UNIVERSITY MEDICAL CENTER

Adult Parenteral Nutrition Order Sheet

Date: ______ Time noted ______ RN signature

1. MACRONUTRIENTS

<table>
<thead>
<tr>
<th></th>
<th>Initial Central</th>
<th>Standard Central</th>
<th>Fluid Restricted Central</th>
<th>Central Specialized</th>
<th>Standard Peripheral</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Calories</strong></td>
<td>710 kcal</td>
<td>1870 kcal</td>
<td>1630 kcal</td>
<td>kcal</td>
<td>kcal</td>
</tr>
<tr>
<td><strong>Standard Amino Acid</strong></td>
<td>4 kcal/gm</td>
<td>50 gm</td>
<td>75 gm</td>
<td>kcal</td>
<td>75 gm</td>
</tr>
<tr>
<td>Other: (See reverse side)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dextrose</strong></td>
<td>3.4 kcal/gm</td>
<td>150 gm</td>
<td>300 gm</td>
<td>gm</td>
<td>150 gm</td>
</tr>
<tr>
<td><strong>Total Volume of Base Solution</strong></td>
<td>1000 ml</td>
<td>1500 ml</td>
<td>1000 ml</td>
<td>ml</td>
<td>2000 ml</td>
</tr>
<tr>
<td><strong>Lipid Emulsion</strong></td>
<td>No lipid</td>
<td>10% (550 ml)</td>
<td>20% (400 kcal)</td>
<td>ml</td>
<td>ml</td>
</tr>
<tr>
<td>10% (1.1 kcal/ml)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20% (2 kcal/ml)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. ELECTROLYTES

<table>
<thead>
<tr>
<th>Electrolyte</th>
<th>Adult Daily Dose</th>
<th>Total DAILY Dose</th>
<th>Multivitamin</th>
<th>Heparin</th>
<th>Trace Elements</th>
<th>Cholestasis</th>
<th>Folic Acid</th>
<th>Regular Human Insulin</th>
<th>Zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>60 to 150 mEq</td>
<td>mEq Sodium Chloride</td>
<td>Dosed by pharmacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>60 to 100 mEq</td>
<td>mEq Sodium Acetate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphate</td>
<td>15 mM PO₄ = 22 mEq K</td>
<td>mEq Potassium Chloride</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 mM PO₄ = 20 mEq Na</td>
<td>mEq Potassium Acetate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium gluconate</td>
<td>10 mEq</td>
<td>mEq Calcium Gluconate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium sulfate</td>
<td>10 mEq</td>
<td>mEq Magnesium Sulfate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. ADDITIVES:

- Multivitamin: Dosed by pharmacy
- Heparin: 1 unit/ml, Omit Heparin
- Trace Elements: Dosed by pharmacy
- Cholestasis: (Direct Bilirubin > 2 mg/dl), (See Trace Elements on back)
- Folic Acid: mg
- Regular Human Insulin: units
- Zinc: mg

4. OTHER ADDITIVES:

- MD Signature: ___________________________
- Pager: ____________________________ Time ____________________________
- For Pharmacy Use:
  - Prepared by: ____________________________ Checked by: ____________________________

5. INFUSION RATE: TPN/PPN will begin at 6 PM unless otherwise specified by unit policy or cycling schedule.
- Base solution over 24 hours
- Lipid emulsion over 12 hours

6. FOR CYCLING RATE: (Please check box)
- Infuse over _______ hours; begin infusion at 6 PM.
(Please indicate cycling rates in the spaces provided on the right)

7. CYCLED RATES:
- ml/hr (1st hour)
- ml/hr
- ml/hr (last hour)

8. STANDING LABORATORY ORDERS:
- 1. Baseline chemscreen, magnesium, phosphate, transferrin, & triglycerides
- 2. Daily miniscreen, magnesium, phosphate
- 3. Fingerstick for blood glucose 4 hours until controlled, then 12 hours
- 4. Repeat transferrin, triglycerides and LFTs weekly on Monday
- 5. If TPN is interrupted, hang D₅W at the same rate for at least 6 hours to prevent hypoglycemia. D₅W is not necessary upon discontinuation of PPN

