Overall Aim

Provision of appropriate nutrition to neonates in a timely and safe manner to facilitate adequate growth and development
Topics at a glance

• Nutrition guidelines for premature infants birth weight less than or equal to 1250 grams
• Vitamin and Iron supplementation guidelines
• Feeding intolerance decision pathway
• Guideline for the use and storage of pasteurized donor human milk in the NICU
Guideline Objectives

• Standardize enteral nutrition introduction and advancement in infants with birth weight less than 1250 grams
• TPN initiation, advancement and weaning
• Standardize definition and management of feeding intolerance
• Provision of adequate vitamin and iron supplementation
• Provision of pasteurized donor human milk (PDHM) if mother’s own milk (MOM) is unavailable or inadequate
• Reduce TPN and central line days by optimizing nutritional status
Nutrition Guidelines for Premature Infants
Birth Weight Less Than or Equal to 1250 grams
Significance

• Extra uterine growth restriction due to inadequate nutrition intake is common
• Adequate nutrition is related to infection resistance, and long-term cognitive, neurologic and developmental outcomes
• Nutritional approach where nutrients are administered at a more rapid rate than previously endorsed recommended to facilitate growth
• Early aggressive parenteral and enteral nutrition is well tolerated and is effective in improving growth
Significance

Ultimate nutritional goals for a preterm infant

• replication of in utero growth similar to that of a fetus of the same GA
• reach a functional outcome parallel to infants born at term
• avoid gastrointestinal injury
Human Milk

• Ideal feeding choice
• Preferred initial feeding choice is Mother’s own milk (MOM)
• Pasteurized Donor Human Milk (PDHM) used if MOM is not available
• Colostrum used for oral care (via swab or syringe) when it becomes available
Enteral Feeding

Minimal Enteral Feedings (MEF)

- Initiated within 12 hours of birth
- Exceptions:
  - Hemodynamic instability
  - Surgical patients
- Umbilical arterial catheter, treatment with indomethacin, and high FiO2 requirement not considered absolute contraindications
- Volume: 15 – 20 ml/kg/day
- Administration: via NG/OG every 3 hours for 3 days
Enteral Feeding

- Feeding advancements after 3 days on MEF
- Increase volume by 20ml/kg/day
- Target feeding volume of 150 – 170 ml/kg/day
- If MOM is unavailable and mother declines PDHM, initiate feedings with Similac Special Care (SSC) 24 kcal/oz High Protein formula
- Feeding advancement adjustments may be needed for surgical conditions, critical illness, hemodynamic instability, signs of feeding intolerance, electrolyte abnormalities
# Feeding Guideline for BW ≤ 1250 grams

<table>
<thead>
<tr>
<th>DOL</th>
<th>Total fluid ml/kg/d</th>
<th>Enteral ml/kg/d</th>
<th>Breast Milk*** kcal/oz</th>
<th>TPN + IL ml/kg/d</th>
<th>Protein g/kg/d (TPN)</th>
<th>Lipid g/kg/d</th>
<th>Total Protein g/kg/d (TPN + Enteral)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>15-20 (MEF)</td>
<td>20</td>
<td>D10 starter</td>
<td>3</td>
<td>1</td>
<td>3</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TPN: 50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DS: 45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lipids: 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>120</td>
<td>15-20 (MEF)</td>
<td>20</td>
<td>120</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>130</td>
<td>15-20 (MEF)</td>
<td>20</td>
<td>130</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>140</td>
<td>40</td>
<td>20</td>
<td>100</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
| 5   | 150                 | 60              | 26 (Prolact+6)* 24 (Similac HMF)** | 90      | 3       | 3 | 4.7 4.5@
| 6   | 150                 | 80              | 26 (Prolact+6)* 24 (Similac HMF)** | 70      | 2.5     | 2 | 4.7 4.5@
| 7   | 150                 | 100             | 26 (Prolact+6)* 24 (Similac HMF)** | 50      | 1.5     | 1 | 4.3 4.0@
| 8   | 150                 | 120             | 26 (Prolact+6)* 24 (Similac HMF)** | D/C TPN + PICC (start MVI) | 3.4 | 3.0@
| 9   | 150                 | 140             | 26 (Prolact+6)* 24 (Similac HMF)** | | 3.9 | 3.6@
| 10  | 150-160             | 150-160         | 26 (Prolact+6)* 24 (Similac HMF)** | | 4.2-4.5 3.8-4.1@

* For infants ≤ 1000g or ≤ 26 6/7 weeks GA at birth use Prolact+6 for 26 kcal/oz
** For infants ≥1001g or ≥ 27 weeks GA at birth use Similac Human Milk Fortifier (HMF) Hydrolyzed Protein Concentrated Liquid for 24 kcal/oz
*** If breast milk is unavailable, begin feedings with Similac Special Care (SSC) 24 kcal/oz High Protein formula.
@Total Protein in g/kg/d if Similac HMF is used

