BASIC CONCEPTS: FLUID, ELECTROLYTE, AND NUTRITIONAL MANAGEMENT IN PRETERM INFANTS

Approach to Early Nutritional Support for Preterm Infants, ≤ 1250 Gm Birth Weight

I. Parenteral Nutrition

A. Initiate **Off-Hours TPN** at 50 mL/kg/d (3 g protein/kg/d) within hours of delivery. Administer, if possible, via an umbilical venous catheter (UVC).

1. Administer 50 ml/kg/d of Off-Hours Neonatal PN as part of an infant's total fluids during his/her first 24-30 hrs of life. Initiate within the first 1-2 hrs of birth.

2. Off-Hours TPN contains dextrose (10 %), protein (60 gm/liter), minimal electrolytes, calcium 100 mg/100 ml (4 mEq/L)] and heparin (0.5 units/ml). It may be infused via a peripheral or a central line.

3. Note that 50 mL/kg/d provides 3.0 gm protein/kg/d, a glucose infusion rate of 3.5 mg/kg/min, and 50 mg calcium/kg/d.

4. To order via SCM select “Off-hours Neonatal (NBSCU) PN” on SCM NBSCU PN order screen.

5. **Rationale**: ELBW infants receiving only intravenous glucose (at about 40 kcal/kg/d) lose > 1% of protein stores/day (1.0-1.2 gm/kg/d). Therefore, administration of at least 1.5 g protein/kg/d is necessary to balance these losses and to achieve a zero nitrogen balance.³ These infants receive about 4.0 gm protein/kg/d across the placenta. Therefore, a PN regimen containing amino acids and providing 3.0 gm protein/kg/d should be initiated in extremely low gestational neonates (ELGANs) within the first several hours of life.

B. Increase TPN to 3.5 to 4.0 g protein/kg/d over the next 1-2 days. Administer “**electrolyte free**” (similar to Off-Hours TPN) for the first 3-4 days of life²,³ as tolerated.

1. The protein infusion should be increased by 0.5 gm/kg/d to provide 3.5 to 4.0 gm protein/kg/d to VLBW infants by the third day of life in order to achieve their daily protein requirements.

2. Note: The daily protein requirement for infants > 32 wks PMA (> 1500 gm body weight) is 3.0 to 3.5 gm protein/kg/d.

3. Most studies have reported no correlation between serum BUN levels and amino acid intake during the first 72 hours of life in infants < 1250 g birth weight. Therefore, limiting protein intake based upon BUN levels is not usually indicated.⁴ Nonetheless, since elevated BUNs (> 60 mg/dL) have been reported in the smallest, sickest infants receiving > 3 g/kg/d⁵, limiting total protein to about 2.5-3 g/kg/d is recommended while other causes of elevated BUN are considered.
C. Initiate lipid emulsion within the next 24-30 hours at 0.5 g/kg/d

1. The purpose of the lipid emulsion is to prevent essential fatty acid deficiency, which requires 0.5 to 1.0 gm/kg/d. A 20% lipid emulsion is administered; compared to the previously used 10% emulsions, the 20% emulsion is associated with a lower phospholipid intake and lower serum triglyceride and cholesterol levels.

2. The lipid emulsion should be administered over 20 to 24 hrs to minimize lipid intolerance.

3. For infants < 1000 gm BW, initiate 0.5 gm/kg/d and advance by 0.5-1 gm/kg/d to a maximum of 3 gm/kg/d.
   a. For infants 1000-2000 gm BW, initiate 1-2 gm/kg/d and advance by 1-2 gm/kg/d to a maximum of 3 gm/kg/d.
   b. For infants > 2000 gm BW, initiate at 2-3 gm/kg/d and advance to a maximum of 3 gm/kg/d.