ADULT PARENTERAL NUTRITION ORDER SHEET

MEDICAL RECORD

REV 10/2/02
GUIDELINES FOR PARENTERAL NUTRITION

A. Indications for Parenteral Nutrition (PN):
1. Patients with non-functional gastrointestinal tracts
2. Central (Total Parenteral Nutrition) vs. Peripheral:
   - Central (TPN) vs. Peripheral (PPN)
     - Full caloric needs
     - Fluid restriction
     - Severe illness
     - Duration of NPO
   - Central (TPN) Peripher (PPN)
     - Hypocaloric support
     - Can tolerate high fluid volumes
     - Not severely ill
     - Anticipated duration of NPO
     - ≤ 5 days
     - Anticipated duration of NPO
     - ≤ 7-14 days

B. Intravenous Access and Administration:
1. For central nutrition:
   - Confirm placement of central access prior to infusing TPN.
   - Begin TPN infusion through an unused catheter/lumen. If an unused lumen has not been reserved, the central catheter can be changed over a guidewire. Use distal port whenever possible.
2. Base solutions (amino acid/dextrose) must be filtered through a 0.22 micron filter. The appropriate in-line filter will be provided by pharmacy with the TPN solution.
3. Lipid emulsion is administered as a separate infusion via Y-site and does not require an in-line filter.

C. Estimation of Nutritional Requirements:
1. Total calories can be calculated using the Harris-Benedict equation plus an activity factor (20%-50%) or can be estimated as 25-30 kcal/kg based on dry weight.
   - Harris-Benedict Estimate of Basal Calories
     - Male: 66.5 + (13.7 X Wgt in kg) + (5 X Hgt in cm) - (6.8 X Age)
     - Female: 655 + (9.6 X Wgt in kg) + (1.8 X Hgt in cm) - (4.7 X Age)
2. Protein (amino acids): 1 to 1.5 gm protein/kg. If actual weight is > 100%, use ideal body weight (IBW) to estimate protein requirements.
   - IBW = Male: 50 + (2.3 X inches over 5 feet)
   - Female: 45 + (2.3 X inches over 5 feet)
3. Lipid Emulsion: 20-30% of total calories
4. PN should be initiated at half the estimated energy needs (approx 150-200 gm dextrose) for the first 24 hours to prevent refedding syndrome and increase to goal calories based on glucose and electrolyte tolerance.

D. Amino Acids (AA): (4 kcal/gm)
1. Standard amino acid solution contains a balanced profile of essential and non-essential amino acids; a 15% stock solution is routinely used to compound TPN/PPN solutions.
2. Other Amino Acid solution:
   - Hepatic: Contains greater amounts of branched chain amino acids, BCAA, leucine, isoleucine, and valine.
   - Phenylalanine, tryptophan, and tyrosine.
3. May be considered for Stage III or IV hepatic encephalopathy to provide greater protein intake via BCAA vs. AAA.
   - BCAA-enriched TPN solutions have not shown to be superior to standard amino acid solution in clinical trials.

E. Carbohydrates (Dextrose): (3.4 kcal/gm)
1. A standard 70% dextrose solution is used to compound TPN/PPN solutions.
2. The maximum recommended rate for carbohydrate infusion is 5 mg/kg/min.
   - Excess carbohydrate administration has been associated with hyperglycemia, hepatic steatosis, and increased CO2 production.

F. Lipid Emulsion:
1. Lipid emulsion is available as:
   - 10% / 500 ml (1.1 kcal/ml)
   - 20% / 200 ml or 500 ml (2 kcal/ml)
2. Lipid 10% and 20% emulsion are isotonic and can be administered via peripheral or central vein.
3. Lipid intake should be reduced or avoided if triglycerides > 400 mg/dl.
4. Medications formulated in lipid emulsion should be considered when developing a TPN regimen.
   - Propofol contains 10% lipid emulsion and provides 1.1 kcal/ml.

