Nutrient Needs and Tube Feeding

1. How to determine protein, calorie, and fluid needs of a pt?

See sample calculations.

Protein needs: 0.8 g./kg of IBW (up to 2 g/kg if stress; 1.2-1.5 g/kg freq. used)
or, another way to estimate protein needs:
nonprotein calorie to nitrogen ratio. Ratios of 100-150 kcal:1 g N in stressful conditions to promote anabolism and 250-300 kcal:1 g N for normal body maint.

Kcal needs: 25-30 kcal/kg actual body wt.
35 kcal/kg if moderately stressed
35-45 kcal/kg if severely stressed.

BMR: 24 kcal/kg if at bed rest and nonhypermetabolic.
REE: BMR+10% for dynamic action of food & baseline activity.
BEE: Harris-Benedict Eq.

Fat: 10%, 20%, and 30% emulsions of fat are available. Many institutions give 1 or 2 500cc bottles of 10% fat weekly to their TPN pts.
10% fat has 1.1 kcal.cc, 20% fat has 2.0 kcal.cc, 30% fat has 3.0 kcal.cc.
Fat emulsions are available in 100-, 200-, 250-, and 500- cc bottles. 1 cc=1/30 oz.
2-4% of kcal must be from EFA.
1.0-2.5 g fat are needed per kg body wt. optimally.
Less than 40% of kcal as fat.
UL 60% fat.
Intralipid is 52% EFA; Liposyn is 77% EFA.

Fluid needs: Pts generally need 30 ml fluid per kg body wt./d to maintain hydration status.
30-50 ml/kg is a moderate amount to aim for.
Needs may go as high as 100-150 ml/kg in severely catabolic states, such as burns.
If pt. is overhydrated, TPN can be used in a concentrated form to pull off extracelular fluid.
Another way to calculate fluid intake is 100 ml free water per 1 g N intake and at least 1 ml water per kcal provided.

Table 1. Routine considerations for determining TPN needs

1. Calories should meet anticipated needs of the individual.
2. There should be 30 to 50 cc fluid per kilogram.
3. Protein needs are 1-2 g/kg/d, or a total calorie to nitrogen ratio of 100-300:1.
4. Minimal fat needs are 2%-4% of calories as essential fatty acids: recommended fat needs are 1-2.5 g.kg maximum. Fat is available in 500 cc bottles of 10%fat (550 kcal) and 20% fat (1000 kcal), or 30% fat (1500 kcal).
5. Often equal amounts of amino acid and dextrose solutions (500 cc each) are mixed. A 250 cc portion is the smallest unit many institutions use.

6. Dextrse is available in 5%, 10%, 20%, 30%, 50%, and 70% solutions.
7. Amino acids are available as 3%, 3.5%, 5%, 7%, 8.5%, and 10% solutions.
8. Each 500 cc bottle of 10% fat has 550 kcal; 20% fat has 1000 kcal, 30% fat has 1500 kcal.

2. How to calculate the nutrients provided by the TF order.

    See sample calculations.

3. What are the different routes of administration of TF and why and when is it appropriate to use each one?
    - **Enteral** feedings are administered through the GI tract.
    - **Parenteral** feedings are administerred outside the GI tract, usually through the veins. **Primary reason: Sufficient calories cannot be ingested or absorbed enterally.**

      Peripheral: into the veins of the arm.

      Central: into the superior or inferior vena cava or into the jugular vein.
        - Parenteral nutrition (PN) is recommended instead of enteral feeding when:
            - ⇒ The gut doesn't work.
            - ⇒ The patient is NPO more than 5 days.
            - ⇒ There is a fistula in the GI tract.
            - ⇒ The patient has severe acute pancreatitis.
            - ⇒ The patient has short bowel syndrome.
            - ⇒ The patient has lost 10-15% of body wt. or is severely malnourished.
            - ⇒ Nutritional needs are greater than the amount of nutrients that can be delivered enterally, such as in hypermetabolic states.

4. What are the different types of TF formulas and when is each one appropriate to use?

    1. polymeric – consist of mostly intact nutrients, requiring digestion. They contain casein or soy protein isolates, hydrolyzed cornstarch, vegetable oils, such as canola, corn, safflower and soy, vitamins and minerals. Some may be fortified with antioxidants, such as β-carotene, vitamin C, vitamin E, selenium and zinc. Other nutrients which may be added are as follows: MCT oil, fish oils, fiber, FOS (fructooligosaccharides), arginine and nucleotides. Blenderized formula is polymeric and consists mainly of pureed foods (meat, vegetables, fruits).
    2. elemental – are used for impaired digestion and absorption, as in pancreatitis or inflammatory bowel disease (IBD). They consist of hydrolyzed proteins (small peptides and/or free amino acids), corn syrup, vegetable oils, vitamins and minerals. Some may contain MCT oil, arginine, glutamine and/or branched-chain amino acids. They are generally low in fat content and have a much higher osmolality than polymeric formulas.
    3. disease specific formula categories are as follows:

a. glucose intolerance – contain less carbohydrate than standard formulas and may contain fructose and starch instead of sucrose. They generally contain fiber and are fortified with antioxidants.
b. Pulmonary disease – contain less carbohydrate and more fat than standard formulas to potentially decrease CO_2 production and the work of ventilation. They contain MCT oil and are fortified with vitamin E.
c. Renal failure – generally high calorie (2.0 calories per cc) which makes them fluid restricted. They are lower in electrolytes but higher in osmolality than standard formulas. High protein content is available for dialysis patients and low protein content is available for acute or chronic renal failure without dialysis.
d. Hepatic failure – contain increased amounts of branched-chain amino acids and decreased amounts of aromatic amino acids and methionine to help decrease hepatic encephalopathy in protein intolerant patients.
e. Trauma, sepsis, immune depression – generally high protein and fortified with antioxidants. They may contain MCT oil, fish oils, arginine and nucleotides.

Isotonic - 350 mOsm/kg or less (most like body fluids)
Intact formulas -digestive/absorptive function present; 300-500 mOsm/kg (relatively low)
Hydrolyzed nutrient formulas - no digestive/absorptive function; hyperosmolar - 900 mOsm/kg (concerns for when you start a TF) Higher osmolarity for pts who need restricted water.

5. What types of carbohydrate, protein, and fat are usually found in enteral formulas and when is it appropriate to use each type?

CHO: starch hydrolysates
maltodextrins
sucrose
fructose
glucose

PROTEIN: soy, cassein, polymeric formulas, free a.a (if small intestine can't digest protein).

FAT: corn, soy, safflower, canola

Amino acids - available in conc. ranging from 3% to 10% solutions.
Dextrose (glucose) - available in conc. ranging from 5% to 70% solutions.
Fat: 10%, 20%, and 30% emulsions of fat are available. Many institutions give 1 or 2 500cc bottles of 10% fat weekly to their TPN pts.
10% fat has 1.1 kcal.cc, 20% fat has 2.0 kcal.cc, 30% fat has 3.0 kcal.cc.
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6. Why is the osmolality of the enteral formula important in choosing an enteral formula?

   Hyperosmolar solutions cannot be given peripherally. That is why TPN is used instead of PPN. PPN solutions must be close to blood osmolarity to prevent thrombosis and inflammation. Blood osmolarity is 300 mOsml/L. In practice, solutions from 250 to 650 mOsm are given without problems. To determine how much of which compounds can be given via PPN, you must learn the osmolarity of the compounds.

7. Explain how a TF can cause dehydration.

   High protein intake can push a pt. toward dehydration. You cannot store excess protein. Must get rid of N thru urea. Therefore, ---> dehydration. May need to lower protein in TF.

8. Why are some long-chain triglycerides always included in TF made with MCT?

   Specialty products for trauma and liver diseases, with increased proportions of branched chain amino acids (leucine, isoleucine, and valine) are available.

