Total Parenteral Nutrition

Student Worksheet

Purpose:

Indications for use:

Disadvantages:

Components & Types of Solutions:

Water

Dextrose: Carbohydrates provided in this form. RDA: 50-100 grams/day to prevent ketosis. Provides 50-60% of total daily caloric needs. *Concentration of Dextrose in solution determines whether it is isotonic and can be given through a peripheral vein, or hypertonic and must be given through a central vein.

Protein: Provides essential & nonessential amino acids. RDA: 0.8 grams/kg. of desirable body weight for adults or about 44 grams for women & 56 grams for men. Provides 10-20% of total daily calorie needs. *Negative nitrogen balance occurs when excretion of protein is greater than intake. Undesirable state that occurs in starvation or with surgery, illness etc. Commonly used solutions are Freamine or Aminosol 10%.

Vitamins: SEE ATTACHMENT

Trace Elements: SEE ATTACHMENT

Medications: Sometimes Heparin (prevents fibrin buildup on catheter tip) or Insulin (metabolizes glucose in solution) are added to solution.
Lipids:  *usually given as a separate solution*  
Provide calories (9 calories/gram) & essential fatty acids  
Provides 30 of calories  
Solutions are isotonic and provide 1.1 cal/ml of solution (500 ml of Solution = 500 calories)  
Currently available lipid solutions:  Intralipid 10%: soybean oil &  
Liposyn 10%: safflower oil  

Central Parenteral Solutions:  up to 50% glucose, approximately 1000 calories  
Requires a central vein to rapidly dilute the hypertonic solution to prevent hyperglycemia & phlebitis to vein.  
Used when total dietary nutrients must be provided IV and/or nutritional support must be for longer than 7-10 days.  

Advantage:  

Disadvantage:  

Peripheral Parenteral Nutrition (PPN):  5-20% glucose, approximately 400 calories  
Provides temporary, supplemental nutritional support  
Less than 2 wks.  
Used for mild deficits and/or reduced oral intake  

Advantage:  

Disadvantage:  

Total Nutrient Admixture (TNA):  3 in 1 solution  
Provides glucose, protein, and lipids in one bag instead of administering lipids separately.  

Advantage:  

Disadvantage:  

Assessment:  assess and monitor nutritional status  
Daily weights, electrolytes, blood glucose levels, BUN & Creatinine levels  
Anthropometric measurements  
Serum pre-albumin levels.  
Intake & output  

Planning:  provide nutrients for clients requiring bypass of GI tract  

Implementation:  Check orders, compare label to order  
Check for precipitates  
Refrigerate until 1 hr. before administering  
Never add meds to solution  

Never hang solutions for longer than 12-24 hrs.

**Venous Access:** Central Lines  
*Short-term:* nontunnelled catheters  
*Long-term:* tunnelled catheters, ports, PICC

**Rates & Pumps:**  
**TPN:** Typical orders: 1000cc every 8 or 12 hrs. Should be started at slow rate (1000cc/23hrs.) and never abruptly discontinued to allow body to adjust to glucose in solution. If delay occurs in obtaining next bottle hang dextrose 10% in water. **TPN solutions (glucose & amino acids) must always be on a pump for accuracy.**

**Lipids:** Typical orders; 500cc every 12 or 24 hrs. May not receive this every day. Usually this solution is piggybacked into the TPN solution. **It must always be below the TPN filter to prevent it from becoming clogged by fat particles.** Lipids may or may not be run on a pump.

**Filters:** required - 0.22micron  
**Lipids:** not required. 3-in-1 solutions contain fat so filter that is used must be larger - at least 1.2micron

**Tubing Changes:** every 24 hrs. Lipids come with their own Nonreactive tubing.  
**Skill:** Tubing Change - practice

**Complications of TPN:**  
**Infection:**  
**Assessment:**  
**Prevention:**  
**Nursing Action:**

**Air Embolism:**  
**Assessment:**  
**Prevention:**  
**Nursing Action:**

**Hyperglycemia:**  
**Assessment:**  
**Prevention:**  
**Nursing Action:**
Hypoglycemia:
Assessment:
Prevention:
Nursing Action:

Catheter Occlusion:
Assessment:
Prevention:
Nursing Action:
## TYPICAL TPN SOLUTION

### COMPONENTS

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>CONCENTRATION PER LITER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dextrose (glucose)</td>
<td>25.00 - 35.00 g</td>
</tr>
<tr>
<td></td>
<td>(850 - 1190 calories)</td>
</tr>
</tbody>
</table>

**Electrolytes**

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>CONCENTRATION PER LITER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>25 - 35 mEq</td>
</tr>
<tr>
<td>Potassium</td>
<td>30 - 40 mEq</td>
</tr>
<tr>
<td>Magnesium</td>
<td>5 - 8 mEq</td>
</tr>
<tr>
<td>Calcium</td>
<td>5 - 8 mEq</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>13 - 15 mEq</td>
</tr>
<tr>
<td>Chloride</td>
<td>35 - 45 mEq</td>
</tr>
<tr>
<td>Acetate</td>
<td>Varies with amino acid source</td>
</tr>
</tbody>
</table>

### COMPONENTS

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>CONCENTRATION PER DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace Elements</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>3 - 5 mg</td>
</tr>
<tr>
<td>Copper</td>
<td>1.2 - 2 mg</td>
</tr>
<tr>
<td>Chromium</td>
<td>12 - 20 mg</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.3 - 0.5 mg</td>
</tr>
<tr>
<td>Selenium</td>
<td>60 - 100 mcg</td>
</tr>
</tbody>
</table>

The above trace elements can be added individually or as a combination (T.E.C.-4, T.E.C.-S, MTE-4, MTE-S trace element cocktails).

**Vitamins**

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asorbic Acid</td>
<td>100 mg</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>1 mg (3000 USP units)</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>5 mg (200 USP units)</td>
</tr>
<tr>
<td>Thiamine HCL</td>
<td>3 mg</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>3.6 mg</td>
</tr>
<tr>
<td>Pyridoxin HCL</td>
<td>4 mg</td>
</tr>
<tr>
<td>Niacinamide</td>
<td>40 mg</td>
</tr>
<tr>
<td>Dexpantenol</td>
<td>15 mg</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>10 mg (10 USP units)</td>
</tr>
<tr>
<td>Biotin</td>
<td>50 mcg</td>
</tr>
<tr>
<td>Folic Acid</td>
<td>400 mcg</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>5 mcg</td>
</tr>
</tbody>
</table>
TOTAL PARENTERAL NUTRITION

ADDITIVES

SODIUM helps control water distribution and maintain a normal fluid balance

POTASSIUM needed for cellular activity and tissue synthesis

MAGNESIUM helps absorb carbohydrates and protein

CALCIUM needed for bone and teeth development and aids in clotting

PHOSPHATE minimizes the threat of peripheral parestheses

CHLORIDE regulates the acid-base equilibrium and maintains osmotic pressure

ACETATE added to prevent metabolic acidosis

ASCORBIC ACID helps in wound healing

VITAMIN A assists in maintaining integrity of the skin and essential to vision

VITAMIN D essential for bone metabolism and maintenance of serum calcium levels

VITAMIN B COMPLEX helps in final absorption of carbohydrates and protein

FOLIC ACID necessary for DNA formation and promotes growth and development

VITAMIN K helps prevent bleeding disorders

TRACE ELEMENTS help in wound healing and red blood cell synthesis

INTERFERON may be added as iron supplement

INSULIN added to metabolize high glucose load
**SUFFOLK HOSPITAL**  
*Department of Pharmacy*  

**Parenteral Nutrition Orders**

DATE: _______________ TIME: _______________

1. A NEW ORDER MUST BE COMPLETED FOR ALL CHANGES.
2. RENEWALS MUST BE WRITTEN DAILY BEFORE 3 P.M.
3. NEW ORDERS WRITTEN AFTER 3 P.M. WILL BE STARTED THE FOLLOWING DAY.

### Parenteral Solutions

- **Standard Central Vein Formula** (1020 calories)  
  - **without electrolytes**
  - 500 n L 50% Dextrose plus
  - 500 n L 8.5% Crystalline Amino Acids
  - (Final concentration 25% Dextrose and 4.25% Amino Acid)

- **Standard Central Vein Formula** (1020 calories)  
  - **with electrolytes**
  - (mEq/liter) Na⁺ 25; K⁺ 40; Mg++ 8; Cl⁻ 33; Acetate 41; Ca++ 5; Gluconate 5

- **Peripheral Formula** (340 calories)  
  - **without electrolytes**
  - 500 mL 10% Dextrose plus
  - 500 mL 8.5% Crystalline Amino Acids
  - (Final concentration 5% Dextrose and 4.25% Amino Acid)

- **Peripheral Formula** (245 calories)  
  - **with electrolytes** (ProcalAmine®)
  - 1000 mL 3% Glycerol and 3% Amino Acids with Electrolytes
  - (mEq/liter) Na⁺ 35; K⁺ 24; Mg++ 5; Cl⁻ 41; Acetate 47
  - (mM/liter) Phosphate 3.5

- **Renal Failure Formula Max 2400 mL/day**  
  - (1190 calories)
  - 500mL 70% Dextrose plus
  - 250 mL 5.4% NephrAmine®
  - (Final concentration 47% Dextrose and 1.8% NephrAmine)

- **Hepatic Formula**  
  - (850 calories)
  - 500mL 50% Dextrose plus
  - 500 mL 8% HepatAmine®
  - (Final concentration 25% Dextrose and 4% HepatAmine)

### Orders Per 24 Hours

<table>
<thead>
<tr>
<th>Total Volume per 24 hrs</th>
<th>1 Liter</th>
<th>2 Liters</th>
<th>3 Liters</th>
<th>4 Liters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of liters to contain electrolytes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin and mineral formulation</td>
<td>Yes</td>
<td>No</td>
<td>(MVI to one liter daily, Folic acid 1 mg, Zn 4 mg, Cu 1 mg, Mn 0.4 mg)</td>
<td></td>
</tr>
</tbody>
</table>

**If ADDITIONAL ELECTROLYTES are required, please order in this section:**

- Sodium Chloride _______ mEq/liter
- Potassium Phosphate _______ mEq/liter
- Potassium Chloride _______ mEq/liter
- Magnesium Sulfate _______ mEq/liter
- Other ________________
  - (500 mg of magnesium sulfate = 4.06 mEq)

**ADDITIONAL ELECTROLYTES IN**

<table>
<thead>
<tr>
<th>1 Liter</th>
<th>2 Liters</th>
<th>3 Liters</th>
<th>4 Liters</th>
</tr>
</thead>
</table>

**REGULAR HUMAN INSULIN** _______ units per liter

- 500 mL of 20% Fat Emulsion Today. (2 kcal./mL)

M.D. Signature: __________________________ R.N. (PLEASE PRINT)

**DO NOT WRITE BELOW THIS LINE * PHARMACY USE ONLY**
Total Parenteral Nutrition Exercises

Circle the statements about parenteral nutrition that are correct:

**Purpose and Indications:**
1. The purpose TPN is to administer nutrition to a client when all other methods would be inadequate to meet the client’s needs.
2. TPN is indicated in clients who can not eat, will not eat, can not eat enough.
3. A client with paralytic ileus is a candidate for TPN.
4. The difference between central and peripheral preparations is the number of calories in the preparation.
5. A client who is malnourished should be prepared for TPN.
6. If your serum albumin is greater than 3.5, you need to get TPN.
7. If you have documented weight loss, the data supports the use of TPN.

Match the following columns to the correct answer:

**Assessment for Complications:**

<table>
<thead>
<tr>
<th>1. air embolism</th>
<th>Malaise, fever, neutrophilia</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. sepsis</td>
<td>Tremors, abrupt discontinuation from TPN</td>
</tr>
<tr>
<td>3. hyperglycemia</td>
<td>Polyuria, blurred vision, headache</td>
</tr>
<tr>
<td>4. hypoglycemia</td>
<td>Chest pain, shortness of breath</td>
</tr>
<tr>
<td>5. circulatory overload</td>
<td>Shortness of breath, crackles, chest pain, hyper/hypotension</td>
</tr>
</tbody>
</table>

**Prevention strategies:**

<table>
<thead>
<tr>
<th>6. change solution every 12 hours, keep refrigerated until one hour before administration and change TPN tubing and central line dressing every 24-48 hours according to policy</th>
<th>Malaise, fever, neutrophilia</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. perform CBG every 6 hours and administer prescribed insulin</td>
<td>Tremors, abrupt discontinuation from TPN</td>
</tr>
<tr>
<td>8. use luer lock IV tubing and clear tubing of air</td>
<td>Polyuria, blurred vision, headache</td>
</tr>
<tr>
<td>9. administer on an infusion pump, perform daily weights and maintain I/O and VS q 4 hours</td>
<td>Shortness of breath, crackles, chest pain, hyper/hypotension</td>
</tr>
<tr>
<td>10. hang a 10% dextrose infusion if TPN is not available</td>
<td>Chest pain, shortness of breath</td>
</tr>
</tbody>
</table>
## Management of complications

| 11. air embolism | Call MD, administer O2, IV diuretics and IV vasodilators as prescribed if indicated |
| 12. circulatory overload | Administration of dextrose 50% IV push, adjustment of prescribed insulin |
| 13. sepsis | 100% O2 and placement in left Trendelenburg position |
| 14. hyperglycemia | Increase frequency if CBG testing, increased administration of insulin, administration of IV fluids |
| 15. hypoglycemia | Call MD, discontinue central line, culture catheter tip and draw blood cultures |

Review the Components & Types of Solutions and compare to the physician orders provided at the end of this handout. Fill in the blanks:

| □ Standard Central Vein Formula (_____ calories) | □ Peripheral Formula (_____ calories) |
| without electrolytes | without electrolytes |
| 500 nL _____ Dextrose plus 500 nL _____ Crystalline Amino Acids | 500 mL _____ Dextrose plus 500 mL _____ Crystalline Amino Acids |
| (Final concentration 25% Dextrose and 4.25% Amino Acid) | (Final concentration 5% Dextrose and 4.25% Amino Acid) |

| □ Standard Central Vein Formula (1020 calories) | □ Peripheral Formula (245 calories) |
| with electrolytes | with electrolytes (ProcalAmine®) |
| List electrolytes Just type not amounts: | 1000 mL 3% Glycerol and 3% Amino Acids with Electrolytes (mEq/liter) Na⁺ 35; K⁺ 24; Mg²⁺ 5; Cl⁻ 41; Acetate 47 (mM/liter) Phosphate 3.5 |

| □ Renal Failure Formula Max _____ mL/day (_____ calories) | □ Hepatic Formula (_____ calories) |
| 500mL _____ Dextrose plus 250 mL 5.4% | 500mL 50% Dextrose plus 500 mL 8% |
| (Final concentration 47% Dextrose and 1.8% NephrAmine) | (Final concentration 25% Dextrose and 4% HepatAmine) |
Circle the statement that are true with regard to assessment and client teaching when TPN is initiated:

16. The nurse needs to get TPN order renewed daily.
17. The nurse should assess the creatinine levels prior to initiating TPN to determine the presence of renal failure.
18. It is unnecessary to check the liver function tests.
19. You explain to the client that you get the same amount of caloric support with peripheral preparation.
20. You explain to the client that a central line is required for standard TPN preparations because the solution is irritating to smaller veins.
21. You explain to renal clients that they will get different types of protein to protect their kidneys.
22. The nurse can use TPN to correct electrolyte problems.
23. The IV tubing has a micron filter and the infusion pump has alarms for occlusion and air.
24. The TPN is free of precipitate.

Medications:
25. The nurse can add medications to the TPN bag if necessary.
26. Sometimes Heparin, additional electrolytes or Insulin are added to solution.
27. Lipids can be given as a separate infusion in the acute care setting.
28. 3 in 1 bags refer to home care infusions that have lipids added.

Monitoring Guidelines (check all that apply)

1. s/s of infection at IV site
2. daily weight
3. electrolytes daily upon initiation, then less frequently
4. elevations in serum BUN & creatinine as a result of excess amino acid
5. elevated liver function tests from problems with lipids, or protein and glucose metabolism
6. capillary blood glucose every 6 hours

Initial assessment guidelines (place in priority order numbering 1-8 in the space provided)

_______ check that the client is on I/O
_______ check the tubing date
_______ check the time the IV bag was hung, that the solution is correct and < 24 hours old
_______ check that the client has had a daily weight
_______ check the IV site for s/s of infection and dressing date
_______ check the IV infusion rate
_______ check the tubing for precipitate or air
_______ check that the clients blood sugar has been checked within the last six hours
Maintaining infusion: (circle all that are correct)

1. IV tubing contain lipids must be changes every 24 hours
2. Lipids administered in a separate infusion are piggyback at the port closest to the drip chamber.
3. IV tubing with filters should be changed according to hospital policy (every 24-72 hours)
4. maximum infusion rates for lipids are 125 cc/hr
5. hyperosmolar diuresis can occur if infusions are given too rapidly.
6. dressing changes and tubing changes follow the CVC procedure standards