G. Electrolytes/Acid-Base:
1. The recommended electrolyte ranges will provide maintenance intake for an adult patient. Select patients may require higher or lower amounts; however, PN should not be used to treat acute electrolyte abnormalities.
2. Calcium and phosphate have limited solubilities in PN solutions. In general, the product of calcium (mEq/L) times phosphate (mmol/L) should not exceed 300 when the amino acid concentration is ≤ 4% to avoid the formation of a precipitate.
   - Contact the pharmacist for information regarding the solubility of a specific TPN solution.
3. Sodium and potassium can be included in a TPN solution as either an acetate or chloride salt. Acetate functions as a precursor to bicarbonate. When metabolic acidosis is present, Na or K can be provided predominantly as the acetate salt. When metabolic alkalosis is present, Na and K can be provided as the chloride salt.

H. Vitamins:
   - The multivitamin preparation in TPN provides maintenance requirements to prevent deficiencies in most adult patients.
   - Adult multivitamin dose (10 cc) contains:
     - Vit A (retinol): 3300 IU
     - Vit D2 (cholecalciferol): 200 IU
     - Vit E (dl-α tocopherol): 10 IU
     - Vit C (ascorbic acid): 200 mg
     - Vit B1 (thiamine): 6 mg
     - Vit B2 (riboflavin): 6 mg
     - Vit B6 (pyridoxine): 15 mg
     - Panthotenic Acid: 15 mg
     - Vit B12 (cyanocobalamin): 5 mcg
     - Folic acid: 1 mg
     - Niacin: 60 mg
     - Betaine: 60 mg
     - VIT K: 150 mcg

I. Trace Elements:
1. The trace elements in PN solution provide maintenance requirements and prevent deficiencies for most adult patients. Standard amounts of trace elements will be added to TPN: zinc 4 mg, copper 1 mg, manganese 0.6 mg, chromium 10 mcg.
2. Patients experiencing significant gastrointestinal loss from the small bowel (e.g., ileostomy output > 500 ml/hr) may require increased zine supplementation.
3. If the "Clot" box is checked, manganese and copper will be omitted from TPN. Manganese and copper are eliminated via biliary tract and may accumulate with repeated doses.

J. Peripheral Parenteral Nutrition (PPN):
1. Total calorie and protein requirements may not be met in most patients by PPN due to the osmolality and volume considerations.
2. The osmolality (Osm) of PPN formulas should be less than 900 mOsm/L.
   - The osmolality of PN solutions can be estimated by the following equation:
     - PPN Osmality = (grams of dextrose/5) + (grams of AAV X 10) + (mEq of NaCl or KCl X 2)
3. PPN should contain no more than 60 mEq/L of potassium or 18% dextrose concentration.
4. Due to the increased risk of phlebitis, PPN should not exceed 14 days.

K. Insulin:
   - For patients with glucose levels persistently > 200 mg/dl, 0.1 units of regular insulin/gm dextrose may be added to PN solution (e.g., 20 units insulin per 200 gm dextrose).
   - If glucose levels are persistently > 200 mg/dl, the PN insulin may be increased by 0.05 units of regular insulin/gm dextrose up to 0.2 units of insulin/gm dextrose (e.g., 40 units insulin per 200 gm dextrose). If glucose remains above 200 mg/dl despite insulin coverage of PN solution and sliding scale with regular insulin, initiation of a separate insulin infusion may be helpful in achieving adequate glycemic control.
   - GOAL: Blood glucose between 100-150 mg/dl unless otherwise specified.

L. Additives:
   - If an H2 Antagonist is indicated (stress ulcer prophylaxis in an ICU setting, history of GI bleeding or ulceration, etc.), the following doses are recommended based on the patient's renal function:
     - Famotidine: 40 mg in PN solution every 24 hours
     - Ranol: C105 mg in PN solution every 24 hours
     - Famotidine (Pepcid) PO/IV will be automatically discontinued if IV taudolide is added to the TPN solution.

M. Cycling of TPN:
   - Cycling is a method of reducing the duration of PN infusion to a shorter interval. If home TPN is planned, cycling should begin 4 days prior to discharge. For recommendations on how to cycle parenteral nutrition, please consult NSS.