9. What is the significance of a "gastric residual"? What action would be taken if it is high?

   Gastric residuals is an issue if the tube is in the stomach (TF remaining in stomach too long.). If high residue, use blenderized formula.

10. What factors should be monitored for a TF pt.?

    Wt., edema, dehydration, fluid i/o, adequacy of enteral intake, nitrogen balance, gastric residuals, serum electrolytes (Na, K, Ca), serum glucose, Mg, Ca, phosphorus, stool output and consistency.

11. What are some complications that can happen when a patient is on TF and how could they be prevented or dealt with?

    1. **weight changes** – s/b monitored daily in acute care settings and weekly in LT care settings. Wt changes may be related to overall caloric intake and/or fluid balance.
    2. **gastrointestinal** – measurement of gastric residuals, stool frequency and consistency, and monitoring for presence of bowel sounds, abdominal distention, nausea and vomiting are necessary to indicate level of TF tolerance. Gastric residuals less than 100cc are associated with less risk of pulmonary aspiration.

3. **feeding tube occlusion** – feeding tubes may become clogged with dried formula residue, medications which were not crushed well enough before being put down the tube, or formation of precipitates between formula and acidic substances. Use of acidic substances, such as cola or cranberry juice, s/b avoided when attempting to dissolve the clob, as they can exacerbate the problem. Plain water or pancreatic enzymes dissolved in water are recommended. Feeding tube occlusion can generally be prevented by careful flushing of the tube with water after every medication is given and each time feeding is stopped for any length of time.

Dehydration - increase fluid, lower protein intake.
Aspiration pneumonia - make sure correct tube and placement of end of tube. (place in duodenum or jejunum), elevate head 30º, continuous drip 22-24 hrs.
Diarrhea - lactose intolerance, bacterial contamination of TF, hyperosmolar formula, low serum alb, medication.
Access problems – pressure necrosis/ulceration/stenosis, tube displacement/migration, tube obstruction, leakage from ostomy/stoma site.
Administration Problems – regurgitation, aspiration, mibrobial contamination.
Gastrointestinal Complications – n&v, distention/bloating/cramping, delayed gastric emptying, constipation, high gastric residuals, diarrhea.
Metabolic Complications – refeeding syndrome, drug-nutrient interactions, glucose intolerance/hyperglycemia/hypoglycemia, hydration status – dehydration/overhydration, hyponatremia, hyperkalemia/hypokalemia, hyperphosphatemia/hypophosphatemia, micronutrient deficiencies.

12. How do you use the Harris Benedict equation to determine kcal needs of a pt?

Harris Benedict equation: (for children and adults, all ages)
Women: RE (kcal) = 655 + 9.56 W + 1.85 H – 4.68 A
Men: RE (kcal) = 66.5 + 23.75 W + 5.0 H – 6.78 A
(where A = age, W = weight in kilograms, H = height in centimeters)

13. For what diseases or conditions is TF appropriate?

- Enteral TF may be indicated when there is inability to take adequate nutrition orally, as in dysphagia or unconsciousness. The gut must be functional and the patient must be hemodynamically stabilized (not in shock).
- Parenteral TF directly into the bloodstream may be indicated when feeding the gut is not an option, or when it would be detrimental to feed the gut, as in bowel obstruction or resection, ileus, chronic pancreatitis and inflammatory bowel disease. It is known as hyperalimentation, total parenteral nutrition (TPN), or total nutrient admixture (TNA). Peripheral parenteral nutrition (PPN) or peripheral TNA is given via a peripheral vein rather than a central vein or PICC (peripherally inserted central catheter).
    - 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.
  - 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.

14. For what conditions is it not appropriate to use TF?

- When the pt is well-nourished, conscious, and capable of ingesting adequate nutrition orally, digesting, and absorbing adequate nutrition.
- When aggressive nutritional support is not desired by the pt. or legal guardian, and when such action is in accordance with hospital policy and existing law.
- When prognosis does not warrant aggressive nutrition support.
- When the risks of TF are judged to exceed potential benefits.