Refer to “Nutrition Guidelines for Premature Infants Birth Weight Less Than or Equal to 1250 grams”
Revised Mar 2020
Fortification

• Prolacta human milk-based fortifier will be used for infants ≤ 1000 grams or ≤26 6/7 weeks GA at birth
• Initiated at +6 kcal/oz at feeding volume of 60ml/kg/day
• Additional fortification done on a case-by-case basis
• Similac Human Milk Fortifier (HMF) Hydrolyzed Protein Concentrated Liquid will be used to fortify to 24 kcal/oz for
  • Infants ≥1001 grams or ≥27 weeks GA at birth
  • Infants with no consent to use donated human milk products
Prolacta Weaning Protocol

Weaning protocol off Prolacta to bovine fortifier:
- 33 0/7 weeks: add 2 feedings Simlac HMF
- 33 1/7 weeks: add 4 feedings Simlac HMF
- 33 2/7 weeks: add 6 feedings Simlac HMF
- 33 3/7 weeks: all feedings of Simlac HMF

- Begins at 33 0/7 weeks PMA
- All feedings fortified with Similac HMF by 33 4/7 weeks
- SGA who are still < 1250g at 33 0/7 weeks, delay Prolacta wean until either > 1250g or 14 days chronological age, whichever occurs later
Vitamins and Iron Supplementation
<table>
<thead>
<tr>
<th>Milk Type</th>
<th>Weight</th>
<th>Vitamin/Iron Supplementation</th>
<th>Iron Goals (mg/kg/day)</th>
<th>Vitamin D Goals (IU/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human milk alone or in combination with preterm formula (regardless of caloric density)</td>
<td>&lt;750g</td>
<td>0.5 mL PVS (no Iron) q12h AND 1.5mg Elemental Iron q day</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>750-1249g</td>
<td>0.5 mL PVS (no Iron) q12h AND 1.5mg Elemental Iron q12</td>
<td>2-4</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>1250-2500 gms</td>
<td>0.5 mL PVS with Iron q day AND 0.5mL D-Vi-Sol q day</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;2500 gms</td>
<td>1 mL PVS with Iron q day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preterm formula (&gt;24 cal/oz)</td>
<td>&lt;2500 gms</td>
<td>0.5 mL PVS q day AND 0.5 ml D-Vi-Sol q day</td>
<td>2-4</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>&gt;2500 gms</td>
<td>1 mL PVS (no Iron) q day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Term formula</td>
<td>Any</td>
<td>1 mL PVS (no Iron) q day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transition formula (e.g., Neosure) (22 cal/oz)</td>
<td>Any</td>
<td>1 mL PVS (no Iron) q day</td>
<td>2</td>
<td>400</td>
</tr>
<tr>
<td>Human milk with term or transition formula (closer to discharge)</td>
<td>Any</td>
<td>1 mL PVS (no Iron) q day</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TERM INFANTS (>37 weeks GA)**

<table>
<thead>
<tr>
<th>Milk Type</th>
<th>Weight</th>
<th>Vitamin/Iron Supplementation</th>
<th>Iron Goals (mg/kg/day)</th>
<th>Vitamin D Goals (IU/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human milk</td>
<td>Any</td>
<td>Provider preference</td>
<td>1</td>
<td>400</td>
</tr>
<tr>
<td>Human milk with term formula</td>
<td>Any</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Feeding Intolerance Decision Pathway
Feeding Intolerance

• Some feeding intolerance expected due to gut immaturity
  intestinal dilation related to noninvasive ventilation
• Feeding should not be withheld unless pathologic signs of feeding intolerance are present.
• Gastric residuals should not be routinely checked prior to feeding stable infants
Feeding Intolerance

Observations which would warrant holding subsequent feeds until medical clearance include:
• Significant abdominal distention (≥ 2cm from baseline)
• Tender, firm or discolored abdomen
• Bilious emesis
• Bilious or dark green gastric aspirates
• Hypoactive/absent bowel sounds
• Blood in stool
• Non-bilious emesis of >50% of feed x 2 consecutive feeds if receiving ≥ 40ml/kg/day enteral feeds
Feeding Intolerance

Observations which may require alteration of current feeding regimen, but not necessarily cessation of subsequent feeds, include:

- Mild abdominal distention (<2cm from baseline)
- Persistent regurgitation/emesis of
  
  25-50% of feeding volume x 2 consecutive feeds

  or

  >50% of feeding volume x 1 feed

- Significant feeding related apnea/bradycardia/desaturation
Feeding Intolerance Decision Pathway

**SIGNIFICANT/RED-FLAG**
- Significant abdominal distention (≥ 2 cm from baseline)
- Tender, firm or discolored abdomen
- Bilious emesis
- Bilious or dark green aspirates (light green is tolerated)
- Hypoactive/absent bowel sounds
- Blood in stool (grossly visible)
- Hemodynamic instability, lethargy
- Non-bilious emesis of > 50% of feeds x 2 consecutive feeds if receiving ≥ 40 mL/kg/day enteral feeds

