Nutritional Support outside the Hospital: 
Home Parenteral Nutrition (HPN) in Adult Patients

Module 19.5

Guidelines for Home Parenteral Nutrition in Chronic Intestinal Failure

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Francisca Joly

Learning Objectives

• How to adapt nutrition support in HPN patients?
• What are the nutritional needs of a patient?
• How to cover the needs for a patient?
• How to evaluate PN dependence?

Contents

1. Introduction
2. General HPN guidelines
3. Nutritional support team
4. Nutritive mixtures
5. CIF in short gut patients and PN dependence
6. PN dependence and HPN management
7. Patient management
8. Conclusion

Key Messages

• Management of HPN must be an integrated part of the management of the disease which has led to chronic intestinal failure;
• A better prognosis is observed in HPN patients having a short but functioning gut than in patients with a longer but non functioning;
• Along with medical therapy, dietary management of intestinal failure due to very short bowel is a crucial point which may reduce the PN dependence at its lower level, therefore decreasing the risk of technical and metabolic complications associated with long term HPN;
• Indeed, HPN for intestinal failure must not be viewed as “hyperalimentation” but rather a complete nutrition support for each PN cycle with a minimum number of nocturnal cycles per week. This is better observed in patients in which hyperphagia takes place;
• Then, HPN is in most cases, a complementary non exclusive mode of nutritional support.
1. Introduction

Home parenteral nutrition (HPN) is the gold standard of treatment which applied to the concept of chronic intestinal failure (1).

The recognized definition of chronic intestinal failure is a non-functioning small bowel either removed, after severe disease leading to very short bowel syndrome, or present but impossible to use by enteral support even accessed through jejunostomy (e.g. chronic intestinal pseudo obstruction or extensive villous atrophy diseases) (2).

HPN should be administered to patients if nutritional requirements cannot be met by or enteral nutrition feeding (3).

This manuscript focuses on nutritional support of adult HPN patients in a tertiary care center in the setting of chronic intestinal failure excluding cancer patients and focussing on short bowel patients (see HPN ESPEN Book) (5).

2. General HPN guidelines

Published guidelines for the use of HPN should be looked at by the reader (3).

These published guidelines related to this chapter are summarised for HPN adults in Table 1 (3, 4).

3. Nutrition support team

Nutrition support team (NST) is required to safely manage HPN. It includes specialized nurse, dietician, pharmacist, physician and surgeon ideally trained in both nutrition and gastroenterology, plus social worker, care giver and general practitioner, patient and family being at the center of the medical sphere.

The NST has to:
- identify appropriate candidates;
- develop a nutritional plan of care agreeable to the patient and care giver;
- make a prescription appropriate for the home setting; and
- properly train the patient/care giver (6).

According to the ASPEN the standard but “minimally required” care for HPN patients is standardized method for “ordering and monitoring HPN support”: this is necessary because physicians with various academic training may order home artificial nutrition support.

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Table 1.

<table>
<thead>
<tr>
<th>Practice Guidelines (A.S.P.E.N.): Monitoring Efficacy for SNS including HPN</th>
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<tbody>
<tr>
<td><strong>Nutrition and outcome goals should be stated in the nutrition assessment prior to the initiation of Specialized Nutrition Support (SNS)</strong></td>
</tr>
<tr>
<td><strong>Nutritional and outcome parameters should be measured serially during SNS therapy</strong></td>
</tr>
<tr>
<td><strong>Periodic comparison of nutritional and outcome measures with SNS goals should occur to monitor efficacy of therapy</strong></td>
</tr>
</tbody>
</table>

The authors used the AHRQ criteria to classify the strength of the evidence supporting each guideline statement.

The evidence supporting each statement is classified as follows (3, 4):
- **A**: There is good research-based evidence to support the guideline (prospective, randomized trials)
- **B**: There is fair research-based evidence to support the guideline (well-designed studies without randomization)
- **C**: The guideline is based on expert opinion and editorial consensus

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**How to adapt nutritional support in intestinal failure patients?**

**What are the nutritional needs of a patient?**

- **REE**: Harris & Benedict*  
- **Activity**: x 1.3 REE (minimum)  
- **Inflammatory**: x 1.2 REE  
- **Aging**: x 1.2 REE  
- **Increased losses**: macronutrients *  
  - H₂O-Na⁺ ± mineral : Ca, Mg...  
  - Micronutrients : 1 to 2 fold basal

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* Wt, height, age, sex. * according to intestinal balance
It is also highly recommended to use “disease specific pathways” for obtaining laboratories values and patient’s visits and to organize formal communication between home care staff and the involved general practitioner (7).

HPN survey in the eighties in French approved HPN centers, has showed a significant increase in the probability of survival according to the date of inclusion: number of deaths being higher during a 3-year run in period than during the two subsequent 3-years periods (8). Then, NST(s) specialized in chronic intestinal failure are a prerequisite for running HPN programs. The learning curve observation showing long term health outcome improvement in HPN pleads now for intestinal failure units covering and integrating expertises in all medical and surgical aspects of chronic intestinal failure treatment (5).

4. Nutritive mixtures

<table>
<thead>
<tr>
<th>HPN : Nutritive Mixtures for adults</th>
<th>Per cycle</th>
<th>60 Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclic PN :</td>
<td>10-12 h</td>
<td></td>
</tr>
<tr>
<td>Amino acid solution (s) : 1.25 (1 to 1.5) g/Kg</td>
<td>N=12g</td>
<td></td>
</tr>
<tr>
<td>Energy : 1.0(0.8 to 1.3) x REE (1200±300)</td>
<td>1200Kcal</td>
<td></td>
</tr>
<tr>
<td>Glucose based : ≤6mg/Kg/min (up to 9)</td>
<td>300g</td>
<td></td>
</tr>
<tr>
<td>EFA : around 5% of total Kcal (1000 Kcal/wk)</td>
<td>45g</td>
<td></td>
</tr>
<tr>
<td>20% ω6 rich emulsion : 100 g/wk*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lipid based (ternary) : ≤30% of E load</td>
<td>45g</td>
<td></td>
</tr>
<tr>
<td>or ≤ 1 g/Kg</td>
<td>45g</td>
<td></td>
</tr>
<tr>
<td>Minerals &amp; electrolytes :++++</td>
<td>“à la carte”</td>
<td></td>
</tr>
<tr>
<td>Vitamins &amp; trace metals: AMA recommendations x 1-2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 2  
BM A-I-O2c

**Definition of All-In-One Parenteral Nutrition Therapy**

- **All 38 nutrients in a single container**
  - 2 or 3 macronutrients:
    - Dextrose-Aminoacids solution(s)
    - ± Lipid emulsion(s) in mono/bi partite bag
  - 35 micronutrients:
    - electrolytes, minerals, vitamins, trace metals

- **A separate sheet for nutrition prescription**
  - should be used to avoid omission

**Total (H)PN indeed means that TPN must be “complete” therapy** for each cycle of infusion including adequate amounts of amino-acids and glucose, a maximum of a third of total energy being furnished as triacyl-glycerol, of which a variable amount of polyunsaturated essential fatty acids is present (19).

"Complete" PN must also include the 35 essential nutrients (electrolytes, minerals, vitamins, trace metals) and should be tailored in amounts according to the clinical and intestinal status of individual patients. All these nutrients, of which it is important to avoid excess or deficit, play a major role in nutritional efficiency and, along with energy, to nitrogen retention of PN. **A separate sheet for PN prescription should be used to avoid omission.**
When nutritive mixtures done by pharmaceutical companies are used in PN, especially at home, there is a risk of deficiencies (vitamins are usually absent from these mixtures) and imbalances (e.g. electrolytes, minerals, excess fat/glucose ratio) if additives are not added according to the patient's requirements.

Doing these necessary IV supplement(s) at home by nurse, care giver or patients themselves (6), instead of doing it under laminar hood flow, brings, despite using aseptic techniques, an additional risk of infection.

Stability of the mixture might be also compromised by inappropriate supplementation. Then, “optimized” HPN care is still sometimes not used after more than 35 years experience in HPN (13, 17, 18).

Then, the authors advise that, for each HPN patient, “all-in-one” complete nutritive mixtures should be tailored according to the specific type of chronic intestinal failure with a cyclic nocturnal infusion of a variable volume, a variable infusion duration (10 h - 16 h) and a variable number of cycles per week.

