PROVINCIAL STANDARDS & GUIDELINES

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Intradialytic Parenteral Nutrition (IDPN)

Created 2007; Updated 2014, 2019, 2021

Approved by the BC Renal Hemodialysis Committee

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IMPORTANT INFORMATION

This BC Renal guideline/resource was developed to support equitable, best practice care for patients with chronic kidney disease living in BC. The guideline/resource promotes standardized practices and is intended to assist renal programs in providing care that is reflected in quality patient outcome measurements. Based on the best information available at the time of publication, this guideline/resource relies on evidence and avoids opinion-based statements where possible; refer to www.bcrenalagency.ca for the most recent version.

For information about the use and referencing of BC Renal guidelines/resources, refer to http://bit.ly/28SFr4n.

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1.0 Description

Intradialytic parenteral nutrition (IDPN) is the provision of nutrients through the venous drip chamber while the patient is undergoing hemodialysis. The solution is administered with an infusion pump at a constant rate.

2.0 Background

2.1 Rationale for Use

There are several factors that are responsible for malnutrition in hemodialysis patients, including but not limited to the following:[1,2]

- Taste alterations/lack of appetite
- Loss of nutrients during dialysis
- Chronic inflammation
- Metabolic and hormonal disturbances
- Superimposed illnesses and infections
- Gastroparesis
- Dietary restrictions

Although there are no randomized controlled trials (RCTs) demonstrating morbidity or mortality benefits of IDPN over oral supplements and nutrition counselling,[3] one open-label randomized control study (RCT) reported patients receiving IDPN in addition to nutrition counseling for 16 weeks demonstrated a significant improvement in pre-albumin levels when compared to nutrition counseling alone.[4] Pre-albumin has been identified as a surrogate marker for survival.[5,6] Results from observational studies suggest treatment with IDPN may increase nitrogen balance and improve nutritional status (weight, arm muscle circumference, BMI) when compared to usual care.[7-10]

Of note, IDPN does not meet the complete nutritional needs of a patient, but provides substantial calories and protein to augment oral intake.

The potential benefits of IDPN must be balanced against potential risks, namely:

- Hyperglycemia, particularly in patients with diabetes
- Hypoglycemia post-discontinuation
- Fatty liver
- Hypertriglyceridemia

2.2 Goals of Therapy

The primary goal of therapy is to meet estimated nutritional requirements and thereby improve nutritional status, as reflected by increased Subjective Global Assessment, weight gain and improved wound healing. IDPN is a long-term treatment that usually requires at least 4 to 6 months of therapy.

3.0 Exclusion and Inclusion Criteria

3.1 Exclusion Criteria

1. Allergy to any of the following (Appendix 1):
   - Eggs (in lipid)
   - Corn (in dextrose)
   - Soybean (in lipid)
   - Peanuts (may cross react with soybean)
   - Olive oil (if using SMOFlipid® or Baxter Olimel® solution)
   - Fish (if using SMOFlipid® solution)
2. Severe hyperlipidemia (triglycerides >10 mmol/L[11])
3. Congenital errors of amino acid metabolism. e.g., Phenylketonuria
4. Unable to maintain a blood pump speed of greater than 200 mL/min

5. On single needle dialysis
6. Patient is palliative with no anticipated increase in quality of life with IDPN

3.2 Inclusion Criteria

1. Patient must be achieving adequate dialysis clearance.

Note: IDPN can be administered in a Community Dialysis Unit (CDU) if the patient meets the criteria for a CDU and IDPN-related logistics can be worked out (i.e., commercial formula available and/or pharmacy is available to mix the solution, space is available for storage of solution on unit, dietitian is available for consult, RNs have received appropriate education, etc)[12]

4.0 Indications for Initiation and Discontinuation

4.1 Indications for Initiation (adapted from[13])

Prior to initiating IDPN, a Renal Dietitian must assess the appropriateness of IDPN.

- Clinical expertise and judgement must be exercised when making treatment decisions for individual patients.
- No single indicator can reliably diagnose malnutrition.

In assessing the appropriateness of IDPN, the Renal Dietitian should consider the following nutrition indicators:

a) Subjective Global Assessment (SGA) B or C indicating moderate to severe malnutrition which includes consideration of the following factors:
   i) Unintentional weight loss of 5- 10% of usual weight or current weight less than 90% of ideal body weight[14].
   ii) Body Mass Index (BMI) less than 20.[15]
   Note: Many situations (e.g., fluid retention/ muscle wasting/ adiposity) influence the validity of BMI assessment. As a result, a patient could be malnourished at any BMI. A BMI below 18.5 kg/m^2 is associated with higher all-cause mortality in patients treated with maintenance hemodialysis[16,17].
   iii) Documented diagnosis of gastrointestinal disorder (i.e. gastroparesis, malabsorption syndromes).

b) Inadequate oral nutrition intake (with the following considerations):
   i) Meets at least 50% of their estimated nutrition requirements (IDPN will not provide adequate support if oral intake is below this level).
      - Consider whether patient may be a candidate for tube feeding or total parenteral nutrition if unable to meet at least 50% of their nutritional requirements.
   ii) Increased nutrition requirements may be temporary or ongoing, resulting in a protein-energy imbalance e.g., wound healing, pre/ post-surgical, high metabolic requirements.
   iii) Failed attempts to increase nutritional status with oral nutrition supplements.
   iv) Not a candidate for tube feeding, i.e. where nasogastric or gastrostomy feeding is unsafe or impractical.

Note: Albumin and pre-albumin are commonly used in the literature for assessing the impact of IDPN even though they are negative acute phase reactants and, as such, do not reflect nutritional intake or malnutrition.[18] When reviewing albumin levels, it is important to

consider the assay type used. The bromocresol purple assay produces albumin results 5.5 g/L lower than the bromocresol green assay. Thus, an albumin level of 30 g/L (using bromocresol purple assay) would be approximately equivalent to an albumin level of 35 g/L (using bromocresol green assay).[19]

4.2 Indications for Discontinuation (adapted from[13])

IDPN is a long-term treatment achievement of goals of therapy could take up to 4 to 6 months.

Consider discontinuing IDPN when:

1. Adequate nutritional status has been achieved (i.e., weight maintenance or increased dry weight, improved SGA score, wound healing) and/or the patient is able to meet at least 80% of nutritional requirements through oral or enteral means.
2. Medical concerns arise. e.g., hyperlipidemia (e.g triglyceride above 11.3 mmol/L), fatty liver, palliative status, chronic fluid overload etc.
3. Treatment goals are not met after 4 to 6 months on IDPN.

5.0 Composition

Parenteral nutrition (PN) solutions are the same as other central parenteral nutrition solutions. Protein is supplied as amino acids, carbohydrate as dextrose and lipids as a soybean or mixed lipid emulsions (refer to Appendix 1). IDPN typically provides approximately 1,000 kcal three times weekly.

All three macronutrients (i.e., amino acids, dextrose and lipids) can be combined together to form a three-in-one admixture (commercially available product or can be mixed by pharmacy). Alternatively, amino acids and dextrose can be combined in one bag and lipids alone in another (not commercially available and must be mixed by pharmacy).

Refer to Appendix 1 for details of the composition and calories of IDPN formulations available in BC.

5.1 Protein

- The most commonly used solution in B.C. contains 10% amino acids. IDPN treatment should provide at least 50 grams of protein. Lower protein intakes result when fluid volume must be limited.
    - 250 ml of a 10% amino acid solution = 25 grams of protein
    - 500 ml of a 10% amino acid solution = 50 grams of protein
- Calories from all energy sources, including amino acids, are used to calculate the total energy being provided[20].
- Each gram of protein provides 4 kcal.

5.2 Carbohydrates

- Concentrated sources of dextrose (e.g. Dextrose 70% or Dextrose 50%) are used to achieve the final dextrose concentration ordered.
    - 250 ml of a 50% dextrose solution = 125 grams of dextrose
- Each gram of dextrose provides 3.4 kcal.
- Unlike PN where the maximum dextrose infusion is 5 mg/kg/min, IDPN often exceeds this rate as it is generally infused over 3.5-4.0 hours, 3 times per week versus a continuous 24-hour intravenous infusion.

5.3 Fat

- Fat is a concentrated source of calories and provides essential fatty acids.
- The most commonly used solution in BC is a 20% lipid emulsion, which provides 2 kcal/mL.
- Available as Intralipid® 20% (soybean oil 10%) and SMOFlipid® 20% (contains soybean oil 6%, medium chain triglycerides 6%, olive oil 5%, and fish oil 3%). SMOFlipid® is considered to be less pro-inflammatory compared to Intralipid®.
- Intralipid® contains Vitamin K53 - 70 mcg/100 mL[21,22] (varies with natural Vitamin K content of soybean oil); SMOFlipid® contains Vitamin K 10 mcg/ 100mL.[23]
- If triglycerides are elevated, SMOFlipid® may be preferred as it has a triglyceride lowering effect.[23]
- If triglycerides rise to >4.5 mmol/L, slow the infusion rate until triglyceride levels return to normal.

    - 250 ml of 20% lipid = 50 grams of fat

- Each gram of fat provides 10 kcal (due to emulsifying agent).
- Fat should not exceed 60% of total calories.
- Maximum clearance rate of 20% lipid is 1 ml/minute or 60 ml/hour.
- In practice, up to 250 ml of 20% lipid is infused over 3.5 to 4.0 hours. For run times shorter than 3.5 hours, do not increase the infusion rate to use up the bag (continue at the same rate and discard unused solution).

5.4 Additional Ingredients

Vitamins, minerals and electrolytes
Vitamins, minerals and electrolytes are not routinely added to IDPN formulations but they may be added in special cases.

Insulin
The presence of dextrose in IDPN formulations can pose a concern with glycemic control. Some patients may require supplemental insulin. Insulin is best administered separately (subcutaneously), especially during initial administrations of IDPN while insulin requirements are being identified. Once insulin requirements have been identified, insulin may continue to be administered separately (subcutaneously), preferably, or may be added to the IDPN formulation by pharmacy on a patient-specific basis.

6.0 Administration

There are no definitive guidelines on how to initiate IDPN. Individual needs and the tolerance of each patient need to be taken into account. Refer to Table 1 for monitoring parameters.

6.1 Principles of Administration

Starting and monitoring IDPN infusions:
Registered nurse (RN) who have completed the required hemodialysis (HD) specialty education and who provide nursing care in a BC Renal Program may start or monitor IDPN.

As per the BC College of Nursing Professionals Scope of Practice for Licensed Practical Nurses (LPNs)

document, starting or monitoring IDPN is not within the scope of practice of an LPN.[24] The document authorizes LPNs to provide care to a patient receiving IDPN in a *team nursing approach.*[24]

IDPN infusion:

- Infuse IDPN into the venous line distal to the dialyzer.
  - 3-in-1 IDPN: Use DEHP-free tubing with 1.2 micron filter and intermittent infusion pump.[25]
  - 2-in-1 IDPN:
    - For dextrose/amino acid solution, use DEHP-free tubing with 0.20 or 0.22 micron filter and intermittent infusion pump.[25]
    - For lipids, use DEHP-free tubing and intermittent infusion pump. A filter is not required.[i] The lipids are Y-sited to the dextrose/amino acid solution below the 0.2 or 0.22 micron filter. Do not use the same infusion pump as the dextrose/amino acid solution.
- For a typical 4-hour HD dialysis run, initiate IDPN at the beginning of the run and run at a continuous rate throughout the run. For an extended HD run (e.g., nocturnal dialysis), initiate IDPN at a lower rate and continue for the duration of the run.

IDPN interruptions:

- If IDPN needs to be interrupted for a period of time, reinitiate at the rate used prior to the interruption. Do not increase the rate to compensate for lost time.
- Discard any remaining solution upon discontinuation of dialysis.

Compatibility of IDPN with other substances:

- Medications, including antibiotics and iron products, should not be infused through the same port as IDPN during dialysis.
  - If more than one venous port exists, infuse medications and IDPN through separate ports.
  - If only one venous port exists, switch IDPN to the arterial chamber and infuse the medication through the venous chamber. IDPN should not be Y'ed in with another medication prior to being administered into the dialysis circuit.
- Blood/blood products may be infused concurrently with IDPN during dialysis[ii]. Administer into the arterial medication port while IDPN is infused via the venous port.

