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Home Parenteral Nutrition Part I: Essential Steps for Safe Transitions from Hospital to Home



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Home parenteral nutrition (HPN) is a complex, high-risk therapy used in patients with prolonged or chronic intestinal failure (IF) who require long-term nutritional support. Preparation for HPN typically begins during an acute hospitalization once a clinical indication for home therapy is identified. In the United States, after the need for HPN is established, case management verifies insurance authorization for nursing and home infusion services. Patients who meet clinical and financial eligibility criteria require appropriate central venous access and stabilization of their parenteral nutrition (PN) regimen prior to discharge. If the responsibilities associated with home therapy are accepted by patients and caregivers, comprehensive education is essential to ensure understanding of HPN therapy. It is equally important that the acute care provider establishes a clear transition plan to outpatient care, with designated providers assuming responsibility for ongoing PN prescribing, monitoring, and follow-up. This review summarizes key considerations and steps for a safe hospital discharge and successful transition to home.

BACKGROUND

Parenteral nutrition (PN) is a goal-directed intravenous fluid that provides macro- and micronutrients based on energy, protein, fluid, electrolyte, and micronutrient needs assessed at the time of PN initiation. The successful use of PN began in the late 1960s when Dr. Stanley

Dudrick and colleagues demonstrated its ability to support growth and survival in hospitalized patients with nonfunctioning gastrointestinal (GI) tracts (i.e., intestinal failure [IF]).¹ At that time, PN was limited to the inpatient setting due to the lack of technology for compounding and administering PN in the home environment. Now, 60 years later, most patients with prolonged or chronic IF receive PN support for weeks, months, or years after discharge from acute care.

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A variety of conditions may result in IF, including diseases affecting the GI tract and surrounding organs, bowel injury, extensive bowel resection, or intestinal bypass procedures. These conditions can significantly impair absorption of essential nutrients and fluids necessary to maintain nutritional status and hydration, and for long-term survival. When IF is diagnosed, PN is required to provide calories, protein, fluids, electrolytes, vitamins, and minerals intravenously.²

Sub-classifications of IF are defined as:²

- Type I: Acute, short-term IF resolving during the acute care encounter
- Type II: Prolonged acute IF lasting weeks to months
- Type III: Chronic IF requiring PN for months to years

The exact prevalence of IF in the United States is unknown, though it is estimated that 25,011 patients in the United States require HPN.³ These data indicate there is a significant patient population receiving HPN, underscoring the importance of gastroenterologists, internists, oncologists, general practitioners, and nutrition support clinicians understanding principles of safe PN management. This review focuses on practical considerations for hospital teams of HPN candidates.

Discharge Preparation for Home Parenteral Support

Identification of a patient requiring prolonged PN support should immediately trigger the HPN discharge planning process. Key steps for ensuring a safe transition from hospital to home include:

- Identification of appropriate patients
- Verification of suitable central venous access
- Stabilization of the PN formulation and infusion regimen
- Coordination of insurance benefits and home healthcare services
- Patient and caregiver education
- Identification of accountable providers to manage care following discharge

- Clear communication among all parties involved at the time of discharge

The managing inpatient team must recognize the complexity of the process, as it may require several days to more than a week to complete all of the steps. Prompt consultation with the care coordinators and nutrition support specialists will initiate the cascade of events required for a safe and timely discharge.

Patient Selection

Identification of patients with clinical indication for HPN is the first step in the discharge process (Box 1). Once clinical eligibility is established, other key criteria must be met. The minimum criteria for HPN include⁴

- Stable housing
- Reliable utility services - electricity for refrigeration, running water for sanitation, and telephone access to communicate with the care team
- Geographic proximity to medical providers, home healthcare agencies, and a laboratory testing facility
- Ability to understand the goals of HPN therapy and importance of adherence to provider-directed guidelines
- Insurance authorization (United States)

Not all patients discharged on PN meet the necessary requirements for safe HPN. In some cases, patients may require discharge to the home of a family member or a friend while receiving HPN services. When safe and appropriate housing

Box 1. Indications for Long-Term Home Parenteral Nutrition⁸

- Bowel obstruction – mechanical or pseudo-obstruction
- Enterocutaneous fistula (non-repairable)
- Intestinal dysmotility disorders
- Malabsorption
- Mesenteric ischemia
- Radiation enteritis
- Short bowel syndrome
- Severe malnutrition

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Table 1. Central Venous Access Devices for Home Parenteral Nutrition Support^{5,6}

Catheter Type	Benefits	Risks
Peripherally Inserted Central Catheter (PICC)	• For short term HPN (≤ 6 months) • Least expensive • Low risk and least painful placement • Easily removed - home or clinic • Lower rate of CLABSI	• Easily displaced • Requires x-ray verification of tip location • Increased risk of blood clots • Limits self-care
Tunneled Catheter	• For long-term use (years) • Discrete exit site • Internal cuff anchors and provides microbial barrier • Easy self-care	• Placement by radiologist or surgeon • Removal in a medical setting
Implanted Catheter	• For long-term use (years) • Discrete exit site • Can intermittently de-access	• Requires access by a skilled clinician • Placement by radiologist or surgeon • Difficult to treat if infected • Invasive removal

Abbreviations: HPN, home parenteral nutrition; CLABSI, central line associated bloodstream infection.

is unavailable, placement in a skilled nursing facility may be required. Barring any barriers, patients who understand and accept the goals, risks, and responsibilities associated with HPN infusion therapy may proceed with discharge.

Central Venous Access

Central venous access is essential for HPN infusion therapy; peripheral intravenous catheters are unstable and not suitable for concentrated solutions used for long-term PN support. The most common types of central venous catheters (CVCs) used for HPN infusions and the associated benefits and risks of each catheter type are listed in Table 1.^{5,6} Selection of the proper CVC is patient-specific and dependent on several factors including: the patient's clinical condition, anticipated length of need for HPN, and whether or not the patient requires central access for other non-nutrition therapies.

The tip of the CVC should be positioned in the distal superior vena cava (SVC), inferior vena

cava, or at the junction of the SVC and right atrium for rapid dilution of concentrated PN solutions. Catheter displacement occurs most frequently with peripherally inserted central catheters (PICCs), which depend on external securement devices for stability. PICC migration may occur during routine dressing changes secondary to catheter manipulation, or as a result of coughing, emesis, vigorous physical activity, high-pressure infusions, or high-frequency ventilation.⁷ Tunneled catheters also carry a risk of displacement; however, this is less common because the catheter is sutured in place for approximately 4-6 weeks to allow tract maturation and tissue growth into the Dacron cuff. The cuff serves a dual purpose; it anchors the catheter in place and is a physical barrier to prevent skin flora migration through the tract and into the bloodstream. Visible exposure of the Dacron cuff may indicate catheter migration, necessitating prompt notification of the managing clinical team. Although uncommon, displacement of implanted ports may also occur.

Primary prevention strategies are essential for reducing the incidence of and facilitating early detection of localized infections and central line-associated bloodstream infections (CLABSIs). Vascular access beyond what is clinically necessary increases exposure risk to infectious pathogens. Therefore, expert opinion advises placement of catheters with the least number of lumens while allowing one to be dedicated for PN infusion only.^{8,9}

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Table 2. Refeeding Syndrome Identification and Risk Avoidance Guidelines¹⁰

Definition	- The metabolic and physiologic responses of shifts in body fluids and electrolytes with initiation of feeding by mouth, by enteral tube, or with intravenous dextrose, amino acids, and lipid emulsions - Highest risk for developing RS is in the first 5 days of feeding
Clinical Features	- Hypophosphatemia - Hypokalemia - Hypomagnesemia - Cardiopulmonary edema - Peripheral edema - Wernicke's encephalopathy
Risk Factors	- Anorexia nervosa - Alcohol and substance abuse disorders - Recent weight loss (intentional and unintentional) - Patients with malnutrition or risk of malnutrition - Known intestinal malabsorption - Renal failure managed with dialysis - Critical illness - History of bariatric surgery - Recent bowel resection - Malignancy - Starvation
Risk Reduction	- Do not start feeding if serum K < 3.0 mg/dL, P < 2.0 mg/dL, or Mg < 1.0 mg/dL - Initiate PN with only 10-20 kcal/kg the first day* - When serum K, P, Mg are stable in normal ranges, then calories increase by 33% every 1-2 d - Give at least one dose of thiamine prior to initiation of PN and include 100 mg of thiamine in the PN for at least 5-7 days
Management in Case of Occurrence	- Check serum K, P, Mg every 12 hours, or more frequently, if giving electrolyte repletion - Do not advance calories if still replacing electrolytes - In severe cases, when K, P, Mg levels drop below levels above, hold the PN during electrolyte repletion to safe levels

Abbreviations: RS, refeeding syndrome; K, potassium; P, phosphate; Mg, magnesium; PN, parenteral nutrition

*Includes all sources of calories and dextrose

To ensure proficiency in PN administration and reduce the risk of CLABSI, it is essential that HPN patients and caregivers receive infection prevention education prior to discharge (Box 2). Additionally, patients and caregivers are instructed to promptly report signs and symptoms of infection, including fever, to the healthcare team.