5. Chronic Intestinal failure in short gut patients and PN dependency

CIF is “reduction in functioning gut mass below the minimal amount necessary for adequate digestion and absorption of nutrients” (1).

Three - 2 clinical and one biochemical - variables have been then shown to be able to delineate transient from permanent - or indefinite - CIF in short bowel syndrome (SBS) adult patients (20-24). SBS representing nearly 80% of long term HPN in adult patients (5, 8, 25).

- length of remnant bowel;
- duration of HPN use;
- citrulline levels.

### Vitamin requirements and supply in TPN

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Dosing/Units</th>
<th>AMA/d</th>
<th>IVd</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1, Thiamine</td>
<td>mg</td>
<td>1.5</td>
<td>1-5 / CHO</td>
</tr>
<tr>
<td>B2°, Riboflavin</td>
<td>mg</td>
<td>1.7</td>
<td>3.4</td>
</tr>
<tr>
<td>PP, Niacine</td>
<td>mg</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>B6, Pyridoxine</td>
<td>mg</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>B9, Folic acid</td>
<td>µg</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>B12, Cyanocobalamin</td>
<td>µg</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>* Pantothenic acid</td>
<td>mg</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>** Biotin</td>
<td>µg</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>C, Ascorbic acid</td>
<td>mg</td>
<td>60</td>
<td>200</td>
</tr>
<tr>
<td>A, Retinol (RE)</td>
<td>IU / µg</td>
<td>1000°</td>
<td>3300</td>
</tr>
<tr>
<td>D, Cholecalciferol</td>
<td>IU / (µg)</td>
<td>200 = (5 µg)</td>
<td>200</td>
</tr>
<tr>
<td>E, α-Tocopherol</td>
<td>IU / mg</td>
<td>10</td>
<td>0.6mg/g PUFA</td>
</tr>
<tr>
<td>K°, Phytylmenaquinone</td>
<td>µg</td>
<td>1/Kg daily or 10mg / wk</td>
<td></td>
</tr>
</tbody>
</table>

* not recognized clinical deficit, ° contribution by colonic bacteria

### Proposals to delineate transient from permanent intestinal failure in SBS

- Time limit of weaning or not off HPN:
  - = 2 yr in adult*, = 4 yr in children
  - ? time to allow maximum intestinal adaptation
- Citrulline blood threshold:
  - transient: 20-30 umol/l°
  - permanent: Adult < 20°, Kids < 19 umol/l°°
- Lenght of remnant small bowel threshold*:
  - = 100 cm for abnormal but non-occluded
  - = 100, 60, 35 cm for EE, JC, JIC SBS types

Fig. 4 TRACE-METAL NEEDS in HPN

<table>
<thead>
<tr>
<th>Trace Metal</th>
<th>Specific for IF°</th>
<th>RDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Se</td>
<td>70 µg</td>
<td>50-100 µg</td>
</tr>
<tr>
<td>Cr°</td>
<td>15 µg</td>
<td>10 – 20 µg</td>
</tr>
<tr>
<td>Mo</td>
<td>25 µg</td>
<td>300 µg</td>
</tr>
<tr>
<td>Cu°</td>
<td>0.48 mg</td>
<td>up in celiac</td>
</tr>
<tr>
<td>Zn</td>
<td>10 mg</td>
<td>3 mg / L</td>
</tr>
<tr>
<td>I &amp; Co</td>
<td>1.5 µg</td>
<td>- µg</td>
</tr>
<tr>
<td>Mn°</td>
<td>0.2 mg</td>
<td>0.15 - 0.80 mg</td>
</tr>
<tr>
<td>Fe°</td>
<td>1 mg</td>
<td>according losses</td>
</tr>
<tr>
<td>Fluor</td>
<td>1.45 mg</td>
<td>- mg</td>
</tr>
<tr>
<td>Al°°</td>
<td>-</td>
<td>&lt; 30 µg/d</td>
</tr>
</tbody>
</table>

* Better to decrease or stop in chronic cholestasis patients
° contaminant of NP solutions with potential toxicity. **Intestinal failure

Fig. 5

Formulations: Kabi & Baxter around 2 – 2.5 times AMA...

Fig. 6

Weaning off HPN can be obtained, according to different remaining lengths of small bowel depending on the three main anatomical types of SBS (20, 21); in end-jejunostomy (type I, no colon in continuity), in jejuno-colonic (type II, some part of the colon is in continuity) and in jejuno-ileal (type III, the full colon is in continuity) type of anastomosis, the minimal lengths of a normal small bowel are respectively 100 cm, 60 cm and 35 cm (20, 21). For types II and III, 100 cm is required to wean off HPN patients if remaining bowel is abnormal but without stenose(s).

- Probability of weaning off HPN, became less than 10%, if the weaning off has not been obtained during the first two years of HPN (21, 22).
- A plasma level of post absorptive citrulline - a non essential amino-acid, not incorporated into peptides or proteins - lower than 20 μmol/l (half the normal value in controls) is significantly associated with permanent intestinal failure, past the adaptive - 2-year - period following the re-establishment of bowel continuity after extensive small bowel resection (24).

This biochemical marker cannot be used in renal insufficiency. It is highly correlated to remnant small bowel length and absorptive capacity; it is more predictive of permanent CIF (negative and positive predictive values of 86% and 95% respectively) than remnant length of small bowel within the 3 anatomical types of SBS.

In fact, citrulline seems to reflect the absorptive function of the remaining short gut because its level was significantly higher in 10 hyperphagic patients than in 10 normophagic patients paired with a same length of remnant small bowel (24).
It is interesting to note that in children with SBS, a similar citrulline threshold (19µmol/L) has been recently found for both length of remnant small bowel and development of enteral tolerance with comparable high negative (100%) and positive (87%) predictive values to observe weaning off HPN (26). Then, length of remnant bowel plus citrulline level offer the advantage to better define appropriate HPN candidates for either complementary (pharmacological trophic gut factors or reconstructive surgery) or alternative treatments for permanent intestinal failure (5).

6. PN dependence and HPN management

Knowing the probability of HPN weaning off (see previous paragraph), it is also important to know the capacity and eating intake of a given patient, plus the absorption of the remnant gut (under optimal therapy including dietary counselling, to set up a minimum level of PN dependence during HPN management. PN dependence can be viewed as minimal needs through a complementary IV route for:
- water, Na and mineral (K and especially Mg), at one hand;
- macronutrients on the other hand;
- both should be set up at equilibrium for nutritional purpose (27, 28).

In each patient, it is useful to look at the degree of PN dependence (from 0 to 100%) by comparing net absorption (expressed in percentage of oral autonomy (3-day balance study - for both energy/protein and water/Na-)) and PN inputs of water, protein and energy delivery (mean of one week IV infusion) expressed in percentage of nutritional needs. This calculation will give data to set the PN delivery closer to the effective PN dependence level.

**PN dependence: a complicated matter**
- PN dependence depends from 3 parameters:
  1. Energy/protein absorbed (oral autonomy)
  2. Water salt equilibrium (= 0 balance)
  3. Normal magnesium
- Attempt to dissociate Energy/protein absorbed from H2O/Na & Mg balances deserves attention
- oral autonomy should be crossed against HPN dependence to point out discrepancy

**PN dependence versus oral autonomy**

Balance studies are complicated to perform
**In - out = 3-day absorption ...**
- Energy balance
- Hydro-electrolyte
  ± Magnesium (hypoK & hypoCa)
- Easier to get:
  - urinary collection/day
  - volume of fluid intake/day

**How to adapt nutritional support in HPN adult patients?**

- What are the nutritional needs of a patient?
- How to cover the needs for this patient?
  - Partial PN- is better than total PN-dependence
  - Management of primary disease has to be optimal
- How to evaluate PN dependence?
For example, an important discrepancy may exist in a patient between its potential for achieving oral autonomy with diet alone (i.e., its rate of absorption for energy/protein and/or water/salt indicate positive balance whereas its HPN prescription is still important: i.e., more or equal than 3 infusions per week) (27).