4. Serum triglyceride levels should be monitored the morning after an infusion of 3 gm/kg/d has been reached to ensure that the lipid emulsion is cleared (or tolerated).
   a. For infants ≤ 750 gm BW, consider measuring serum triglyceride levels in the morning after 2 gm/kg/d has been reached for the first time.
   b. Serum triglyceride levels should be maintained < 200 mg/dL. Serum triglyceride levels should be monitored every 2 wks, if enteral feeds are not being advanced.
   c. Adjust the dose of lipid emulsion when hypertriglyceridemia occurs as follows:6

<table>
<thead>
<tr>
<th>Serum Triglyceride Level</th>
<th>Decrease lipid emulsion by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>200-249 mg/dL</td>
<td>1 g/kg/d</td>
</tr>
<tr>
<td>250-299 mg/dL</td>
<td>1.5 g/kg/d</td>
</tr>
<tr>
<td>&gt; 300 mg/dL</td>
<td>Reduce to 0.5 g/kg/d</td>
</tr>
</tbody>
</table>

D. Fluids

1. Initiate intravenous fluids at about 100 mL/kg/d. For example:
   a. ¼ N saline via a UAC at 0.5 mL/hr
   b. 50 mL/kg/d as Off-Hours TPN
   c. balance as “free water” [glucose only fluid (eg D10W) to achieve an adequate GIR]

2. Adjust fluid administration rate to maintain weight loss within 10% of BW during first week of life. Adjustments should be based upon body weight measurements (1 to 2 times/day), gestational age, physical environment (radiant warmer vs isolette, % humidity), and urine output. Typical total daily volumes are 120 mL/kg/d on day 2, 140 ml/kg/d on day 4-5, and 150 mL/kg/d on day 6-7.
   a. In general, restrict fluids if weight gained; liberalize if weight loss > 10% of BW.
   b. If urine output > 4 ml/kg/hr, liberalize fluids if the increased urine output is thought to be secondary to renal immaturity and poor concentrating ability. Otherwise consider fluid restriction.
c. If urine output < 0.5 ml/kg/hr, liberalize fluids if the decreased urine output is thought to be secondary to intravascular volume depletion. Otherwise, consider fluid restriction.

3. As the fluid balance stabilizes, increase the % of total daily fluids as TPN, so that TPN provides the majority of the IV fluids by about day 5 of life.

E. Electrolytes

1. Minimize Na administration, as tolerated, during the first several days of life (ie, 3-4)\(^2,3\); expect a "concentration hypernatremia". Restrict fluids if serum Na < 130 mEq/L; liberalize if Na > 145 Eq/L.

2. Do not begin K supplementation until urine output is established (> 1 mL/kg/hr) and/or serum potassium is < 3.5 mEq/L.

3. Monitor serum electrolyte concentrations every 12 hrs for the first 24-48 hrs; BUN/Cr levels once/day.

4. Note that electrolyte-free or electrolyte-limited parenteral nutrition solutions should be ordered during the first several days of life. Also, unless specified, sodium acetate is the form of acetate included in parenteral nutrition.

F. Glucose

1. Start intravenous glucose infusion at about 5-8 mg/kg/min and adjust to keep plasma glucose concentration between 50 and 120 mg/dL. (Note D7.5W @ 100 mL/kg/d provides 5.2 mg glucose/kg/min; D10W @100 mL/kg/d provides 6.9 mg /kg/min; D12.5W @ 100 mL/kg/d provides 8.7 mg/kg/min).

2. Adjust glucose concentration of IV fluids to maintain a glucose infusion rate (GIR) of 6-8 mg/kg/min during the first several days of life.

3. If the glucose concentration of the IV fluids is not monitored closely (and usually decreased) as the total daily fluids are increased, hyperglycemia and glucosuria may result, and the obligate urinary water loss associated with glucosuria may increase the infant’s dehydration and further complicate fluid management.

4. After the first week of life, increase GIR > 10 mg/kg/min as tolerated and indicated. Maximum GIR should be ~15 mg/kg/min.

II. Enteral Nutrition

A. Minimal enteral feedings (also called non-nutritive feedings, "GI stim" feedings, and priming feedings) are very low volume feedings initiated to acclimate the GI tract to feedings, stimulate gut hormone secretion and promote GI tract maturation.

