Health Sciences North
Horizon Santé-Nord

PHARMACY
PROCEDURE

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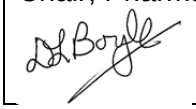
Approval: Dr. David Boyle Chair, Pharmacy & Therapeutics Committee 	**Date:** June 5, 2019

PURPOSE
To ensure a standardized approach to the administration of total parenteral nutrition (TPN).

PROCEDURE
See Appendix A for Ordering of Parenteral Nutrition
See Appendix B for Administration of Parenteral Nutrition
See Appendix C for Preparation of Parenteral Nutrition
See Appendix D for Intravenous Electrolytes Replacement Recommendations in TPN
See Appendix E for TPN Administration Record

EDUCATION AND TRAINING

References and Related Documents
Ayers P, et al. A.S.P.E.N Parenteral Nutrition Safety Consensus Recommendations. Journal of Parenteral and Enteral Nutrition, 38 (3),296-331.

Boullata J, et al. A.S.P.E.N Clinical Guidelines: Parenteral Nutrition Ordering, Order Review, Compounding, Labeling, and Dispensing. Journal of Parenteral and Enteral Nutrition, 38 (3),335-377.

ISMP Guidelines for Safe Preparation of Compounded Sterile Preparations. Institute for Safe Medication Practices. Revised 2016.

Model Standards for Pharmacy Compounding of Non-Hazardous Sterile Preparations. National Association of Pharmacy Regulatory Authorities. 2015.

Mueller C, et al. ASPEN Adult Nutrition Support Core Curriculum. 3rd Edition (2017).

Personal communication from Baxter regarding stability of CLINIMIX. November 22, 2018.

APPENDIX A

Ordering of Parenteral Nutrition

Indications
TPN is a therapy utilized to provide patients with optimal nutrition in order to improve and maintain their health.

TPN therapy is indicated in individuals who are severely malnourished (or are at risk of becoming malnourished) and who are unable to meet their nutritional requirements via the gastrointestinal (GI) tract alone. In order to minimize the risk that is involved with TPN, the patient should also meet one of the following criteria:

- Failed enteral nutrition with an appropriate tube placement (must be documented in chart)
- Enteral nutrition is contraindicated (i.e. paralytic ileus, bowel ischemia, intestinal obstruction/pseudo-obstruction, gastrointestinal fistula, peritonitis or intractable vomiting/diarrhea)
- Expected transition to an adequate enteral diet is expected to last greater than 14 days
- Documented inability to absorb adequate nutrients via the GI tract (extensive small bowel resection/short bowel syndrome, radiation enteritis, steatorrhea)
- Enterocutaneous fistula (greater than 500 mL)

Special Instructions

- TPN orders must have a signature from the physician or a documented verbal consent prior to being processed. Verbal and/or telephone orders are discouraged unless modification or clarification of the order is required. Verbal and/or telephone orders should be limited to the pharmacist and/or dietitian in the event that clarification is required.
- **Electrolytes:**
    - The maximum amount of potassium that may be added to one bag of TPN will not exceed 60 mmol/L (max: 10 mmol/hr).
    - The maximum recommended amounts of calcium and phosphate that can be contained in 1 L of TPN solution without pharmacist consultation are: Calcium = 5 mmol and Phosphate = 15 mmol. Due to the risk of precipitation, the pharmacist will be consulted if the ordering clinician requires additional calcium or phosphate.
    - Any acute serum electrolyte abnormalities should be managed via boluses (**Appendix D**). Custom TPN should be reserved for exceptional cases or to address more prolonged/chronic abnormalities. Due to the delay between current bloodwork and the initiation of any new TPN solutions, any subsequent customization of electrolytes in TPN should only be done after the current TPN has been infusing long enough to properly assess its clinical impact (suggest 48 hours – exemption critically high levels). IV boluses may be used daily to correct any low serum levels.
    - It is recommended that the clinician utilize the Intravenous Electrolytes Replacement Recommendations in TPN (**Appendix D**) as a guide in the decision making process when ordering a bolus.
- Lipid emulsions will be ordered as mL/hr. Due to the clinical risk to the patient, any lipid orders exceeding 20 mL/hr will be reviewed by a pharmacist/dietitian to ensure safety measure. If the patient is on propofol, this should be considered towards the total lipids ordered (i.e. lipids may not be needed at all). Contraindication to lipid therapy includes nut, egg, or soy allergy. Additionally, SMOF lipids are contraindicated in patients with a fish allergy.
- When infusing a peripheral TPN, lipids should always be infused as a vein protector (unless contraindicated – allergy, triglycerides greater than 4 mmoL/L).
- The deadline for processing new TPNs and alterations to existing TPNs is 1200 hours. All TPN orders received after the deadline shall be deferred to the following day. The ordering clinician may request a D10W IV solution until the TPN bag is sent. All requests for new TPNs or changes to

existing TPNs received between Friday at 1201 hours and Monday at 1200 hours will be processed on Monday.
    - Exception: Critically high serum electrolyte values or TPN to initiate Saturday/Sunday. A physician may request a TPN solution without electrolytes or one containing the standard amount as prepared by the manufacturer (Na = 35 mmol/L, K = 30 mmol/L, PO_4 = 15 mmol/L, Mg = 2.5 mmol/L). All low serum electrolyte values will be addressed by other means. **(Appendix D)**
    - Exception: Physician may consult Pharmacy to initiate a modified TPN over the weekend. For all TPNs requested on weekends/past the deadline, Pharmacy will supply 5% amino acids and Dextrose 10% at 45 mL/hr with standard electrolytes prepared by the manufacturer (Na = 35 mmol/L, K = 30 mmol/L, PO_4 = 15 mmol/L, Mg = 2.5 mmol/L) or no electrolytes. The pharmacist will also order SMOF lipids at 7 mL/hr.
- **Monitoring:**
    - The following Laboratory parameters will be monitored as indicated below:
        - Lytes, urea, creatinine, glucose, phosphorus, magnesium, and ionized calcium on Day 1, 2, 3 and then every Monday, Wednesday and Friday
        - Total protein, albumin, liver function tests, total bilirubin, aPTT, CBC and diff on Day 1 and then every Monday, Wednesday and Friday
        - Lipid Profile and INR on Day 1 then every Monday
        - Blood glucose monitoring Q6H. If blood glucose remains normal x 72 hours and no insulin has been required, consider decreasing blood glucose monitoring to Q12H x 48 hours, then Q24H. If insulin has been required, continue to monitor Q6H.
    - Patient will be weighed by nursing every Monday and Thursday and clearly documented in the chart. Changes in patient weight can have a significant impact on a TPN prescription.
    - Stable patients with no required changes in formulation for two weeks will be considered for weekly bloodwork monitoring for phosphorus, magnesium, calcium, total protein, albumin, liver function tests, total bilirubin, aPTT, CBC and diff.
- Pharmacy must be notified immediately if TPN therapy is to be discontinued.
- TPN is not to be discontinued abruptly due to hypoglycemic complications.
    - To reduce the risk of hypoglycemia in patients not ordered a specific wean/taper and not receiving enteral intake or dextrose containing IV solutions, nursing may half the infusion rate for 1-2 hours before discontinuation.
    - Blood glucose checks should continue Q6H for at least 24 hours after discontinuation of TPN.
    - Any previously ordered insulin should be reassessed after discontinuation of TPN.
- **Home TPN:** Patients may continue home TPN solution if the physician indicates this by clearly writing an order in the chart. Pharmacy will not alter home TPN. If the patient runs out of their home TPN supply and it is to continue, the dietitian should be consulted to initiate hospital-supplied TPN.

Method

The ordering physician/dietitian/pharmacist will:

1. Fill out the Total Parenteral Nutrition order form.
2. Order a PICC line (double lumen) to be inserted for all central TPNs. Central TPN will not be initiated until the placement of the central venous catheter has been confirmed and documented in the chart.
3. Indicate the preferred amount of electrolytes as amount per liter. Electrolytes will be ordered as the individual ion (i.e. Mg, K+).
4. Send the completed signed form to Pharmacy by 1200 hours, Monday to Friday.
5. If reordering a previously discontinued TPN, a new TPN order form should be completed and sent. It is recommended that a new TPN form be completed for all TPN adjustments with the exception of a rate change.

APPENDIX B

Administration of Parenteral Nutrition

Equipment

- TPN solution (Amino acid/dextrose) (AA/D)
- Lipids (fat emulsion solution) if ordered
- Infusion pump
- Primary non-vented IV pump set with in-line filter for AA/D solution
- *For lipids:* If using pump for concurrent delivery mode, use secondary IV set with convertible pin
- Dedicated IV access for TPN/lipid administration

Special instructions

- When no other IV sites are available, TPN may be held and blood products/medications may be delivered through the TPN access site on the order of the physician. Please advise the dietitian so that the TPN rate can be adjusted to optimize nutrition status. **Caution:** Blood glucose should be monitored carefully and any insulin reassessed if TPN will be held in order to deliver blood products/medications.

Method

The nurse will:

1. Hang TPN daily at 1800 hours and discard any remaining TPN/lipid solution. TPN changes are only to be processed with the next bag prepared by Pharmacy at 1800 hours. Exception when alternative hang/start time is specified on the order.
2. Retrieve the TPN solution from the medication refrigerator on the unit 30 minutes prior to the infusion in order to bring it up to room temperature. Visually inspect the TPN bags for leaks, colour changes, clarity and beyond-use dates.
3. Ensure that the solution corresponds to the TPN Administration Record **(Appendix E)**, initial and complete the record in its entirety including the date, time started, volume to be absorbed and total absorbed. Identify the patient using at least two identifiers. Follow infection prevention strategies as set out by HSN. An independent double check must be completed by a second RN/RPN as per the *High-Alert Medications - Safeguarding* standard. The independent double check consists of ensuring the bag to be hung corresponds to the TPN Administration Record.
4. Check the TPN bag number to ensure the solution is infused in correct sequence.
5. No medications are to be added to the prepared TPN solutions.
6. Spike the AA/D bag with tubing, prime the tubing and label with the date and time hung. TPN/lipid and tubing/filters must be changed every 24 hours.
7. If lipids are ordered:
   A. Spike the lipid bag with the pump tubing and label with the date and time hung. Prime the tubing.
   B. Insert the tubing into the secondary port on the cassette and infuse using the concurrent delivery mode.
8. The administration tubing shall be traced to the point of origin in the body at the initiation of the infusion and at all handoffs.
9. If the TPN administration is interrupted for any reason, notify the physician for appropriate orders. Monitor the patient closely for signs and symptoms of hypoglycemia due to the abrupt cessation of AA/D solution.
10. If TPN solution is not available for any reason, D10W will be infused in place of the TPN at the same rate until the new solution is available. The pharmacist should advise the dietitian if the solution is expected to be unavailable for more than 24 hours. Patients are to be monitored for signs and symptoms of hypoglycemia and the Point of Care Blood Glucose Testing for Suspected Hypo/Hyperglycemia medical directive (MD HSN 11) initiated as appropriate.
11. During the TPN infusion, monitor the patient for signs and symptoms of metabolic-related complications and electrolyte imbalances.

Pharmacy will:

1. Prepare the solution as ordered. **(Appendix C)**
2. Deliver the solutions ordered by the physician and place them in the patient care area medication refrigerator.
3. Complete the TPN Administration Record **(Appendix E)**

APPENDIX C

Preparation of Parenteral Nutrition

Equipment

- TPN solution (AA/D)
- Lipids (fat emulsion solution) if ordered
- Syringes
- Electrolytes as required

Method

Preparation

1. All TPN solutions are prepared in Pharmacy using aseptic technique.
2. Pharmacy will utilize the following pre-made solutions (with or without electrolytes) for adult TPN:
    - 5% amino acids and 10% dextrose
    - 5% amino acids and 16.6% dextrose
    - 5% amino acids and 20% dextrose
3. Potassium and sodium will be added in TPN using the chloride salt unless otherwise specified.
4. TPN solutions will be packaged in administration containers that can ensure maintenance of sterility and allow visual inspection during preparation, storage and administration.
5. The receiving pharmacists will complete the TPN Worksheet based on the order. An independent double check by a second pharmacist will then be completed prior to compounding the TPN formulation. Both pharmacists will sign the preparation sheet.
    - Calculations will not be rounded until the final volume to be added.
    - All additive amounts will be rounded to a measurable amount, depending on the syringe required.

Syringe Size	Measurable Amount
1 mL	0.01 mL
3 mL	0.1 mL
5 mL	0.2 mL
10 mL	0.2 mL
20 mL	1 mL

    - MVI-12 and trace elements will be added daily to one bag if ordered.
    - Pharmacy will prepare enough TPN solution to last 24 hours. At 1800 hours, all remaining solution will be discarded by nursing.

Compounding

Refer to Pharmacy's*Total Parenteral Nutrition (TPN) Compounding* Standard of Work.

Storage and Labelling of TPN

1. The TPN label shall include the following:
    - Two patient indentifiers (patient name and SH#)
    - Patient location
    - Beyond-use date
    - Infusion rate expressed in mL/hr
    - Ingredients listed in the same sequence and same units of measure on the TPN order. The electrolytes will be expressed as the individual ion. If a special request is made for a specific salt, it will be added as a comment to the bottom of the TPN label. (i.e. "Sodium added as sodium acetate")
2. All TPNs will be assigned a beyond-use date of 48 hours and stored in the refrigerator. No TPN solution is to infuse greater than 24 hours.