Indeed, initial overuse of PN upon entry into a study of diet, growth hormone and glutamine therapy may explain, in part, the long-term success at weaning from PN over time with modified diet + glutamine alone, long after a short course of growth hormone was completed (29).

Noteworthy, a parallel 3-arm study, comparing PN-dependent short bowel syndrome patients given either an individualized modified diet + oral glutamine (control), individualized modified diet with growth hormone alone or the modified diet with growth hormone + oral glutamine showed that a significant decrease in PN needs occurred in the control group during a one-month treatment period, although it was significantly less than the one achieved in the two other arms (30).

Insufficient oral intake or «oral failure» - not directly dependent on the intestinal condition - is another caveat which compromise oral autonomy and may also induce a higher than needed PN delivery.

In that circumstance, apart from psychological evaluation, one may decide having a period of naso-gastric tube feeding in order to properly evaluate absorptive capacity of the remnant gut. This management may be justified because a high degree of PN dependence with IV “hyperalimentation” may accelerate, as demonstrated in the past, the occurrence of metabolic complications: i.e., liver failure (see this chapter) (31).

How to adapt nutritional support?

- Therapy of diseases should be optimized* :
  - Surgical for : - Crohn’s & radiation enteritis
  - Medical for : - Celiac, Crohn’s, CIPO...
  - Endoscopy for Crohn’s : eg, prosthesis for stenoses...
  - Endoscopy for CIPO : eg, double-lumen gastrostomy with gastric aspiration & jejunal perfusion...

- To access the gut in order to feed the gut and the patient through the gut, i.e., partial, non exclusive mode of PN

Fig. 13 * In HPN ESPEN Book, F Joly & B Messing, to be published

How to adapt nutritional support?

Prognosis is worse in Exclusive HPN (nil po) than in Partial HPN (non negligible enteral feeds)

Consequences :

<table>
<thead>
<tr>
<th>Total</th>
<th>Partial</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2-6</td>
</tr>
<tr>
<td>Lower</td>
<td>Higher QOL</td>
</tr>
<tr>
<td>Higher</td>
<td>Lower rate of complications*</td>
</tr>
</tbody>
</table>

Fig. 14 * higher PN dependence has more frequent line connections & higher IV loading implying greater risk of complications (eg, Stanko RT, Gastro 87. Messing B, Nutrition 92).

Intestinal Resection

To decrease PN dependency?

- In chronic radiation enteritis : yes°
- In crohn ’s disease : yes°
- in CIPO without systemic fate : ? +*

° «It is better to have a short gut than a longer but non functioning gut»
° M Irving et al Gut 1994, F Joly et al ESPEN 2003 (a total of 10 patients)
  Messing B et al Gastro 1995
7. Patient Management

Two principles apply to obtain in a patient the minimum required level of PN dependence:
- avoid, as much as possible, exclusive or total IV feeding and
- implement, as much as possible, enteral feeding.

Indeed, prognosis of HPN patients was shown to be significantly better in patients with no bowel obstruction than in patients with chronic obstruction (e.g. Crohn’s or radiation enteritis patients).

So, the lesson issued from this observation is that it is better to have a functioning and accessed short gut rather than a longer but non functioning gut (8).

In our tertiary care center we therefore discuss every case in order to:
- re-establish colonic continuity in SBS patients whatever the age of the patient or the percentage of remaining colon (if > to 30% of a full colon (32)) or the recto sigmoid alone provided a normal anatomy and function after treatment with short chain fatty acid enemas (33): in these cases, hydro mineral and energy balance (34) improve and the numbers of PN cycles per week decrease;
- perform bowel resection in patients with multifocal obstructive disease (e.g. in radiation enteritis plus a left colostomy if the anorectum is involved by the disease): in these cases, patients may recover normal fluid intake and enjoy again food intake as large as possible, with a benefit of a reduced PN dependence.

SBS treatment : postoperative phase

- Fluid and electrolyte monitoring is needed several times /day until equilibrium status is obtained (Vanderhoof, 1997)
- Gastric hypersecretion gastrique contributes to water and electrolyte losses. Anti H2 receptors antagonists or proton pump inhibitors are needed. Octreotide can be useful for secretory diarrhea (Nightingale, 1993).
- Parenteral nutrition must be initiated early, on a separate venous access.
- Parenteral nutrition is able to attenuate body weight and fat-free mass depletion, and to improve long term survival (Gouttebel, 1986).