B. Aim to initiate minimal enteral nutrition (MEN) by 48 ± 12 hours of age with about 12 mL/kg/d [10 – 15 mL/kg/d].\(^7,8\) See table below of estimated total daily volumes.

1. Use human milk (colostrum) if possible.\(^9,10\) Consider delaying initiation of minimal enteral feedings beyond 60 hrs of age if HM expected.
2. Use premature formula if the mother is not planning to express HM.
## Estimated Total Daily Volumes:

<table>
<thead>
<tr>
<th>BW (kg)</th>
<th>Total Daily Volumes @ 12 mL/kg/d</th>
<th>Total Daily Volumes [10 - 15 mL/kg/d]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4</td>
<td>4.8</td>
<td>4 - 6</td>
</tr>
<tr>
<td>0.5</td>
<td>6</td>
<td>5 – 7.5</td>
</tr>
<tr>
<td>0.6</td>
<td>7.2</td>
<td>6 – 9</td>
</tr>
<tr>
<td>0.7</td>
<td>8.4</td>
<td>7 – 10.5</td>
</tr>
<tr>
<td>0.8</td>
<td>9.6</td>
<td>8 – 12</td>
</tr>
<tr>
<td>0.9</td>
<td>10.8</td>
<td>9 – 13.5</td>
</tr>
<tr>
<td>1.0</td>
<td>12</td>
<td>10 – 15</td>
</tr>
<tr>
<td>1.1</td>
<td>13.2</td>
<td>11 – 16.5</td>
</tr>
<tr>
<td>1.2</td>
<td>14.4</td>
<td>12 – 18.0</td>
</tr>
</tbody>
</table>

C. Initially provide MEN every 4 hours. Continue every 4 hour feedings for 2 days, then change to every 2 hour feedings.

### Feeding Advancement Table:

<table>
<thead>
<tr>
<th>Feeding Day (Volume - mL/kg/d)</th>
<th>Birth Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤ 0.550</td>
</tr>
<tr>
<td>1 (~12)</td>
<td>1 mL q4h</td>
</tr>
<tr>
<td>2 (~24)</td>
<td>2.0 mL q4h</td>
</tr>
<tr>
<td>3 (~36)</td>
<td>1.5 mL q2h</td>
</tr>
<tr>
<td>4 (~48)</td>
<td>2.0 mL q2h</td>
</tr>
<tr>
<td>5 (~60)</td>
<td>2.5 mL q2h</td>
</tr>
<tr>
<td>6 (~72)</td>
<td>3.0 mL q2h</td>
</tr>
</tbody>
</table>

D. After feeding Day 6, increase by 1 mL/feeding q24h for 2-3 days and then consider increasing by 1 mL/feeding q12h until full enteral nutrition achieved.

E. Advance enteral feeding volume by 12 mL/kg birth weight/d whenever at least ½ of the feedings given were tolerated during the previous 24 hours.

1. Maintaining a constant total daily fluid intake (IV plus enteral) of 120-150 mL/kg/day.

2. The goal is to reach full enteral nutrition (> 120 mL/kg/d) between 14-21 days of life, and possibly without having to insert a PICC line.

3. As enteral feeds are advancing:
   a. Maintain an “NPO” protein concentration in the TPN. That will provide 4 g/kg/d of parenteral protein if enteral feedings are interrupted and the infant is made NPO.
b. Decrease the lipid emulsion in steps (ie, from 2 gm/kg/d to 1.5. to 1.0) as the enteral volume reaches 1/3, 1/2, and 2/3 of the total daily fluid volume.
c. Include the enteral volume into the calculation of total fluid intake when > 20 mL/kg/d is provided.

F. Introduce human milk fortifier (HMF) when the infant is receiving about 100 mL HM/kg/d. Add 1 package to 50 mL HM for 24 hours; if tolerated, increase to 1 pkg in 25 mL HM.

