Basics of TPN Calculation

1. Establish a total fluid goal
   - Use Holiday Segar Method
   - If patient is fluid sensitive may need to subtract lipid amount from total fluid goal
   - Consider ordering in ½ L increments up to 2L to save on TPN cost and piggybacking in remaining fluids to meet goal volume

2. Estimate Energy Needs
   - Calculate goal calories
   - PN energy needs are 10-15% lower than when fed enterally
   - Goal calories: usually 45-60% CHO, 10-15% protein, 25-40% fat

3. Macronutrients
   - Lipids
     - Start at 1-2 g/kg/day and increase by 0.5-1 g/kg/day to max of 3 g/kg
     - 10 kcal/gram
     - 5 mL/gram and 2 kcal/mL (CHW has 20% IV Fat Emulsion)
     - Rate/hour calculation = g/kg x weight x 5 mL/g ÷ hours of infusion
   - Protein
     - Start at 1-2 g/kg/day and increase by 1 g/kg/day (max varies by age)
     - 4 kcal/gram
     - Use Trophamine for <12 months and Travasol for >12 months
   - Dextrose
     - Start at 10% dextrose or 5% higher than current IV fluids and advance by 2.5-5% per day to goal (order in increments of 0.5)
       - Max depends on age and access
         - Central: 25% dextrose
         - Peripheral: 10-12.5% dextrose (must be <900 mOsm/L)
     - 3.4 kcal/gram
     - % Dextrose calculation = dextrose calories desired ÷ 3.4kcal/gram ÷ desired volume (mL/day) x 100%
   - Calculating GIR
     - Grams carbohydrate x 1000 ÷ patient weight (kg) ÷ number of minutes TPN infuses (example: 1440 minutes for 24 hour infusion)

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Goal GIR (mg/kg/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preterm Infant</td>
<td>~12</td>
</tr>
<tr>
<td>Term Infant</td>
<td>10-14</td>
</tr>
<tr>
<td>Child (1-10 years)</td>
<td>8-10</td>
</tr>
<tr>
<td>Adolescent (&gt;10 years)</td>
<td>5-6</td>
</tr>
</tbody>
</table>
4. Micronutrients (Refer to CHW TPN Guidelines, located on Children’s Connect)
   - Electrolytes and Minerals

<table>
<thead>
<tr>
<th>Electrolyte</th>
<th>Preterm</th>
<th>Infants/children</th>
<th>Children &gt;40kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>2-5 mEq/kg</td>
<td>2-5 mEq/kg</td>
<td>2-3 mEq/kg</td>
</tr>
<tr>
<td>Potassium</td>
<td>2-4 mEq/kg</td>
<td>2-4 mEq/kg</td>
<td>2-3 mEq/kg</td>
</tr>
<tr>
<td>Calcium</td>
<td>2-4 mEq/kg</td>
<td>0.5-4 mEq/kg</td>
<td>0.2-2 mEq/kg</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>1-2 mmol/kg</td>
<td>0.5-2mmol/kg</td>
<td>0.5-2 mmol/kg</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.3-0.5 mEq/kg</td>
<td>0.3-0.5 mEq/kg</td>
<td>0.3-0.5 mEq/kg</td>
</tr>
<tr>
<td>Acetate</td>
<td>As needed for acid-base balance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td>As needed for acid-base balance</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Vitamins
  - Pediatric MVI (<11 years): Dose 3 mL/kg with max of 5 mL/day
  - Adult MVI (11+ years): Dose 10 mL/day
  - Vitamin K: if none in MVI add up to 1 mg/day

- Trace Elements
  - Dose 0.15 mL/kg with max of 4 mL/day
  - Some patients may require additional trace elements (See Parenteral Trace Element Requirements)
  - Consider decreasing copper with liver failure
  - Consider decreasing chromium and selenium with renal failure
  - Zinc:
    - Preterm: 400mcg/kg/day
    - Infants/Children: 150mcg/kg/day, up to 5000mcg/day
    - Children >40kg: 150mcg/kg/day, up to 5000mcg/day

- Other Additives
  - Iron:
    - Incompatible with Intralipid
  - Levocarnitine
    - Dose 10 mg/kg/day (typically used in premature babies and infants on long term TPN)
  - PN related medications
    - H-2 Antagonists and Heparin

References: