Parenteral Nutrition – Role and Responsibilities of the Dietitian

Site Applicability

All VCH and PHC Acute Care Sites

Practice Level

RD: Registered with Restricted Activity B

Policy Statements

- All initial Parenteral Nutrition (PN) orders must be signed by the PN Provider
- Dietitians cannot take verbal orders for PN

Need to Know

Parenteral Nutrition (PN) is a life-saving intervention for those who are unable to receive or absorb nutrition via the gastrointestinal tract; however, it is associated with significant risk from potential catheter-related, gastrointestinal, and hepatic complications[1–3]. Due to the potential for life-threatening complications, PN preparations are on the Institute for Safe Medication Practices list of high-alert medications[4] and its use should be limited to those in whom the benefits outweigh the risks[1,3]. This includes patients who are malnourished or hypermetabolic in whom enteral nutrition EN is absolutely contraindicated or attempts to establish adequate EN have been unsuccessful and treatment is anticipated for at least 7 days [1–3].

Due to the potential for harm, only those dietitians who are registered with the College of Dietitians of British Columbia to practice Restricted Activity B, and who also meet site specific requirements for PN, may provide recommendations regarding the macronutrients and micronutrients to be included in the PN solution[5]. Year 5 dietetic students may assess the patient and provide PN recommendations in collaboration with a dietitian preceptor.

Procedure: Initiation, Monitoring, and Discontinuation of Parenteral Nutrition

Initiation

1. Complete nutrition assessment using the nutrition care process (refer to eNCPT).

2. Identify appropriate patients for PN:

   a) Determine which feeding modality is the most appropriate and discuss this with the Most Responsible Provider (MRP).
      - Advocate for early Enteral Nutrition (EN) - (oral or tube feeding) - whenever possible given the physiologic and immunologic benefits for the patient [3,6]. If EN is absolutely contraindicated or attempts to establish EN have failed and the patient has had, or will have, inadequate nutrition then PN may be indicated[2,3,7-10] (Appendix A: Examples of Conditions Likely to Require PN).
      - PN is not indicated if patients have a functional GI tract, expected duration of therapy is less than 7 days, the risks outweigh the benefits of nutritional support, or the provision of nutrition support is not consistent with the goals of care.[2,3,7,8,11].

   b) Determine the appropriate timing of initiation of PN[2,8-10,12].
      - Initiation of PN depends on the patient's nutritional status and the severity of illness
      - Initiation of PN is indicated for severely malnourished or high nutrition risk patients as soon as possible following admission or a change in clinical status if EN/oral intake is not possible or is insufficient.
      - Standard initiation of PN is indicated for well-nourished, low nutrition risk patients after 7 days without EN/oral intake if EN remains contraindicated or not feasible, or has been attempted and was not tolerated.
      - Supplemental PN is indicated for high or low nutrition risk patients who, for 7-10 days, have been unable maintain EN/oral intake at greater than 50% estimated requirements.
      - Continuation of PN is indicated for Home Parenteral Nutrition (HPN) patients who are admitted to acute care unless PN access is compromised or administration is contraindicated. Contact the HPN program for the most recent PN prescription. At St. Paul's Hospital, the HPN RD will follow and provide care for HPN Program patients while admitted. Note: HPN solutions are not recommended for hospital administration. (Refer to D-00-12-30069 Parenteral Nutrition, Care and Management (Adult) in Acute and Community

c) Document all discussions regarding the indications for initiation of PN. This should include clarifying the reason for initiation when the indication is unclear or when it is not initiated according to recommended time frames. Whenever possible the RD will request the MRP and/or PN provider also document the indication for PN, expected outcome, and anticipated duration of therapy.