Parenteral Nutrition Optimization

Determination of PN fluid and nutrient composition considers the patient's underlying disease state, level of physical activity, and capacity to consume and assimilate nutrients and fluid from oral intake. By evaluating the patient's nutrition requirements

and absorptive capacity, the nutrition support team (NST) can provide recommendations for initiation of PN and determination of a patient-centered HPN regimen.

Many hospitalized patients have some level of malnutrition at the time of PN initiation. The hospital providers should consider the risk of refeeding syndrome (RS) when ordering PN. Although not the focus of this review, Table 2 highlights important points to consider when ordering PN for patients with risk of RS. The usual mantra for feeding patients at risk of developing RS is: "start low and go slow." Initiate feedings with $\leq 50\%$ total calories, ≤ 1 g protein/kg/d, and

Box 2. Elements of Patient Education for Home Parenteral Nutrition

- HPN goals
- Roles of NST members, Infusion Pharmacy, Home Health agency, Medical team
- Home environment requirements
- Infection Prevention - clean technique, handwashing, PN/supply storage
- Infusion pump operation and management
- Step-by-step process of PN bag preparation and infusion
- Catheter care maintenance
- Self-monitoring-preventing, recognizing, and reporting complications
- Contact information for the medical team, infusion pharmacy, and home nursing agency
- Medical follow-up expectations and appointments

Abbreviations: NST, nutrition support team; PN, parenteral nutrition; HPN, home parenteral nutrition

doses of potassium, phosphate, magnesium, and thiamine as medically appropriate per interpretation of labs.¹⁰ Once serum chemistries are stable and within normal ranges, the calorie and protein concentrations of the PN solution are advanced toward the goal formula to meet assessed needs.

When the patient has stable blood chemistry levels with adequate serum glucose control on the “goal” PN formula, then the infusion time can be shortened (i.e., cycled). Compression, or cycling, of PN infusions refers to administration of the entire PN bag over a specific duration of time within a 24-hour period. The primary goals for cycling PN infusions are to enhance the quality of life (QoL) of the patient by allowing time disconnected from the infusion pump and PN bag, and to simulate normal metabolic patterns of feeding and fasting. The amount of time off the PN depends on:

- A patient’s ability to eat and drink for comfort and hydration
- The nutrient composition of the PN solution
- The patient and caregiver’s usual daily schedule
- Patient preference

Cycling the PN infusion often happens over several days. Ideally, this process should take place in the hospital to simulate home infusion conditions while allowing for close monitoring of the patient’s hydration status (including 24-hour urine volume), glucose control, and electrolyte balance without additional IV fluids or electrolyte replacements.

To establish PN formula stability, it is recommended for patients to remain in the hospital for at least 48 hours receiving only the “goal” PN formula.¹¹ In general, laboratory monitoring in the home setting is done no more than once a week, and homecare pharmacies compound and dispense HPN on a weekly schedule. Therefore, patients requiring laboratory monitoring, PN formula changes, and/or fluid or electrolyte replacement every few days are not yet stable to receive weekly PN deliveries and should remain in a medical facility that can respond to their dynamic metabolic needs.

Patient/Caregiver Education

HPN education should commence once the patient is deemed an appropriate candidate, CVC access is established, and their medical/surgical status is stable. The HPN educator assesses the patient’s literacy level, emotional acceptance of their need for HPN, and physical ability to perform required tasks (e.g., dexterity to open multivitamin vials and strength to connect pump tubing to the PN bag). Most patients will need a care partner to participate in the initial discharge training session(s), as the process of PN infusion is technical and can be overwhelming. Box 2 lists the elements required for HPN education.