**NONSPECIFIC/BORDERLINE**
- Mild abdominal distention (< 2 cm from baseline)
- Persistent regurgitation/emesis of 25-50% of the feeding volume x 2 consecutive feeds or:
  - ≥ 50% of the feeding volume x 1 feed
  - Feeding-related apnea/bradycardia/desaturation

**Continuous evaluation for signs of feeding intolerance**

* Notify physician for order
** NO Significant/Red Flag signs present

**Restart feeds at 40 mL/kg/day and advance as tolerated***

**GRV <50% **

Reduce feeds to 15-20 mL/kg/day for 12-24 hours*

**GRV <50% **

Continue and evaluate GRV at next scheduled feeding time

**GRV still >50 **

Continue and evaluate GRV at next scheduled feeding time

**GRV still >50% **

Reduce feeding volume by 25%

Continue same feeding volume

**Check Gastric Residual Volume (GRV)**

- ≥ 50% of feeding volume
- <50% of feeding volume

**Feeding Volume ≥40 mL/kg/day**

**Feeding Volume <40 mL/kg/day**

**Significant/Red Flag signs are present before next feeding**

- Routine feeding advancement permitted
- No routine gastric residual checks

**Hold feedings and notify physician/NNP**

**NO**

Continue and advance feeds at previous volume after 6-12 hrs*

- Routine feeding advancement permitted
- No routine gastric residual checks

**GRV <50% **

Continue and evaluate GRV at next scheduled feeding time

**YES**

* TOMORROW STARTS TODAY.
Use and Storage of Pasteurized Donor Human Milk (PDHM) in the NICU
Donor Milk

Banked donor human milk that is screened, pooled, and pasteurized
Milk is obtained from one of the Human Milk Banking Association of North America (HMBANA) milk banks
Definitions

• **Preterm Donor Milk**: collected from mothers who deliver infants ≤ 37 weeks’ gestation, within the first month after delivery

• **Early Term Donor milk**: collected from mothers who deliver infants > 37 weeks’ gestation, within the first month after delivery

• **Term Donor Milk**: collected from mothers who deliver infants > 37 weeks’ gestation, within the first year after delivery
Criteria for using PDHM

- Birth gestational age (GA) < 35 weeks
- Per parental request if ≥35 weeks birth GA at sites where this option is available
- GI diagnosis (e.g. short-gut syndrome, Hirschsprung's, malabsorption, GI surgery)
- Post NEC or a history of NEC
- Renal failure
- Feeding intolerance
- Some inborn errors of metabolism
- Provider discretion
Considerations

• Mother’s own milk (MOM) is always used first
• PDHM may be mixed with MOM to achieve desired feeding quantity
• If MOM is unavailable, PDHM is used exclusively
• PDHM can be fortified similar to MOM per current NICU protocol
• Multiples: If one infant is eligible, all siblings will receive PDHM
• Preterm PDHM used for infants < 1000 grams if available
  Early Term PDHM used if preterm PDHM not available
  Term PDM used if Preterm or Early Term PDHM not available
• Term PDHM used for all infants ≥1000 grams
PDHM initiation steps

• Obtain signed consent from parent/guardian
  Telephone consent obtained if parents are not physically available to sign consent
• Physician to order PDHM for the eligible infant as a nutrition order
• A formula order will not be written for these infants
PDHM weaning process

- Physician enters Nursing Communication Order “Wean donor milk per protocol.”
- General criteria for weaning PDHM
  - Stable and tolerating enteral feedings well
  - Absence of conditions that warrant the extended use of BM
- May extend weaning process if feeding intolerance develops
- Ideally, weaning should be completed at least 2 days prior to discharge
PDHM weaning process

• Infants born <35 weeks GA
  after 14 days on PDHM or 35 weeks PMA, whichever is longer
  until on ad lib feedings
• Infants born ≥35 weeks GA
  after 14 days of life
• Suggested weaning schedule
  Day 1: Two formula feedings intermittently throughout the day
  Day 2: Four formula feedings
  Day 3: Six formula feedings
  Day 4: All formula
Ordering/Storing/Handling of PDHM

• NICU Lactation Consultants (LC) or designated healthcare provider (HCP) notified if the PDHM stock is low
• LC or HCP will arrange for milk delivery with the milk bank
• PDHM will be stored in accordance with the current Safe Human Milk Handling Policy
• PDHM stored in the NICU freezer until the milk bank designated expiration date
• A single “Unit Bottle” of PDHM can be used for several infants
• RN to chart the feeding as “Donor Human Milk” in electronic medical record
• Human Milk, Bovine Fortifier and Prolacta Conservation guidelines should be followed
References


References

• Donor Human Milk for High Risk Infant: Preparation, Safety and Usage Options in the United States. Committee on Nutrition, Section on Breastfeeding, Committee on Fetus and Newborn. Pediatrics Volume 139, number 1, January 2017


