# TOTAL PARENTERAL NUTRITION (TPN)

PURPOSE: To outline the management of patients receiving TPN.

SUPPORTIVE DATA:

TPN may be administered centrally or peripherally depending upon solution osmolality. The TPN formulary lists solutions by letter. A and B formulas are predominantly used and C**,** D, E, F, G & K are specialized formulas (see formulary for specific information).

Pharmacy processes TPN orders received by 1330 for same day TPN delivery. TPN is dispensed for infusion over a 24-hour period. The infusion rate is usually increased by no more than 1/2 to 1 unit daily until the recommended volume has been reached. This is to minimize risks associated with Refeeding Syndrome. When the patient is being prepared to be discharged on TPN, infusion administration is compressed over a shorter period of time (e.g., over 20 hours, 16 hours or 12 hours per day).

Peripheral TPN (see table) always contains Dextrose with a concentration of 12.5% or less (or osmolality less than 900 mOsm, NICU less than or equal to 1000 mOsm). Central TPN (see table) usually contains Dextrose with a concentration of 25% or greater (osmolality less than or equal to1900 mOsm).

Lipids are administered with TPN to prevent essential fatty acid deficiency.

For most central TPN (all except for Formula E): These formulas are "glucose-based TPN." Supplemental 20% lipids are administered two to three times per week (daily for pediatrics and neonates). The usual rate of lipid infusion is over 12 hours for adults. For pediatric patients, a lipid infusion is divided into two-12 hour containers and infused over 24 hours. For NICU patients, lipids are infused over 24 hours.

For peripheral TPN (Formula A) and for central TPN Formula E, the lipids are mixed in the dextrose formula (they are "lipid-based TPN") and the infusion is over 24 hours unless patient is on an alternate protocol (e.g., cyclic schedule or home TPN administration).

To minimize the metabolic abnormalities associated with Refeeding Syndrome:
Potassium should be maintained at greater than 4 mmol/L
Magnesium at greater than 2 mg/dL
Phosphorus at greater than 3.5 mg/dL

Infusion of TPN through a line that has not been used for any other purpose (e.g., I.V. fluid, blood, medication) is recommended but is not required. For the adult patient, the decision to infuse TPN through a previously used line should be made by a second year resident or above. In pediatrics and NICU, the use of a previously used central/PICC line is frequently unavoidable, and therefore consultation with the physician is not required.

PEDIATRICS/NEONATES (NICU)
TPN is based on patient weight/nutritional status/electrolyte needs. Peripheral TPN contains 12.5% Dextrose or less. A filter shall be used for all neonates and pediatric patients for the TPN but not the Lipids.

ASSESSMENT:

1. Assess prior to initial administration:
   - Laboratory values, including electrolytes, pre-albumin level, chemistry panel, and triglyceride level if patient starting on lipids.
   - Breath sounds
   - Vital signs (VS)
   - Baseline weight
2. Assess for the following signs and symptoms (S/S) of adverse reaction during the

first 2 hours of lipid administration, then a minimum of every 8 hours (ICU/every 4 hours):

- Chills
- Rash, itching
- Shortness of breath
- Nausea and vomiting
- Headache
- Diaphoresis
- Chest or back pain
- Dizziness
- Slight pressure over the eyes

NOTE: If signs/symptoms of reaction occur within the first 2 hours of administration, place lipids on hold and notify physician.

3. Assess TPN solution prior to administration and every shift including:
   - TPN formula, correct infusion route and rate
   - Glucose concentration
   - Additives: Electrolytes, insulin, heparin, $H_2$ blockers
4. Assess each lipid-based TPN /intralipid bag prior to and during administration for:
   - Separation of layers
   - Fat globules
   - Free oil

   NOTE: If any of the above are present, discontinue the infusion, and hang appropriate dextrose solution as ordered (see item #11)
5. Assess the following a minimum of every 8 hours (ICU: every 4 hours)
   - Signs/symptoms fluid overload
   - Signs/symptoms hyper/hypoglycemia
6. Weigh patient:
   - ICU, pediatrics (every day)
   - Wards (every week)
7. Evaluate laboratory results as drawn, including fingerstick glucose every 6 hours as ordered.
   - Evaluate fingerstick glucose at intervals as ordered for patients receiving compressed TPN schedule in preparation for discharge on TPN

PHYSICIAN ORDER:

8. Verify the following on the physician's order. (Order must be renewed every 24 hours.)
   - TPN formula
   - Route
   - Total number of units per 24 hours
     - Pediatrics/NICU total volume per 24 hours
   - Additives, e.g., electrolytes, multivitamins, trace elements, $H_2$ blockers, insulin, heparin