Calculation of UF Target:

- Add the volume of IDPN to the amount of fluid that is to be removed. e.g., If 1.4 L is required for the total fluid removal target and the IDPN bag is 930 mL, remove 1.4 L + 0 .93 L = 2.33 L.

Withholding IDPN:

- Withhold IDPN if the fluid gain is higher than the typical interdialytic weight gain for a given patient. Discuss with nephrologist/NP regarding administration of IDPN.
- Withhold IDPN if patient receiving single needle dialysis.
- Withhold IDPN if patient has signs/symptoms of suspected or confirmed sepsis.

[i] E-mail correspondence from Fresenius Kabi, Sept 25, 2018.

[ii] Correspondence from Dr. Robert Coupland, Medical Director, Provincial Blood Coordinating Office on behalf of the BC Transfusion Medicine Advisory Group (TMAG), Sept 22, 2017.

6.2 Monitoring during IDPN infusions

Table 1: Potential Complications & Actions during IDPN infusion

Potential Complications	Actions
Possible reaction to IDPN solution: Nausea, vomiting, discomfort, hypotension, respiratory distress and/or cardiac arrhythmias (rare).	If reaction suspected, stop IDPN. Contact MD/NP for direction.
Hyperglycemia or hypoglycemia Check blood glucose: • Blood may be drawn by finger poke or from the HD line. If drawn from the HD line and the result is high, repeat test using finger poke method to verify results (recirculation may result in falsely elevated blood glucose levels). `For people without diabetes: • For the first 3 sessions, monitor blood glucose at the beginning, midway and at the end of the dialysis run, regardless of the length of the HD run. • Discontinue monitoring after the first 3 sessions unless results were outside of safe blood glucose ranges. • If the patient requires additional subcutaneous insulin, during infusion of IDPN, monitor blood glucose at the beginning, midway and at the end of every dialysis run on an ongoing basis. For people with diabetes: • For the first 6 sessions, monitor blood glucose at the beginning, midway and at the end of the dialysis run, regardless of length of HD run. • Reduce monitoring to weekly after the first 6 sessions unless results were outside of safe blood glucose ranges. • If the patient requires additional subcutaneous insulin, during infusion of IDPN, monitor blood glucose at the beginning, midway and at the end of every dialysis run on an ongoing basis.	Teach patients about the signs and symptoms of hypoglycemia (refer to Appendix 2). Encourage all patients receiving IDPN to bring 15-30g carbohydrate snack (e.g., 2 plain cookies - refer to Appendix 2) to the dialysis session and to consume it 20 - 30 minutes prior to discontinuation of IDPN. If IDPN is stopped prematurely, check blood glucose level and encourage patient to eat their 15 – 30g carbohydrate snack (refer to Appendix 2). Consult MD/NP if: • Beginning, midway or end of dialysis blood glucose levels exceed 16.5 mmol/L.[26] • End of dialysis blood glucose level is less than 6.0 mmoL/L (patient is at risk of rebound hypoglycemia). Encourage patient to eat their carbohydrate snack. • After 3 dialysis sessions, a pattern of persistently raised blood glucose levels is apparent (insulin may be required when receiving IDPN).

6.3 Laboratory monitoring between IDPN infusions

Table 2: Laboratory monitoring between IDPN infusions

Recommended Tests	Frequency
• CBC • Electrolytes (K+, Ca++, P04--, Mg++ , Na+) • Urea, Creatinine • Albumin • Liver Function Tests (alkaline phosphatase, ALT, total bilirubin) • Triglycerides	• Initial treatment • Weekly x 2 weeks • Then every 4-6 weeks to coincide with regular dialysis blood work Note: IDPN may reduce the post-dialysis Kt/V by 0.2[27], which amounts to approximately 10% change in PRU. If the post- dialysis Kt/V or PRU level is low, blood work could be repeated on the next HD run and IDPN held on that session.

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8.0 Sponsors

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Developed by:

- A working group of multidisciplinary renal care providers from across BC (nephrologist, nurses, dietitians and pharmacists).

Reviewed by:

- BC Renal Dietitians Group
- BC Renal Educators Group

Approved by:

- BC Renal Hemodialysis Committee (Dec 5, 2018)
- BC Renal Medical Advisory Committee (June 6, 2019)

Appendix 1: IDPN Formulations Available in BC

Product	Volume	Composition			KCal	General Information
		Dextrose	Amino Acid (no lytes)	Lipid		
Pharmacy-mixed						
Pharmacy-mixed - Vancouver General	750 mL	D70W: 150 mL 105 g dextrose	Travasol 10%: 350 mL Protein = 35 g	Intralipid® 20%: 250 mL Soybean 100% Fat = 50 g	997	3in1 Refrigerated 7 day expiry
Pharmacy-mixed - Vancouver General	930 mL	D70W: 180 mL 126 g dextrose	Travasol 10%: 500 mL Protein = 50 g	Intralipid® 20%: 250 mL Soybean 100% Fat = 50 g	1125	3in1 Refrigerated 7 day expiry
Pharmacy-mixed- Fraser Health	750 mL	Dextrose 20% 100 g	Amino Acids 7% Protein = 35g	Intralipid® 20%: 250 mL Soybean 100% Fat = 50 g	480 + 500 (lipid) = 980	2in1 Refrigerated 7 day expiry. Lipids hung separately
Pharmacy-mixed- Fraser Health	1000 mL	Dextrose 16.6% 125 g	Amino Acids 7.5% Protein = 56 g	Intralipid® 20%: 250 mL Soybean 100% Fat = 50 g	648 + 500 (lipid) = 1148	2in1 Refrigerated 7 day expiry. Lipids hung separately.
Commercially available (code)						
Fresenius Kabi - SMOFlipid® (831901610)	986 mL	125 g	50 g	SMOFlipid® 20%: 190 mL Fat = 38 g Fish oil: 3% w/v MCT: 6% w/v Olive oil: 5% w/v Soybean oil: 6% w/v	510 + 500 (lipid) = 1010	3in1 2 yr expiry at room temperature
Baxter Olimel® 5.7% (CJDB3XP1E)	1000 mL	110 g	56.9 g	ClinOleic 20%: 200 mL Fat = 40 g Soybean oil:20% Olive oil: 80%	1002	3in1 2 yr expiry at room temperature
Baxter Olimel®7.6% (CJDB3XH1E)	1000 mL	73.3 g	75.9 g	ClinOleic 17.5%: 200 mL Fat = 35 g Soybean oil: 20% Olive oil: 80%	950	3in1 2 yr expiry at room temperature

Appendix 2: Snack Ideas for Hemodialysis Patients on IDPN

Snack Ideas
for Hemodialysis Patients on IDPN

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▶ IDPN stands for intradialytic parenteral nutrition. It gives you nutrition while you are having dialysis.

- Some people have low blood sugar shortly after IDPN is stopped. This may happen right away or up to 2 hours after IDPN is stopped.
- **If you have low blood sugars you may feel light headed, shaky, sweaty, have blurred vision or a headache.** Low blood sugars are more common in people who take insulin.
- To prevent low blood sugar, **bring** a snack with you and **eat** it 20 -30 minutes before the end of your treatment or at the end of dialysis.

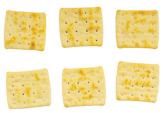
Your snack should have 15-30 grams of carbohydrate in it. Here are some ideas:


1 small apple or pear


½ - 1 cup of grapes


1 cup of berries


175 g flavoured yogurt


6-8 crackers


1 fruit cup


1 small muffin


1 pudding cup


½ sandwich


2 digestive or 3 arrowroot biscuits

Vector® or Special K® Protein Bar
*These bars may contain chocolate and nuts but are OK in potassium & phosphorus.

½ to 1 Ensure Plus® or Novasource Renal®

▶ Check the nutrition facts label to be sure you are getting enough carbohydrate.
▶ Ask your dietitian if you need more information or other snack ideas.

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