Basics of TPN Calculation

1. Establish a total fluid goal
   - Use Holliday Segar Method
   - If patient is fluid restricted, you may need to subtract lipid volume from patient's total fluid goal

2. Estimate Energy Needs
   - Calculate goal calories
   - PN energy needs are 10-15% lower than when fed enterally, due to no thermic effect of food
   - Goal calories: usually 45-60% CHO, 10-15% protein, 25-40% fat
     - Higher percentage of fat typical in infancy

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 (for 20% emulsion, n that is most commonly used)
     - Rate/hour calculation = g/kg x weight x 5 mL/g ÷ hours of infusion
     - Start with Intralipid, transition to Smoflipid, Clinolipid or Omegaven per CW protocols
   - Protein
     - Start at 1-2 g/kg/day and increase by 1 g/kg/day (max varies by age)
     - 4 kcal/gram
     - Use Premasol for <12 months (Inpatient Order: NEONATAL TPN) and Travasol for >12 months (Inpatient Order: PEDIATRIC TPN)
   - 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)

Age (Years)	Goal GIR (mg/kg/min)
Preterm Infant	~12
Term Infant	10-14
Child (1-10 years)	8-10
Adolescent (>10 years)	5-6

4. Micronutrients (Refer to CHW TPN Guidelines, located on Children's Connect)

- Electrolytes and Minerals

Electrolyte	Preterm	Infants/children	Children >40kg
Sodium	2-5 mEq/kg	2-5 mEq/kg	2-3 mEq/kg
Potassium	2-4 mEq/kg	2-4 mEq/kg	2-3 mEq/kg
Calcium	2-4 mEq/kg	0.5-4 mEq/kg	0.2-2 mEq/kg
Phosphorus	1-2 mmol/kg	0.5-2mmol/kg	0.5-2 mmol/kg
Magnesium	0.3-0.5 mEq/kg	0.3-0.5 mEq/kg	0.3-0.5 mEq/kg
Acetate	As needed for acid-base balance		
Chloride	As needed for acid-base balance		

- 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
    - Not added to TPN at CW
  - Levocarnitine
    - Dose 10 mg/kg/day (typically used in premature babies and infants on long term TPN)
  - PN related medications
    - H-2 Antagonists (Famotidine) and Heparin

References:
ASPEN Practice Guidelines. 2012.
Canada, T, Crill, C, Guenter, P. *ASPEN Parenteral Nutrition Handbook*. 2009
Pediatric Manual of Clinical Dietetics Second Edition, Updated 2008. Pg 44