G. Management of gastric residuals during early enteral feedings.\textsuperscript{7-11}

1. Check for gastric residuals prior to each feeding.

2. The color of the gastric residuals (clear, cloudy, yellowish, greenish), in and of itself, is not a reason to hold or discontinue early enteral feedings.\textsuperscript{11}

3. If gastric residual volume (GRV) ≤ 5 mL/kg, provide the scheduled feeding.

4. If the GRV > 5 mL/kg and is > the volume of the scheduled feeding:
   a. Hold that scheduled feeding and just re-feed the residual.
   b. If this occurs with 2 consecutive feedings, and the abdominal exam is benign, do not re-feed the residual or give the scheduled feeding. Let the bowel rest until the next feeding is due, then re-try enteral feedings as ordered.
   c. Consider a glycerin suppository if the infant is still clearing meconium or has not passed a stool for > 48 hours.

5. If the GRV > 5 mL/kg, but is < the volume of the scheduled feeding:
   a. Re-feed the residual plus give the difference up to the scheduled feeding volume.
   b. If this occurs with 2 consecutive feedings, the abdominal exam is benign, do not re-feed the residual or give the scheduled feeding. Let the bowel rest until the next feeding is due, then re-try enteral feedings as ordered.
   c. Consider a glycerin suppository if the infant is still clearing meconium or has not passed a stool for > 48 hours.

H. This strategy of initiating and advancing enteral feeds should not be altered by such clinical conditions as:

1. Hypotension (unless being treated with > 5 mcg/kg/min Dopamine)
2. Infection (suspected or confirmed)
3. Mild abdominal distension
4. Prophylactic indomethacin
5. PRBC transfusion

I. However, enteral feedings should be interrupted during:

1. The performance of a sepsis work-up
2. An abdominal evaluation that includes an abdominal radiograph and has been performed due to such signs and symptoms as a significant increase in GRV (> 50% of the scheduled feeding once full enteral nutrition has been reached), abdominal distension and heme+ stools.
3. An evaluation for emesis.
Enteral feedings should be resumed if the abdominal evaluation is within normal limits.

**J. Enteral feedings should be held for:**

1. An abnormal abdominal examination is characterized by such findings as significant abdominal distension, persistent visible bowel loops, absent or diminished bowel sounds, abdominal tenderness, or frank blood in the stool.
2. Enteral feedings should be held if there is a hemodynamically significant PDA (including during treatment with indomethacin or ibuprofen) or if there is significant hypotension requiring therapy with > 5 mcg/kg/min of Dopamine.
3. In addition, feedings should be held for 6 hours s/p extubation or intubation.

References:

III. Approach to Nutritional Support of Preterm Infants, > 1250 - 1750 gm Birth Weight

A. For critically ill infants, insert IV within first two hours of life and initiate IV fluids at about 80 mL/kg/day with D10W.

1. Order Off-Hours PN to provide 3.0 gm protein/kg/d as part of initial intravenous fluids.

2. Order lipid emulsion to provide at least 1.0 gm/kg/d as soon as possible, but by day 2 of life.

3. If the infant remains NPO, advance the administration of parenteral protein and lipid emulsion by 1-2 gm/kg/d to provide 3.5 to 4.0 gm protein/kg/d and 3.0 gm lipid/kg/d, respectively. Initiate minimal enteral feedings by 48 hrs of age.

B. If not critically ill: NPO for at least 12 hrs. Then, if stable, NG feedings may be initiated. NG feedings should be delayed at least 24 hrs if labor and delivery were complicated by evidence of fetal distress or if the infant is having any respiratory distress.

C. NG feedings may be offered every 2-3 hrs as tolerated. Initiate enteral feedings with full strength human milk or Premature Formula; 4-5 mL/kg/feeding. The use of “clear liquids” [sterile water, dextrose & water, or a dextrose & electrolyte solution (eg Pedialyte) as the first feeding is not necessary.