3. TPN with MVI will be protected from light with a UV amber bag.

Preparation, Storage and Labelling of Lipid Emulsion

1. Lipid emulsion bags will be labelled on the exterior overwrap. Once the overwrap is removed, the stability of the product is 24 hours.
2. The lipid emulsion label shall include the following:
    - Two patient identifiers (patient name and SH #)
    - Patient location
    - Beyond-use date
    - Infusion rate expressed in mL/hr
3. A pharmacist or regulated pharmacy technician will double check the final product in accordance with HSN standards for verification of sterile compounded products.

Delivery

1. TPN solutions are delivered to the nursing unit by approximately 1700 hours daily and placed in the refrigerator.
2. When the pharmacy technician delivers the TPN, they will complete the TPN Administration Record **(Appendix E)** by transcribing the information on the TPN label to the sheet and initialing.

APPENDIX D

Intravenous Electrolytes Replacement Recommendations in TPN

Principles

- IV electrolyte replacement recommendations are based on parenteral route access only. Consider additional or partial dosing via the enteral route if available.
- Reduce dosing in renal insufficient patients.
- Suggestions are to be considered against previous replacement trends, TPN composition, timing since initiation of TPN and patient symptoms.
- Electrolyte levels may be repeated sooner or later as clinically indicated.
- Magnesium/Potassium relationship:
  - Correct hypomagnesemia in any state of hypokalemia
  - Hypomagnesemia may require correction over 3 to 5 days
- Phosphate:
  - Correct hypophosphatemia with appropriate phosphate product
  - TPN patients at high risk of hypophosphatemia may require 3 to 5 days to normalize
- If patient is symptomatic from an electrolyte imbalance, contact the physician.

MAGNESIUM (Range 0.7-1 mmol/L)	
Magnesium Value (mmol/L)	**IV Replacement (Magnesium Sulphate)**
Less than 0.4	2 g/50 mL NS over 2 hours **x 3 doses**
0.41-0.69	2 g/50 mL NS over 2 hours **x 2 doses**
0.7-0.8	2 g/50 mL NS over 2 hours **x 1 doses**
Repeat level next day.	

PHOSPHORUS (Range 0.81-1.45 mmol/L)	
Phosphate Value (mmol/L)	**IV Replacement (Potassium or Sodium Phosphate)** • If K is **less than** 4 mmol/L: use **potassium** phosphate • If K is 4 mmol/L **or greater**: use **sodium** phosphate
Less than 0.5	15 mmol/250 mL D5W over 2 hours **x 3 doses**
0.5-0.79	15 mmol/250 mL D5W over 2 hours **x 2 doses**
0.8-1	15 mmol/250 mL D5W over 2 hours **x 1 doses**
Repeat level next day.	

POTASSIUM (Range 3.5-5 mmol/L)	
Potassium Value (mmol/L)	**IV Replacement (Potassium Chloride)**
2-2.4	10 mEq/100 mL Sterile Water IV over 1 hr **x 4 doses**
2.5-3	10 mEq/100 mL Sterile Water IV over 1 hr **x 3 doses**
3.1-3.5	10 mEq/100 mL Sterile Water IV over 1 hr **x 2 doses**
Rule out hypomagnesemia. Reduce dose in renal insufficiency. Recheck level 2 hours post last infusion.	

IONIZED CALCIUM (Range 1.15-1.27 mmol/L)	
Calcium Ionized (mmol/L)	**IV Replacement (Calcium Chloride)**
Less than 0.7	3 g/250 mL NS over 4.5 hours **x 1 dose**
0.7-0.89	2 g/250 mL NS over 3 hours **x 1 dose**
0.9-1.12	1 g/100 mL NS over 1.5 hour **x 1 dose**
Repeat level 4 hours post infusion.	

APPENDIX E

TPN Administration Record

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Bag Number																
Date																
Rate																
Amino Acids (%)																
Dextrose (%)																
Sodium (mmol)																
Potassium (mmol)																
Phosphate (mmol)																
Magnesium (mmol)																
Calcium (mmol)																
Multivitamin (mL)																
Trace Elements (mL)																
Total Volume (mL)																
Pharmacy *Initials*																
Date and Time of Tubing changes (every 24 hours)																
Initials																
Date and Time Started																
Initials																
Initials(IDC)																
Volume to be absorbed/Time																
Initials																
Date and Time Total Absorbed																
Initials																
Amount wasted																
Fat emulsion 20 %																
Date and Time started																
Initials																
Date and Time Total Absorbed																
Initials																
Amount wasted																