Mr Ba.. : SGC type II with Jejunal reverse segment

- Protein Absorption in g/ Kg/ Day

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
<th>120</th>
<th>140</th>
<th>160</th>
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<td>3</td>
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</tbody>
</table>

* Percent of Oral Autonomy : Total Absorption / 1.5 x REE

55 yr old Patient; mesenteric arterial infarction; J(40 cm)-C anastomosis

Management of HPN : examples

- In SBS, attempt to re establish colonic continuity should always be discussed
- In SBS, “solid”oral free hyperalimentation should be encouraged instead of restrictive regimens
- In SBS with secondary anorexia, enteral nutrition through gastrostomy may decrease PN dependence
Indeed the macronutrient absorption of a very short remnant bowel is never negligible and the net balance increases with increased intake of free oral solid foods as large as 3-fold the patient’s Resting Energy Expenditure (REE) (27, 35).

The behavior of hyperphagia should be encouraged with no futile solid food restriction since it promotes "physiological" adaptive intestinal process (34) and gives some patients with borderline remnant gut a full oral nutritional autonomy.

The latter lesson is derived for our large experience with balance studies on western free solid food feeding to determine net intestinal absorption (In-Out): "In" being measured either with dietary enquiry or with duplicated diets and "Out" by 3-day stool collections (27, 28, 35).

To this regard, our HPN management in a patient with chronic intestinal failure is a two-stage process:

1. First, with a goal of restoring a low normal BMI in under weight patients, we implement a 6-cycle PN regimen per week with a PN-free day - water electrolytes only if necessary (23), each cycle being no more than 1.3 fold the REE (19) together with a free solid oral feeding pertaining a non occluded gut (34);

2. Second, with a goal of maintaining a near normal nutrition status, we tried to reach, step by step, a minimum number of cycles per week (22); water-electrolytes needs being dissociated from energy-protein needs, especially in SBS patients type I, where the fluid balance is more difficult to achieve than the energy balance. Indeed, it was showed that 20% of these patients require only a water-electrolyte supply (23).
8. Conclusion

- Management of HPN must be an integrated part of the management of the disease which has led to chronic intestinal failure.
- We have new tools which allow to better delineate, in short bowel patients, transient from permanent; i.e., irreversible intestinal failure.
- A better prognosis is observed in HPN patients having a short but functioning gut than in patients with a longer but non-functioning gut.
- Along with medical therapy, dietary management (27, 28, 34, 35) of intestinal failure due to very short bowel is a crucial point which may reduce the PN dependence at its lower level, therefore decreasing the risk of technical and metabolic complications associated with long term HPN.
- Indeed, HPN for intestinal failure must not be viewed as “hyperalimentation” but rather a complete nutrition support for each PN cycle with a minimum number of nocturnal cycles per week. This is better observed in patients in which hyperphagia takes place.
- Then, HPN is in most cases, a complementary non-exclusive mode of nutritional support.

PN dependence: a complicated matter

Weaning off PN attempt: parameters to check

- Diuresis and natriuresis
- Transthyretin
- no obvious dehydration: weight, Ht, creat
- K & Mg
- Albumin
- micronutrients

Management of HPN

- Should be an integrated part of the management of the primary disease which has led to Intestinal Failure (IF)
- Outcome is better in functioning and accessed short gut than in a longer non-functioning gut
- Absorption of the (very) short remnant functioning bowel is never negligible
- In SBS patients Transient IF can be distinguished from permanent “irreversible” IF

Conclusion: Management of HPN Nutrition Support

- HPN is not Hyper alimentation
- HPN is a full complete IV support per cycle
- A minimum Number of cycles per week should be tried after reaching an “optimal” BMI
- Protein / calorie input should be dissociated from the hydroelectolytes / minerals needs
- In most cases, HPN is a complementary, non exclusive mode of nutritional support
References

3. Guidelines for the use of parenteral and enteral nutrition in adult and pediatric patients. JPEN J Parenter Enteral Nutr 2002;26:15A-1385A.