Nutrient Needs and Total Parenteral Nutrition

1. When is it advisable/acceptable to use TPN?

   The decision to recommend TPN rather than PPN is based on the number of calories needed.

   - Inability to absorb nutrients via the GI tract owing to massive small bowel resection, diseases of the small intestine, radiation enteritis, severe diarrhea, or intractable vomiting.
   - High-dose chemotherapy, radiation, and bone marrow transplantation.
   - Moderate to severe pancreatitis.
   - Severe malnutrition in the face of a nonfunctional GI tract.
   - Severe catabolism with or without malnutrition when the GI tract is not usable within 5 to 7 days.
   - Examples: major surgery, moderate stress, enterocutaneous fistulae, inflammatory bowel disease, hyperemesis gravidarum, moderate malnutrition requiring intensive medical or surgical intervention.
   - Inability to establish adequate enteral nutrition w/I a 7-10 day period of hospitalization.
   - Inflammatory adhesions with small bowel obstruction.
   - Intensive cancer chemotherapy.

2. What are the difference between TPN (Central) and PPN (Peripheral) and the factors associated with appropriate use of each, such as osmolality of solution, etc.?

   Central access refers to catheter tip placement in a large, high blood flow vein such as the superior vena cava. Peripheral access refers to catheter tip placement in a small vein typically in the arm. Peripheral veins cannot tolerate concentrated solutions; therefore, diluted larger volume infusions are often necessary to meet nutritional requirements. Volume-sensitive patients such as those with cardiopulmonary, renal, or hepatic failure are not good candidates for PPN. Concentrated calories in the form of CHO are hypertonic solutions. Hypertonic solutions cannot be given in peripheral veins, which have low blood flow. If a hypertonic solution is given, the area can become infiltrated and then inflamed, or a thrombosis can occur. This means that it is difficult to administer a large number of CHO or protein calories with PPN. Fat calories are provided as isotonic emulsions that can be administered peripherally. Concentrated calories or hypertonic solutions can be administered directly into the superior vena cava because the solution is quickly diluted in the blood due to the rapid blood flow. This decreases the risk of inflammation and venous thrombosis.

3. How to calculate the total calories, grams of protein, grams dextrose, grams fat provided in a mixed TPN solution?

   See sample calculations.

4. How to calculate the total kcal: g N ratio and interpret what it means? Is it the

appropriate ratio for the described pt?

See sample calculations.

5. How to determine if the ordered TPN is appropriate to prevent complications and what you could do to change the TPN to make it appropriate to prevent complications?

See sample calculations.

6. What factors are monitored for a pt. on TPN?

1. Weight changes – s/b monitored daily in acute care settings and weekly in LT care settings. Weight changes may be related to overall caloric intake and/or fluid balance.
2. Hyperglycemia – will likely result from feeding excessive dextrose loads. Finger stick blood sugars (FSBS) s/b checked every 6 hrs to monitor forhyperglycemia induced or exacerbated by TPN. FSBS < 200 mg.dL are considered tolerable and will likely not impair immunity.
3. Refeeding syndrome – refers to the serum electrolyte depletion which can result from feeding large dextrose loads to patients who are malnourished or have been NPO for several days. The dextrose load stimulates insulin release. Insulin causes cellular uptake of potassium, phosphorus and magnesium along with the glucose, which can deplete the serum levels of these electrolytes under conditions in which they are being provided artificially. Serum electrolyte levels s/b monitored daily.
4. Liver dysfunction – may result from deposition of triglycerides in the liver ("fatty liver") for patients receiving long-term TPN and/or excessive dextrose loads. Liver function tests and triglycerides s/b monitored weekly.

7. What are possible complications of TPN?

See question 6 above.

8. What is transitional feeding and how would a patient be taken off TPN or a TF and transitioned to another feeding method?

Nutrition support care plans strive to use the GI tract when possible , so care plans frequently involve transitional feeding, moving from one type of feeding to another with multiple feeding methods being used simultaneously. The challenge is to maintain adequate feeding to meet nutritional req. throughout the transition period.
PARENTERAL TO ENTERAL FEEDING: To begin the transition from parenteral to enteral feeding, the initial step is to introduce a minimal amount of enteral feeding at a low rate of 30-40 mL/h to establish GI tolerance. The parenteral rate can then be decreased to keep the nutrient levels at the same prescribed amount. As the enteral rate is increased by 25-30 mL/h increments every 8-24 hrs, the parenteral prescription is reduced accordingly. Once it is established that the patient tolerates approx. 75% of

nutrient needs by the enteral route, the parenteral solution can be discontinued. This process ideally takes 2-3 days.

9. How to estimate the osmolarity of a liter of a mixture that is 20% dextrose and 15% crystalline amino acids? How many total kcal are contained in the mixture?

200 g dextrose x 5 = 1000 mOsm/L
150 g protein x 10 = 1500 mOsm/L
Fat is isotonic and does not contribute to osmolarity.
Total osmolarity = 1000 + 1500 = 2500 mOsm/L.
Total kcal = (200 g dextrose x 4 kcal/g) + (150 g protein x 4 kcal/g)
= 800 + 600 = 1400 kcal/L

10. What are the limitations of PPN?

- Cannot exceed 800-900 Osm/kg (PPN solutions must be close to blood osmolarity to prevent thrombosis and inflammation)
- Cost >$1000/d
- More monitoring
- More sterile techniques

11. Why are the following values monitored in a TPN fed pt.?

Blood glucose – imbalances, glucose intolerance. Rapid infusion of carbohydrate stimulates insulin, which reduces salt and wter excretion and increases the change of cardiac and pulmonary complications from fluid overload.
BUN – values are increased in renal disease and excessive protein catabolism, but decreased in liver failure, negative nitrogen balance (and pregnancy).
Serum electrolytes – low serum levels of potassium, phosphorus, and magnesium are the hallmark of refeeding syndrome which has severe, potentially dangerous electrolyte flucations leading to metabolic, neuromuscular, and hematologic problems. Fluid overload.
Serum albumin – protein status.
Body weight – adequate caloric intake.
Serum prealbumin – protein status.