Educators should provide both written materials and hands-on training in one or more sessions prior to discharge. Instructional videos may serve as helpful adjuncts to traditional training methods. A recent study found that training videos reduce CVC complication rates in those receiving HPN.¹² Utilization of a standardized checklist of the necessary steps for safe discharge on HPN can improve lines of communication with the patient and other healthcare providers.¹³

At the minimum either the patient or their caregiver should receive hands-on training to:

- Prepare a workspace

(continued on page 20)

(continued from page 18)

- Perform infection prevention measures including handwashing
- Prepare the PN bag for infusion
- Operate the infusion pump
- Connect the PN tubing to central venous access
- Maintain the central venous access device

Additionally, reinforcement of safety measures such as self-monitoring for complications and what to do in the event of a problem are all vital elements of the education process. A key element of the training is the return demonstration by the patient/caregiver, in which they demonstrate competency in carrying out the required tasks. Greater acquisition of skills by the patient/caregiver at the time of discharge will aid in increasing confidence in the home setting to administer the PN. Depending on the patient's condition and/or caregiver's abilities, hands-on training may take multiple inpatient sessions before the educator can attest to safely discharge.

Care Coordination and Insurance Authorization

When a patient is identified as a potential HPN candidate, the inpatient discharge planner or care coordinator should immediately initiate referrals to home infusion pharmacies and nursing agencies. Either the care coordinator and/or the home health agency will directly contact the patient's insurance company for prior authorization. In some cases, coverage for HPN is limited, and the patient may be required to pay for part of the services (pharmacy or nursing), including applicable co-pays.

Following approval of insurance authorization, the care coordinator will arrange services with a home infusion pharmacy and a home nursing service (if not provided by the infusion pharmacy). Homecare agencies serve as liaisons between patients and the healthcare team after discharge, including:

- Perform health assessments including vital signs and ideally measure weight
- Assess the CVC and perform dressing changes and line care according to the

provider's order

- Collect laboratory specimens
- Report any complications or abnormal findings to the managing team for further evaluation and clinical recommendations

The names and contact information of the homecare providers should be clearly documented in the medical record and disseminated to the patient and the inpatient care team. Near the actual day of discharge, the care coordinator is responsible for transmitting all orders (PN prescription, medications, nursing services, durable medical equipment, etc.) to the home health agencies (Table 3 and Table 4).

Nutrition Support Teams

Ideally, all patients receiving HPN are to be managed by an expert multidisciplinary NST.⁸ NSTs are often composed of physicians, registered dietitians, nurses, and pharmacists (Box 3).¹⁴ Each member of the NST contributes discipline-specific care and often have certification of nutrition support expertise by national credentialing boards.

The organizational structure of NSTs (professional disciplines and number of members) varies across the spectrum of medical facilities and is often dependent on the HPN patient volume. Traditional, hospital-based NSTs are uncommon

Box 3. Nutrition Support Team Members¹⁴

Core Team Members

- Physicians – Internists, pediatricians, gastroenterologist, endocrinologists, and surgeons
- Registered Dietitian Nutritionists
- Registered Nurses
- Registered Pharmacists
- Advanced Practice Nurses
- Physician Assistants

Auxiliary Team Members

- Psychologists
- Social Workers
- Case Managers
- Administrators
- Coding Experts
- Pharmacy Technicians

Table 3. Components of Home Parenteral Nutrition Orders

Order Components	Details
Date and time	Anticipated discharge date
Patient Information	- Name and at least one identifier - Age and date of birth - Height, weight - Diagnosis, HPN indication
PN volume and infusion duration	- Based on fluid requirement and length of infusion - Include at least one hour taper-down
Macronutrients (grams)	- Dextrose, amino acids, lipids - Include lipid type and frequency of infusion if not daily
Electrolyte salts (mEq, mmol)	- Sodium – chloride, acetate, phosphate - Potassium – chloride, acetate, phosphate - Magnesium sulfate - Calcium gluconate
Micronutrients	- Vitamins (MVI-Adult) - Trace minerals
Medications	Insulin, H2RA, Sandostatin
Allergies	Egg, soy/legumes, fish
Infusion route	Catheter type, lumens, tip position
Prescriber information	Name and contact information

Abbreviations: HPN, home parenteral nutrition; H2RA, histamine-2 receptor antagonist

Table 4. Components of Home Nursing Orders

Order Components	Details
Dressing Change Instructions	- Dressing type - Dressing change frequency - Allergy and skin sensitivity interventions - Antiseptic application instructions - Injection cap change frequency - Catheter stabilization device guidelines
Lab Specimen Collection	- Lab test name, frequency, and schedule - Preferred collection method (peripheral) - Blood sampling instructions - Communication of test results
Central Venous Catheter Maintenance	- Catheter position assessment - Disinfecting cap usage instructions
Patient Education	Continue training until patient and/or caregiver have demonstrated competency with procedures.

due to small populations of HPN patients, lack of physician leadership, and defunding by hospital administration. In some settings, patients are cared for by NSTs of healthcare providers from collaborating networks of medical centers, infusion pharmacies, and home nursing agencies. Irrespective of the NST members' physical

locations, all HPN patients should receive ongoing monitoring from each of the core disciplines. This is necessary to reduce the risks associated with PN compounding complexities, CVC maintenance, metabolic and nutrition derangements, and underlying diseases/health maintenance. Clear and efficient communication between the patient, NST,

and home health agency is essential to prevent deleterious complications and optimize QoL.