D. If initial enteral feedings are tolerated for 24 hrs, begin to slowly advance enteral feeding volumes as tolerated.

E. Decrease parenteral nutritional support as the enteral feeding volume is increased slowly, as tolerated, to about 150 mL/kg/day. For example, rates of increase of enteral feeding volume range from 1-3 mL/feeding every 24 hours to 1-3 mL/feeding every other feeding. But, increases of greater than 20 mL/kg/day should be avoided.

F. Example of a schedule for advancement and provision of total daily fluid intake (IV + enteral):

<table>
<thead>
<tr>
<th>Total daily fluid volume (mL/kg/d)</th>
<th>Approximate hourly rate (mL/kg/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>day 1 80</td>
<td>3.5</td>
</tr>
<tr>
<td>day 2 100</td>
<td>4</td>
</tr>
<tr>
<td>day 3 120</td>
<td>5</td>
</tr>
<tr>
<td>day 4 130</td>
<td>5.5</td>
</tr>
<tr>
<td>day 7 150</td>
<td>6.5</td>
</tr>
</tbody>
</table>

G. The IV rate should be decreased according to the infant's ability to tolerate NG feedings, so as to provide the recommended total daily fluid volume. As above, the IV should not be discontinued until the infant is tolerating his/her total daily fluid volume by NG feedings.

IV. Approach to Nutritional Management of Preterm Infants, >1750 gm Birth Weight

A. If stable, feedings (NG or PO) should be initiated within 6 hours of life. However, if labor and delivery were complicated by evidence of fetal distress or if the infant is
having any respiratory distress, feedings should be delayed at least 24 hours and IV fluids [about 60 mL/kg/d D10W or parenteral nutrition (3.0 gm protein/kg/d and at least 1.0 gm lipid/kg/d)] should be started ASAP.

1. Feedings may be offered every 3-4 hrs as tolerated and may be increased by 5 mL every other feeding as tolerated.

2. Begin feedings with full strength human milk or formula.

3. If enteral feedings are tolerated, decrease IV fluids according to the infant’s ability to tolerate feeding advancements.

B. If the infant is to remain NPO:

1. Order parenteral nutrition to provide 3.0 - 3.5 gm protein/kg/d

2. Order lipid emulsion to provide at least 1.0 gm/kg/d ASAP, but by day 2 of life.

3. If the infant continues NPO, continue to provide 3.0-3.5 gm protein/kg/d parenterally, and begin to advance the administration of lipid emulsion by 1-2 gm/kg/d to provide 3.0 gm lipid/kg/d.

4. Initiate minimal enteral feedings by 48 hours age if the infant remains NPO due to severity of illness.

5. When appropriate, IV fluids should be decreased and enteral feedings initiated and advanced according to the infant’s ability to tolerate feedings.

V. Types of Enteral Feedings:

A. Human Milk (fresh or frozen from mother)

1. For infants with a birth weight < 1750 gm and/or gestational age < 34 weeks:
   a. Fortify HM with Human Milk Fortifier (HMF) until > 2200 g body weight or > 36 weeks PMA or until discharge home is anticipated to occur within the next 48-72 hrs.
   b. Then offer HM fortified with NeoSure powder or EnfaCare powder (eg 1 tsp:130 mL for 22 cal/oz or 1 tsp/70 mL for 24 cal/oz) in preparation for discharge home.
   c. After discharge the infant should breast feed or receive HM fortified with NeoSure powder or EnfaCare powder if bottle-fed expressed HM. If supplemental formula is offered, NeoSure or EnfaCare should be used.
   d. HM fortification with NeoSure or EnfaCare or provision of NeoSure or EnfaCare as a supplemental formula should continue until about 52 weeks PMA.

2. For infants with a birth weight > 1750 g and < 2200 g and/or a gestational age > 34 weeks and < 36 weeks:
   a. Fortify HM with NeoSure powder or EnfaCare powder (eg, 1 tsp:130 mL for 22 cal/oz or 1 tsp/70 mL for 24 cal/oz).
   b. Continue that feeding after discharge.
   c. If supplemental formula is offered, NeoSure or EnfaCare should be used.
   d. HM fortification with NeoSure or EnfaCare or provision of NeoSure or
EnfaCare as a supplemental formula should continue until about 52 weeks PMA.

3. For infants with a birth weight ≥ 2200 g and/or a gestational age ≥ 36 weeks:
   a. Unfortified HM should be adequate for most infants. Proprietary term infant formulas should be used if HM is not available.
   b. If fortification is needed to increase caloric density and/or to provide selected nutrients, discuss with Neonatal Nutritionists.

B. Proprietary Infant Formulas

1. For infants with a birth weight < 1750 gm and/or gestational age < 34 weeks:
   a. Premature Infant Formula [whey protein preparation, 24 calories/oz; (eg Enfamil Premature Formula, Similac Special Care Formula)] should be used until > 2200 g body weight or > 36 weeks PMA or until discharge home is anticipated to occur within the next 48-72 hrs.
   b. Then switch to NeoSure or EnfaCare Formula in preparation for discharge home.
   c. Continue that feeding after discharge until about 52 weeks PMA.

2. For infants with a birth weight > 1750 g and < 2200 g and/or a gestational age > 34 weeks and < 36 weeks:
   a. Offer the infants NeoSure or EnfaCare.
   b. Continue that formula until about 52 weeks PMA.

3. For infants with a birth weight ≥ 2200 g and/or a gestational age ≥ 36 weeks, a proprietary term infant formula should be adequate for most infants.

C. Note: Use of “clear liquids” [sterile water, dextrose & water, or a dextrose & electrolyte solution (eg Pedialyte)] as the first feeding is not necessary.

VI. Nutritional Assessment of the Enterally-fed VLBW Infant

Goal of Nutritional Support: To provide 150 mL/kg/day and 110-130 kcal/kg/day.

Monitoring of Intake/Output

<table>
<thead>
<tr>
<th>Fluid Intake (cc/kg/d)</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine Output (cc/kg/d)</td>
<td>Daily</td>
</tr>
<tr>
<td>Nutrient Intake</td>
<td></td>
</tr>
<tr>
<td>Energy (kcal/kg/d)</td>
<td>Daily</td>
</tr>
<tr>
<td>Protein (gm/kg/d)</td>
<td>Daily if poor weight gain</td>
</tr>
</tbody>
</table>

Anthropometric monitoring (plot on growth charts)

| Body weight (gm)      | Daily |
| Length (cm)           | Weekly |
| Head Circumference (cm)| Weekly |

Biochemical monitoring

CBC, including platelet & reticulocyte counts Every 2 weeks
(Follow reticulocyte counts when PMA >32 wks)
Calcium, phosphorus, alkaline phosphatase  
Every 2 weeks 

Serum electrolytes, BUN  
Weekly, if fluid restricted, with increased caloric density. Then every 2 weeks, if stable. 

Total protein, albumin, prealbumin  
Consider if poor weight gain (<10 g/kg/d) or low BUN (<10 mg%) 

Renal Ultrasound  
Consider if treated with chronic diuretics (esp furosemide) 

VII. Additional Recommendations: 

A. Intravenous fluids/parenteral nutrition (glucose/amino acids/lipids) should be provided until an infant has achieved full enteral nutrition, see Guidelines for Use of Total Parenteral Nutrition for information about TPN. An intravenous lipid emulsion should be continued until an infant is consuming at least 2 gm/kg/d of fat enterally. 

B. Infants <1500 gm: Electrolytes (especially sodium) should be determined (at least) daily until full strength feedings are tolerated. In addition, urine output should be followed closely. Fluid intake should be adjusted (increased or decreased) when indicated by these data. Also, if the infant is under phototherapy, increase fluid volume by 10-20 ml/kg/day. Remember low birth weight infants lose about 10% of their birth weight over the first week of life and should not lose more than about 2%/day. Therefore, a daily weight (or twice daily) is an important measure of hydration. 

C. When an infant who has been made NPO is to be restarted on enteral feedings, the following regimen is suggested: 

1. If previously on full strength formula, begin with about ½ the previously tolerated feeding volume. Then increase to full feeding volume over 1-2 days as tolerated. 

2. If previously on full strength, fortified human milk, begin with full strength, unfortified human milk at about ½ the previously tolerated feeding volume. Then increase to full feeding volume over 1-2 days as tolerated. 

VIII. Recommendations for post-hospital nutrition of VLBW infants 

A. Rationale 

1. Recent evidence suggests that the feeding of preterm infants during the early weeks after birth is important to their later outcome, notably their neurodevelopment. For this reason, special nutrient-rich formulas (that is preterm formulas and human milk fortifiers) have been developed for feeding these infants, especially VLBW (BW ≤ 1750 gm) infants; and use of such preterm formulas and human milk fortifiers has become standard of care for these infants. 

2. However, since VLBW preterm infants are being discharged home at about 1900 gm and 35 completed wks postmenstrual age (PMA), there is increasing concern that term infant formulas and breast milk alone may not meet the special nutritional needs (eg protein and mineral) that are required to promote satisfactory growth and development.
3. Therefore, the rate of growth achieved in the nursery prior to discharge may slow and catch-up growth may be incomplete or delayed, possibly predisposing these infants to viral and bacterial infections during the first year of life and lower scores on developmental tests at school age.

B. Strategies for improving post-hospital nutrition of formula-fed preterm infants, especially VLBW, might include continued use of preterm formulas or initiation of specially designed post-hospital (post-discharge) formulas.

1. At this time, 2 specially designed post-hospital formulas are available - NeoSure (Abbott Nutrition) and EnfaCare (Mead Johnson Nutritionals).

2. Both are available as a ready-to-use formula in the hospital and as a powder for hospital and home use. They provide 22 kcal/oz (74 kcal/dL) at regular concentration, but formulas with greater caloric density (eg 24, 27 or 30 kcal/oz) can be made from the powder.

3. Both contain more nutrients/100 kcal than term infant formulas, but less nutrients/100 kcal than preterm formulas; both are iron fortified.

C. Therefore, it is recommended that AGA infants with birth weights <1750 gm and/or gestational age < 34 weeks should be fed preterm human milk fortified with HMF or a premature infant formula until they are > 2200 gm and/or > 36 weeks PMA and close to discharge.

1. At that time formula-fed infants should be switched to one of the specially designed post-hospital/discharge 22 cal/oz formula with iron (plus daily oral vitamin supplement). This formula should be continued for about 4 months-post-discharge or until about 52 wks PMA, whichever is longer. (See recommendations for iron and vitamin.)

2. Unless feeding at the breast, human milk-fed infants should be offered fortified human milk until discharge from the hospital. A daily iron and multivitamin supplement should be given to infants receiving only unfortified human milk in the NBSCU and to human milk fed infants at discharge. (See recommendations for iron and vitamin supplementation.)

3. VLBW infants who continue to receive breast milk following hospital discharge may be offered a feeding of one of the post-hospital/discharge formulas as a supplement or the powdered formula may be used to fortify human milk that is expressed and then bottle-fed. This supplement and/or fortification should be continued for about 4 months-post-discharge or until about 52 weeks postmenstrual age, whichever is longer. (1 tsp powder/130 mL human milk increases human milk's caloric density to about 22 kcal/oz; 1 tsp/70 mL produces about 24 kcal/oz; and 1 tsp/40 mL produces about 27 kcal/oz).

D. SGA Infants

1. Due to increasing concern about the relationship between postnatal nutrition and the development of such long-term health outcomes as hypertension and metabolic syndrome in former SGA infants, a post-hospital/discharge formula should not be offered to SGA infants ≥ 34 weeks gestation. A proprietary term formula should be used.
2. Although use of such a formula in VLBW-SGA infants, and especially in ELBW-SGA infants, may be required to support steady weight gain following discharge, once these infants are capable of feeding well ad libitum, it should be discontinued and a proprietary term formula should be offered.