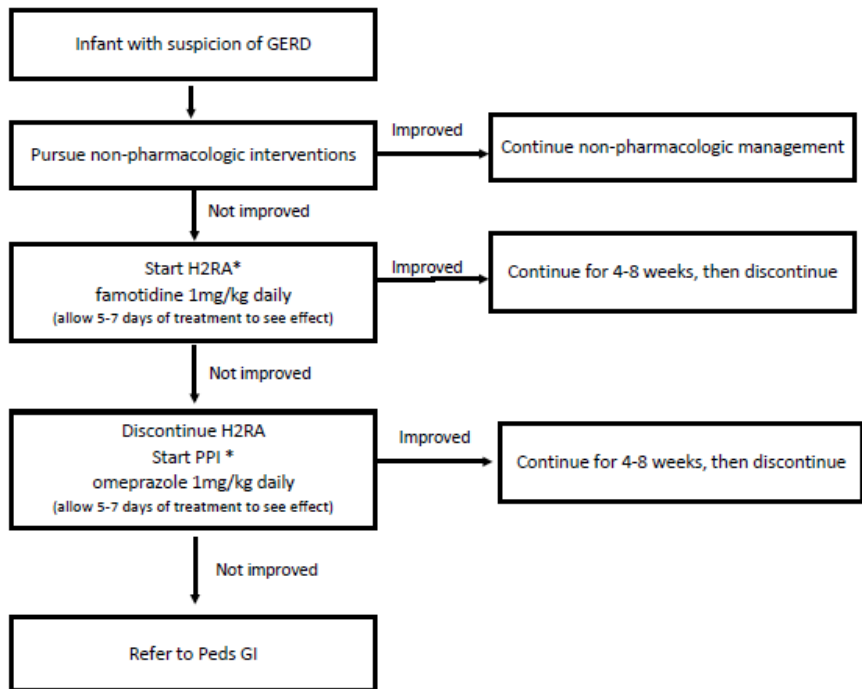
NON- SURGICAL GERD GUIDELINE

* Symptoms that may be associated with GERD
GI- Regurgitation, Spitting, Emesis, Abdominal distension
Cardiorespiratory- Spells
Somatosensory- Irritability, Back arching, Crying, Grimace
Aerodigestive- Sneezing, Coughing, Choking, Wheezing, Stridor
Feeding or swallowing problems



Algorithm for acid suppression in Non-Surgical Infants

July 2020



*Medication should be prescribed at the lowest effective dose for the shortest amount of time possible.

H2RA – histamine receptor antagonist

PPI – proton pump inhibitor

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Vitamins and Iron Supplements

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itamin D

- Start on term and preterm infants when tolerating enteral feeds.
- Dose is according to the total daily intake volume.

	400 units*	200 units*	D/C when
EBM + HMF 24	<200 ml/day	>200 ml/day	>400 ml/day
EBM + HMF 22	<350 ml/day	>350 ml/day	>700 ml/day
Similac Special Care 24	<200 ml/day	>200 ml/day	>400 ml/day
Neosure	<400 ml/day	>400 ml/day	>800 ml/day
Term formula	<500 ml/day	>500 ml/day	>1000 ml/day
EBM (Exclusively or partially)	Daily	If less than half the feeds are EBM.	Never

* Concentration is 400 units/ml

Iron

- Term infants do not need routine iron supplement
- For infants < 37 weeks at birth or term SGA.
 - Start when on at least 60 mL/kg/day of feeds and approximately 2 weeks of age.
 - Standard dosing of iron for inpatients = 3 mg/0.2 ml. (Give 3 mg dose 1-3 times per day based on patient need)
 - If on erythropoietin = 6 mg/kg/day
 - Iron fortified formulas (@ ~150 ml/kg/day) provide ~2 mg/kg/day

Multivitamin with Fe

- Each 1 ml provides 11 mg iron and 400 IU Vit D
- Can be used in lieu of separate Vit D and Fe supplements in the premature or SGA infant
- Give 1 ml/day or 0.5 ml 1-2 times/day based on patient need

Formula Analysis							
Nutrient	AAP-per kg/d	MBM Preterm	MBM Term	MBM w/HMF - CL- HP	Similac Special Care-24, HP	Similac Special Care -30	MBM w/ Neosu
Kcal/oz		20	20	24	24	30	24
	Preterm	100 ml/kg	100 ml/kg	100 ml/kg	100 ml/kg	100 ml/kg	100 ml/
Kcal/kg	110-130	67	68	80	80	100	80
Protein(g)	3.4-4.4	1.4	1.0	2.44	2.68	3.0	1.5
CHO (g)	7-20	6.6	7.2	8.0	8.1	7.8	8.7
Fat (g)	5.3-8.4	3.9	3.9	4.0	4.4	6.7	4.7
Calcium (mg)	100-220	25	28	121	146	183	44
Phosphorus (mg)	60-140	13	14	67	81	101	24
Iron (mg)	2-4	0.12	0.03	0.47	1.46	1.83	0.32
Zinc (mg)	1.4-2.5	0.34	0.12	1.31	1.22	1.52	0.31
Sodium (mEq)	3-5	1.1	0.8	1.6	1.5	1.9	1
Potassium (mEq)	2-3	1.5	1.4	2.9	2.7	3.4	1.9
Osmolality		290	286	450	280	325	340

*Pediatric Nutrition Handbook, 8th Edition. American Academy of Pediatrics, 2019

*Neofax, accessed on line 3/2022