ADMINISTRATION:

9. Read label for instructions.
   - Verify patient's name and medical record number (MRUN)
   - Identify an appropriate infusion route.
10. Discontinue / hold TPN **ONLY** per Physician's order.
11. Administer the following dextrose solution **as ordered** when TPN is not available or when TPN is discontinued or held per Physician's order (e.g. when patient goes for a procedure or surgery):
    - Lipid-based TPN (formulas A & E): Administer $D_5W$ at the same rate that TPN was infusing
    - Glucose-based TPN (all formulas **except** A &E) Administer $D_{10}W$ at the same rate that TPN was infusing
    - NICU - administer stock TPN or individualized IV fluid
12. Change I.V. administration set with each new TPN bag.

- Exception: If administering more than 4 units every day change tubing every 24 hours

13. Administer TPN at constant rate via infusion pump. Do not attempt to "catch up" or compensate for under or excess infusion by adjusting infusion rate.
14. Use filter for neonates and pediatric patients on TPN but not the lipids.

DISCONTINUATION:

15. Discontinue TPN as ordered:
    - Formula A
      - No weaning period required unless patient is receiving insulin in the TPN (monitor diabetics for S/S hypoglycemia). Decrease by one-half to one unit per day with insulin decreased proportionately as po/enteral intake is increased.
    - Formula B, C, D, E, F, G, and K
      - Decrease rate by one-half to one unit every day as po/enteral intake is increased. If receiving insulin this must also be decreased proportionately.
      - If immediate discontinuation is necessary - decrease rate by 1/2 for one hour and then decrease rate again by 1/2 for another hour then discontinue TPN and flush catheter as necessary.
      - Observe for S/S of hypoglycemia
      - If S/S of hypoglycemia occur, perform glucose fingerstick immediately, and recheck every 30 minutes x 2 hours
    - PICU/NICU: wean gradually as enteral intake is increased

SAFETY AND INFECTION CONTROL:

16. **DO NOT** allow TPN solution to hang for longer than 24 hours
    - Intralipids no longer than 12 hours
    - NICU, intralipids no longer than 24 hours
17. Maintain a closed system:
    - Designate an IV line for TPN USE ONLY
    - Do not administer any other substance through the TPN line
      - PICU/NICU: May administer compatible medications with TPN
    - For drawing blood, see Central Venous Catheter Protocol
      - NICU: when infusing TPN via an umbilical arterial/venous catheter blood specimens may be obtained
    - Do not take any readings from TPN line (CVP readings). (Except NICU)

COLLABORATION:

18. Collaborate with other disciplines (e.g., TPN service, Food and Nutrition services, pharmacist) regarding nutritional requirements.

REPORTABLE CONDITIONS:

19. Notify physician if adverse reactions are noted.

PATIENT/FAMILY TEACHING:

20. Instruct on the following:
    - Purpose of TPN
    - Signs and symptoms of adverse reaction:
      - Fever, chills, rash, itching
      - Shortness of breath
      - Nausea and vomiting
      - Headache
      - Diaphoresis
      - Chest or back pain
      - Dizziness
      - Slight pressure over the eyes
      - Hypo/hyperglycemia
    - Their role in maintaining accurate output reporting

ADDITIONAL PROTOCOLS

21. Implement the following as indicated:
    - Arterial Line - ICU (NICU)
    - Central Venous Access Device Teaching
    - Central Venous Catheter
    - Electrolyte (Intravenous) Replacement
    - Insulin (Regular) Continuous Infusion - ICU
    - Insulin Management (Subcutaneous)
    - Intravenous Therapy

DOCUMENTATION:

22. Document in accordance with “documentation standards”.

**TPN FORMULARY FOR ADULTS**

| Formula | | Line | Dextrose gm (%) |
|---|---|---|---|
| A | Standard Lipid Formula | Peripheral/Central | 50 (5%) |
| B | Standard Glucose Formula | Central | 250 (25%) |
| C | High Protein Glucose Formula | Central | 250 (25%) |
| D | Fluid Restricted Glucose Formula | Central | 350 (35%) |
| E | Fluid Restricted Lipid Formula | Central | 50 (6.7%) |
| F | Low Protein Formula - Hepatic Insufficiency | Central | 350 (46.7%) |
| G | Low Protein Formula - Renal | Central | 350 (46.7%) |
| K | Very High Protein Glucose Formula | Central | 350 (35%) |

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