3. Provide safe recommendations:

a) Review allergy status to determine potential contraindication to PN components (i.e. allergy to egg, soybean, peanuts, and fish).
b) Determine calorie (kcal) and protein requirements and provide recommendations for balanced PN solutions which avoid overfeeding. Refer to Table 1 below for safe daily dose for macronutrients.
c) Use either the percentage or subtraction methods to determine the macronutrient distribution. For more information, refer to the VA PN Workbook from the Vancouver Acute (VA) Parenteral Nutrition (PN) Course for Dietitians on the Learning Hub.
d) Macronutrient requirements are calculated in grams per day of protein, dextrose and lipid. Once requirements are determined, the RD calculates the most appropriate volume in mL per day of dextrose solution, amino acid solution and lipid emulsion. Consider if patient is on a lipid based drug infusion (e.g. propofol) when determining macronutrient recommendation; the lipid emulsion many need to be held or decreased.
e) Round grams of carbohydrate (CHO) and grams of protein to the nearest 5 gram. Use increments of 10 mL for dextrose solution and 50 mL for amino acid solutions.
f) Initial PN preparations should provide approximately 20 kcal/kg[8], based on the patient's medical and nutritional status, and be progressed to goal kcals as indicated by the patient's response. For patients at risk for refeeding syndrome refer to BD-00-07-40058 Nutritional Management of patients at risk for Refeeding Syndrome (Adult Only).
g) Goal kcal should be determined based on the diagnosis and clinical status of the patient using appropriate equations and stress factors to estimate energy requirements.
    - 25 to 30 kcal/kg is usually sufficient to meet nutritional needs and avoid overfeeding[3,8,9].
h) If appropriate, recommend changing IV fluids to a dextrose-free solution and request a Total Fluid Intake (TFI) order.
i) Provide baseline electrolytes, vitamins and trace element recommendations.
j) Do not provide baseline electrolytes to patients with renal dysfunction. Additions should be made in consultation with the PN provider based on bloodwork and replacement requirements.
k) Recommend appropriate nutritional monitoring using site specific PPOs where available. (Refer to Documentation section).

Table 1. Safe Infusion Rates for Macronutrients [3,8,9,13-15]

Macronutrient	Minimum	Usual	Maximum
Protein	0.8 g/kg/day	1.2 to 1.5 g/kg/day	2.2 g/kg/day 2.5 g/kg/day if on CRRT
Carbohydrate	100 g/day	4 to 5 g/kg/day	7 g/kg/day (2 to 3 g/kg for refeeding syndrome)
Lipid	500 mL Intralipid® 20%/week (100 g) 1500 mL *SMOF*lipid® 20%/week (300 g)	Less than 1 g/kg/day	1.5 g/kg/day

4. Facilitate the signing of PN orders and PN Initiation.
   a) Refer to site specific guidelines for information regarding authorized PN providers and cut-off times for submitting orders to the pharmacy department.
   b) Central venous access is required for PN infusions (**VCH:** Parenteral Nutrition: Care and Management (Adult) in Acute and Community (D-00-12-30069); **PHC:** TPN (Total Parenteral Nutrition): Care of Patient (B-00-13-10022). Vascular Access Team/ Infusion Program/ IV Clinician will facilitate insertion of a PICC when notified by the RD/Medical Team of intent to start PN, the PN orders have been written and signed and the MRP has ordered the PICC insertion.

Monitoring

1. Monitor appropriateness of PN prescription and need for changes[1-3]

   a) Monitor bloodwork and respond to laboratory value trends to avoid or minimize metabolic complications.
   b) Monitor weight trends and fluid status. (Changes of greater than 0.25 kg over a 24-hour period usually reflect fluid gain or loss.)
   c) Monitor changes in clinical condition or use of lipid based medications (e.g. propofol) that may require modification of macro or micronutrient prescription. For information regarding management of common gastrointestinal, hepatic, and metabolic complications associated with PN refer to Appendix B.

2. Critical or urgent prescription changes/nutritional concerns **(immediate response required)**
   a) Pursue **immediate** communication with the PN provider when there are nutritional concerns that may severely compromise the patient if not addressed within 12 to 24 hours such as:
      - Significant overfeeding in a patient at high risk for the refeeding syndrome.
      - Metabolic acidosis/alkalosis.
      - Hyperkalemia where there are no other sources of potassium (i.e. no potassium in IV fluid) and blood sample was not hemolyzed.
      - Severe hypokalemia, hypophosphatemia, or hypomagnesemia requiring urgent repletion.
      - Low blood sugars when insulin is in the PN.

3. Non-critical prescription changes /nutrition concerns **(requires a response in 24 to 48 hours)**
   a) Alert the PN provider when patients have persistent hyperglycemia. Providing recommendations regarding insulin additions is not within the Dietician's scope of practice.
   b) Provide recommendations when:
      - Modifications to the PN order (macronutrients and micronutrients) are indicated. Changes should be nutritionally significant, i.e. at least 10% of calories or PN solution volume.
      - Additions to the standing bloodwork are indicated (e.g., patients at refeeding risk).
      - Cyclic PN is indicated.
      - Modification of the lipid emulsion is appropriate. (Appendix C: Choosing a Lipid Emulsion).
      - The transition from PN to enteral nutrition (includes oral nutrition) and/or termination of PN is indicated.

Discontinuation of Parenteral Nutrition

1. Advocate for the initiation and/or progression of EN:
   a) Regularly reassess the patient's clinical status and the appropriateness of withholding or minimizing PN. As contraindications or relative contraindications to EN resolve, advocate for the initiation and/or progression of oral intake or tube feeding.
   b) The PN prescription does not need to be adjusted when a Clear Fluid diet or trickle feeds are initiated. Changes should be nutritionally significant, and based on demonstrated intake and tolerance of diet or tube feeds.
   c) To avoid overfeeding, the PN prescription should be adjusted as EN/oral intake is progressed and the calories and protein consumed or received exceed 25% of estimated requirements.

2. Recommend discontinuation of PN when appropriate:
   a) EN/oral is well tolerated and the patient is consistently consuming or receiving an adequate amount of calories and protein (50 to 75 percent of estimated requirements) [2,7] or
   b) The patient's clinical status has changed and the provision of PN is no longer consistent with the goals of care.

3. Referral to the BC Home Parenteral Nutrition Program
   a) Patients who are unable to transition to EN or oral diets due to intestinal failure may be candidates for the HPN program. Click here for the HPN referral process and forms.

Patient/Client/Resident Education

Parental Nutrition (PN): A Guide for Patients and Their Families

Site Specific Practices

Lions Gate Hospital

1. Dietitian Training
   - Dietitians with limited experience or infrequent exposure to patients receiving PN are recommended to complete the Vancouver Acute (VA) Parenteral Nutrition (PN) Course for Dietitians.

2. Preparing Recommendations
   - Recommend appropriate 3-in-1 core PN solutions
   - Liaise with PN providers and pharmacists when adjustments to macronutrients, electrolytes, vitamins and trace elements are needed.

3. Cut-off Times
   - **New PN orders and PN changes: 11:00 am.**
   - PN solutions are only processed when a Central Venous Device is inserted by the deadline.
   - If the 11:00 am deadline is missed and the PN is urgent for that day, call the attending pharmacist or IV pharmacist (local 3716 IV Room).
   - PN orders may not be processed on weekends due to limited pharmacy staffing at LGH.

4. Authorized Providers
   - Authorized PN providers at LGH include internists, gastroenterologists, surgeons, and intensivists. Check with Pharmacy for other authorized PN providers by exception.
   - All PN orders and changes must be signed by PN providers.

PHC

1. Dietitian Training
   - Dietitians are trained by Nutrition Support Dietitians and must complete a minimum of 10 PN assessments under the supervision of PN Resource Dietitian before independently providing PN recommendations. PHC PN Resource Dietitians are those who work in a dedicated Nutrition Support role or have completed training with Nutrition Support Dietitian and have greater than 2 years' experience of covering in Nutrition Support areas and/or are frequently involved in the provision of nutritional care to patients receiving PN. PHC PN Resource Dietitians are encouraged to seek additional training or certification [e.g. National Board of Nutrition Support Certification as a Certified Nutrition Support Clinician (CNSC)].

2. Preparing Recommendations
   - Available dextrose solutions include D70W.
   - Available lipid emulsions include SMOFlipid®20% and Intralipid®20% in 250 mL formats. Recommendations are rounded to the nearest 25 mL increment.
   - Dietitians provide recommendations for fluid requirements.

3. Cut-off Times
   - **New PN orders and PN changes: 11:00 am.**

4. Authorized Providers
   - All PN orders must be completed by PN physician or pharmacist. Dietitians do not complete the PN order form.

Richmond Hospital

1. Dietitian Training
   - Dietitians are trained by the ICU dietitian, are recommended to complete the Vancouver Acute (VA) Parenteral Nutrition (PN) Course for Dietitians and are encouraged to seek additional training or certification (e.g. National Board of Nutrition Support Certification as a Certified Nutrition Support Clinician (CNSC).

2. Preparing Recommendations
   - The Dietitian collaborates with the ICU intensivist and pharmacist as part of the PN team.
   - Available lipid emulsions include SMOFlipid®20% and Intralipid®20% in 250 mL and 500 mL volumes.
   - Baseline micronutrient additions are determined based on volume of PN solution, bloodwork and patient status. The electrolyte additions are reviewed with the ICU intensivist.
   - On weekends the Dietitian is available for phone consult for any critical/urgent changes to PN such as hyperkalemia and will liaise with the ICU intensivist. The ICU intensivist or pharmacist will then write the adjusted PN order. No new PN starts are done on weekends.

3. Cut-off times
   - **New PN orders: 11:00 am.**
   - **PN changes: 10:00 am.**
   - All PN patients are reviewed daily with the ICU intensivist (i.e. vitals, labs, fluids, ins/outs and GI function). Orders are faxed to pharmacy and the changes are reviewed by phone (local 5114) with the PN pharmacist**.**

4. Authorized providers
   - All orders must be signed by the ICU intensivist.

VGH

1. Dietitian Training
   - VGH Dietitians must complete the Vancouver Acute (VA) Parenteral Nutrition (PN) Course for Dietitians, and have completed 10 PN assessments and/or significant macronutrient adjustments in consultation with a PN Resource Dietitian before independently providing PN recommendations. PN Resource Dietitians are those with greater than two years of experience, and who are frequently involved with the provision of nutritional care to patients receiving PN. Refer to VA PN Resource Dietitian List.
   - After consultation with a PN Resource Dietitian, they will sign the VGH Dietitian PN tracking form. The tracking form is submitted to the PC/PL by January 31 each year until requirements are met.
   - Dietitians with limited experience or infrequent exposure to patients receiving PN are encouraged to seek advice from, and collaborate with, a PN Resource Dietitian prior to providing care to patients on PN.

2. Preparing Recommendations
   - Available dextrose solutions include D20W, D50W and D70W
   - Available lipid emulsions include SMOFlipid®20% and Intralipid®20% in 100, 250, and 350 mL volumes.
   - Baseline electrolyte additions are determined based on the volume of amino acid solution ordered (see PPO 315). The electrolyte combination is designed to meet usual requirements and maintain acid base balance. Adjustments should be discussed with the PN pharmacist and PN Provider based on bloodwork and replacement requirements.
   - Once team is in agreement to start PN, alert the Vascular Access Team (604-875-5876) to confirm that a line is needed for PN.

3. Cut-off times
   - **New orders and changes: 11:00 am.** Additional urgent orders will be accepted between 1100 to 1300 hrs with approval from Pharmacy. Please call the PN pharmacist before this deadline if you are recommending a critical/urgent change or call PN pharmacy (local 63584) to advise them of new orders. Orders received after 1300 hrs will be processed the following day. Refer to Program Specific Responsibilities (PSRs) for individual dietitian positions for information regarding appropriate PN pharmacist contact information and PN physician/team to call to sign orders.

4. Authorized Providers
   - Initial orders must be signed by a PN physician. Continuing orders may be signed by PN pharmacists.

Documentation

- Nutrition Support Assessment Form, VCH.0104
- Nutrition Support Reassessment Form, VCH.0105
- Nutrition Report Form, FNS 53
- Acute Care Nutrition Care Plan VCH.RD. RH.0351
- ICU nutrition Assessment Form VCH.RD.0407
- Acute Care Interdisciplinary Progress Notes VCH 00051844
- Parenteral Nutrition (PN) Orders VCH.VA.PPO.315
- Parenteral Nutrition Initiation Orders VCH.VA.PPO.311
- Nutrition Support Care Plan PHCDI283
- Interdisciplinary Progress Notes PHCNF205

Related Documents

- D-00-12-30069- Parenteral Nutrition, Care and Management (Adult) in Acute and Community
- B-00-13-10022- TPN (Total Parenteral Nutrition): Care of Patient

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APPENDIX A: Examples of Conditions Likely to Require PN[2,3,7,10,11,16]

CATEGORY	INDICATION	EXAMPLES
EN CONTRAINDICATED	Impaired nutrient absorption	Intestinal obstruction Bowel ischemia or discontinuity Acute peritonitis
EN NOT TOLERATED	Impaired nutrient absorption	Short bowel syndrome – less than 200 cm small bowel, weight loss, fluid and electrolyte disturbances Severe mucositis –diarrhea, weight loss, fluid and electrolyte disturbances High-output enterocutaneous fistula (greater than 500 mL), no distal enteral access High output ostomy – persistently greater than 2L, refractory to treatment, weight loss, fluid and electrolyte disturbances Severe infectious colitis (C. difficile) -refractory to treatment, severe diarrhea Severe inflammatory bowel disease – weight loss, severe diarrhea Severe pancreatitis – increased pain with jejunal feeding, persistent steatorrhea
	Impaired nutrient transport	Chyle leak – output does not decrease with very low fat diet or elemental formula
	Disordered motility	Prolonged ileus Intestinal pseudo-obstruction Intractable vomiting
EN NOT FEASIBLE	Inability to achieve or maintain enteral access (after all strategies to establish EN have been attempted)	Partial bowel obstruction Hemodynamic instability requiring vasopressors Massive gastrointestinal bleeding Intractable vomiting Inability to achieve adequate nutrient/fluid delivery enterally (including procedure related interruptions of EN)

APPENDIX B: Management of Common Complications Associated with PN[1-3,15,17-23]

Complication	Prevention	Signs/Symptoms	Management
Gastrointestinal atrophy	Early Enteral Nutrition (EEN)	Enteric bacteremia and sepsis without a clear source.	Transition to enteral/oral nutrition as tolerated.
PN associated liver disease (PNALD): • Steatosis • Cholestasis • Cholelithiasis	• EEN • use mixed and balanced substrate solutions • avoid overfeeding kcal • avoid excessive CHO/lipid administration	Elevated liver function tests within 1 to 4 weeks of initiating PN **Degree of elevation:** **Mild - less than** 2 times normal Aspartate Aminotransferase (AST) and Alkaline Phosphatase (AP), total bilirubin 25 to 32 micromole/L **Moderate** - 2 to 5 times normal AST and AP, total bilirubin 34 to 51 micromole/L **Severe -** greater than 5 times normal AST and AP, total bilirubin greater than 51 micromole/L	• Transition to enteral/oral nutrition and discontinue PN as soon as possible • Before changing PN exclude other causes (e.g. hepatitis, hepatotoxic drugs, sepsis, gallstones). • Limit dextrose to 4 g/kg/day and lipid to less than 1g/kg. • Cycle PN over 12 to 18 hours (infusion rate of CHO should be less than 5 mg/kg/min). • Decrease copper to 0.15 mg/day and withhold manganese (moderate elevation of LFTs) • Change to *SMOF*lipid®
Hypertriglyceridemia	• Limit lipid administration to less than 1g/kg or 30% of kcal • Screen for elevated triglyceride (TG) level before initiating PN. • Avoid overfeeding CHO	• TG level persistently greater than 4.5 mmol/L (400 mg/dL) when PN is infusing. • To assess lipid clearance draw a fasting TG level 6 hours after lipid stops infusing.	• Decrease dextrose and/or lipid, • convert to 3 in 1 admixture to lengthen administration time (no increase in lipid content) • limit lipid to 2 or 3 times/week or change toSMOFlipid®
Hyperglycemia	• Slow initiation and advancement of PN • use of mixed/balanced substrate solutions	Blood glucose greater than 11mmol/L	• Provide 75% of CHO requirement on day 1; increase to goal day 2 or 3. • Reduce dextrose concentration in PN • Alert PN provider to consider addition of insulin to PN solution
Azotemia	• Use of mixed/balanced substrate solutions. • Appropriate dosing of protein and fluids.	Elevated BUN and serum creatinine without existing kidney disease.	• Reduce protein content of PN. • Increase fluids.

APPENDIX C: Choosing a Lipid Emulsion[8-10,15,17,18,21,25-31]

Lipids are a vital component in Parenteral Nutrition as a source of essential fatty acids and calories. Lipid emulsions vary in fatty acid (FA) composition and may contain medium chain, long chain, and/or very long chain triglycerides. The properties of the FA vary according to the length and structure of the FA chain resulting in different effects on physiological processes, including immune response and inflammation.

1. Intralipid®20%

- 100% Soybean Oil, high in Omega-6 Fatty Acids.
- Current guidelines (Canadian Critical Care Practice Guidelines, ASPEN, ESPEN) recommend reducing or withholding soy based lipid emulsions during the initiation of PN for critically ill patients. This is due to the immunosuppressive and pro-inflammatory effects of the Omega-6 Fatty Acids found during severe, surgery related stress (gastrointestinal) and polytrauma.

Indications:

- Mild to moderate stress response.
- Short term PN (less than 1 month).
- Patients on Warfarin (no additional Vitamin K required if receiving at least 200 mL/daily).
- Patients diagnosed with propionic acidemia (cannot receive lipid source containing odd chain FA).

Contraindications:

- Documented allergies to egg, soy, peanuts.
- Severe hyperlipidemia.
- Severely disordered fat metabolism, e.g. Liver insufficiency, acute myocardial infarction, or hemophagocytotic syndrome.
- Acute shock.

Considerations:

- Adequate Vitamin K if receiving volumes greater than 200mL/day. Additional Vitamin K supplementation required (2mg every Wednesday) if providing less than 200 mL/day.
- Essential fatty acid requirements met with 100g or 500 mL/ week.
- If receiving lipid-based drugs (e.g. propofol) during PN, additional monitoring of triglycerides is needed and lipid emulsion may need to be decreased or held.

1. SMOFlipid®20% (SMOF)

- 30% Soybean Oil, 30% MCT, 25% Olive Oil, 15% Fish Oil.
- ASPEN and Canadian Critical Care Guidelines currently state there is not enough evidence to recommend a particular alternative to soybean oil lipid emulsions; however, their use is suggested for critically ill patients requiring PN.

- ESPEN 2009 PN in ICU guidelines state fish oil containing lipids may reduce length of stay for critically ill patients, and ESPEN 2017 Surgery Guidelines suggest Omega-3 fatty acids be used post op for malnourished patients requiring PN, ICU patients requiring PN, and those with surgical complications.
- Potential benefits of SMOF include: decreased ICU Length of stay, decreased mechanical ventilation time, reduced infectious morbidity, improved liver function and TG levels, and reduced inflammatory marker.

Indications:

- Severe stress response, critically ill.
- Liver dysfunction (refer to Appendix B).
- Long term PN (greater than 1 month).
- HPN patients already prescribed SMOF, unless contraindicated by current medical condition or a medication change (e.g. warfarin).

Contraindications:

- Documented allergies to egg, soy, peanuts or fish
- Severe hyperlipidemia, liver insufficiency, or renal insufficiency without access to filtration or dialysis.
- Severe blood coagulation disorders.
- Acute shock.
- Unstable conditions including severe post-traumatic conditions, stroke, embolism, metabolic acidosis, and severe sepsis.

Considerations:

- Insufficient Vitamin K even in volumes greater than 200mL/day. Additional Vitamin K supplementation required per protocol (2mg every Wednesday).
- Greater volume required to meet essential fatty acid requirements (300 g or 1500 mL per week).
- If receiving lipid based drugs (e.g. propofol) during PN, additional monitoring of triglycerides is needed and lipid emulsion may need to be decreased or held."