SUMMARY

Preparing patients for discharge on HPN is a multifaceted process that may require several days to more than a week to ensure a safe transition. The initial steps include identifying patients with a clinical indication for HPN, a suitable home environment, and patient's willingness to accept the risks and responsibilities associated with HPN. Once the patient meets clinical criteria for HPN, the patient's social, emotional, and financial considerations are assessed. In the United States, HPN services (pharmacy and nursing) require insurance authorization. When the clinical, social, and environmental criteria are met for discharge to home, the inpatient team will proceed with PN formulation and infusion stabilization. At the same time the hospital team will engage outpatient medical/surgical providers to assume HPN management upon hospital discharge. Early identification of potential HPN candidates, multidisciplinary collaboration, and clear communication of the PN management plan are fundamental to optimizing patient outcomes and ensuring a safe transition to home with PN support.

Parts II-IV of this Home Parenteral Nutrition series will provide detailed information and practice guidance to manage patients after transitioning to home while receiving PN, address QoL challenges faced by those receiving HPN, and guide weaning of HPN (when possible). ■

References

- Dudrick SJ, Wilmore DW, Vars HM, Rhoads JE. Long-term total parenteral nutrition with growth, development, and positive nitrogen balance. *Surgery*. 1968;64(1):134-142.
- Pironi L, Arends J, Baxter J, et al. ESPEN endorsed recommendations, definitions, and classifications of intestinal failure in adults. *Clin Nutr*. 2015;34:171-180.
- Mundi MS, Pattinson A, McMahon MT, Davidson J, Hurt RT. Prevalence of home parenteral and enteral nutrition in the United States. *Nutr Clin Pract*. 2017;32(6):799-805.
- Adams SC, Gura KM, Seres DS, et al. Safe care transitions for patients receiving parenteral nutrition. *Nutr Clin Pract*. 2022;37:493-508.
- Cuerda C, Pironi L, Arends J, et al. ESPEN practical guideline: clinical nutrition in intestinal failure. *Clin Nutr*. 2021;40:5196-5220.
- Tushar K. Parenteral access devices. In: Chan L-N, Kumpf V, Lord LM, et al. (eds). *The ASPEN Adult Nutrition Support Core Curriculum*, 4th edition. Silver Springs, MD: The American Society for Parenteral and Enteral Nutrition; 2025:435-465.
- Shih CC, Chen SJ, Hsu YP. Timely identified early migration of peripherally inserted central catheter by focused ultrasound. *J Med Ultrasound*. 2018;26(4):215-217.
- Pironi L, Boeykens K, Bozzetti F, et al. ESPEN practical guideline: parenteral nutrition. *Clin Nutr*. 2023;42:411-430.
- Kovacevich DS, Corrigan M, Ross VM, McKeever L, Hall AM, Braunschweig C. American Society for Parenteral and Enteral Nutrition guidelines for the selection and care of central venous access devices for adult home parenteral nutrition administration. *JPEN J Parenter Enteral Nutr*. 2019;43(1):15-31.
- da Silva JSV, Seres DS, Sabino K, et al. ASPEN consensus recommendations for refeeding syndrome. *Nutr Clin Pract*. 2020; 35(2):178-195.
- Roberts K, Shah ND, Parrish CR, Wall E. Navigating nutrition and hydration care in the adult patient with short bowel syndrome. *Nutr Clin Pract*. 2023;38:S59-S75.
- Pierik A, Martins DS, Casey L, Piper HG. Use of instructional videos to reduce central venous catheter complications in children with intestinal failure receiving home parenteral nutrition. *Nutr Clin Pract*. 2021;36(4):872-876.
- Doh J, Hencken L, Mlynarek L, MacDonald N. Utilization of a standardized discharge checklist to improve the transition of care for patients receiving parenteral nutrition. *Nutr Clin Pract*. 2021; 36(4):877-883.
- Lakananurak N, Moccia L, Wall E, et al. Characteristics of adult intestinal failure centers: An international multicenter survey. *Nutr Clin Pract*. 2023;38(3):657-663.

Answers to this month's crossword puzzle:

