

ADVANCES IN NUTRITION

Current Developments in Nutrition Support, Dietary Issues, and Weight Management

Improving Outcomes with Parenteral Nutrition



Donald F. Kirby, MD
 Director of the Center for Human Nutrition
 Medical Director of the Intestinal Transplant Program
 Fellowship Director of the Nutrition Support Fellowship
 Cleveland Clinic
 Cleveland, Ohio

G&H What are the most common indications for parenteral nutrition?

DFK Parenteral nutrition is indicated for hospitalized patients if the gut does not work or the patient cannot or will not eat and the clinician cannot place a tube into the gastrointestinal tract. In this setting, the typical duration of parenteral nutrition is 7–10 days.

Home parenteral nutrition is an entirely separate practice. Two of the main indications for home total parenteral nutrition (TPN) include short bowel syndrome and inflammatory bowel disease; TPN is required when these patients do not have enough gut to maintain fluids, electrolytes, and/or nutrition. Parenteral nutrition can also be indicated on a short-term basis for patients who have complicated surgical problems and enterocutaneous fistulae; surgeons may prescribe TPN for a few months to calm the gut and improve the patient's nutritional status, and then these patients can undergo a take-down of their fistula. Finally, home TPN is sometimes administered to cancer patients, either while they are undergoing treatment or at the end of life. Depending on the indication, patients can be on home TPN for weeks, months, or a lifetime.

G&H When is parenteral nutrition contraindicated?

DFK Parenteral nutrition is contraindicated in any patient who does not have an intravenous (IV) line—either a peripheral IV line for peripheral or partial paren-

teral nutrition, or central venous access for IV nutrition or TPN. Also, while allergies to the components of the TPN solution are rare, they could be a contraindication. Finally, if the patient has an active infection, then clinicians might delay the start of TPN.

G&H Does the indication for parenteral nutrition alter the patient's nutritional requirements?

DFK Absolutely. Patients should undergo a nutrition assessment by a Registered Dietitian before they start parenteral nutrition, and the patient's nutrition can then be tailored accordingly. If patients are underweight, the formula might be tailored to include extra calories to promote growth and weight gain. If patients are at a normal weight, then the goal is to maintain their weight and minimize protein loss. (While most Americans have spare fat in their bodies, there is no storage form for protein, so patients who are not getting enough protein will break down muscles for protein.) For obese patients, clinicians often tailor the nutrition formula to have fewer calories, so that patients will burn some of their fat stores and possibly lose weight.

G&H What are the major complications associated with parenteral nutrition?

DFK Most complications of parenteral nutrition relate to getting access, keeping the line in, or metabolic imbalances. In terms of getting access, clinicians may

encounter technical problems while trying to insert the line, such as pneumothorax, air embolism, or hitting an artery rather than a vein. Some catheters have even caused cardiac perforation, tamponade, and death. Catheter fragments can also become dislodged, which can cause catheter fragment embolism. Finally, if the clinician is using a subclavian approach, there is the potential risk of hitting the brachial plexus.

Once the catheter has been placed, the 2 main complications are infections and thrombosis, both of which clinicians work hard to minimize. Preventing infections is very important in patients on TPN because major infections usually necessitate admission to the hospital and antibiotic treatment; patients with serious infections may also need to have their line replaced, which can be very expensive. In addition, infections that are associated with a blood clot around the catheter can limit the available sites for catheter placement, which can become a major issue in patients who require long-term TPN. In addition to infections and thrombosis, patients can also experience catheter-related problems such as a break or a hole in the catheter. In some cases, patients have even exploded their catheter, for example, if they have left a clamp on the catheter and tried to use a syringe to put something through.

In terms of metabolic complications, parenteral nutrition can cause imbalances in any one of several electrolytes: potassium, sodium, glucose, phosphorus, calcium, magnesium, vitamins, and/or trace elements.

G&H What can clinicians do to try to prevent these complications?

DFK To prevent infections in patients who are receiving home TPN, my colleagues and I have spearheaded a protocol called the ethanol lock. This procedure involves infusing 3 mL of 70% ethanol solution into the catheter; ethanol kills bacteria and fungi and decreases the adherence of bacteria and fungi to the catheter's internal biofilm, so this method is an ideal way to keep the catheter clean. We have shown that infusing ethanol into the catheter can reduce the incidence of catheter-related bloodstream infections.

Previously, antibiotic locks were tried as a way to prevent infections, but patients sometimes developed antibiotic-resistant bacterial infection or fungal infections, so this approach has largely been discontinued. As an alternative to ethanol, a medication called taurolidine is also being considered to help prevent infections. Taurolidine is a potent antiseptic agent derived from amino sulfonic acid taurine; it is not currently licensed in the United States, but it is currently being studied in Europe and Canada.

G&H Is parenteral nutrition best coordinated by a gastroenterologist or a nutritionist?

DFK TPN should be managed using a team approach, but the composition of the team may differ among institutions. In some institutions, IV nutrition is managed by gastroenterologists, surgeons, endocrinologists, or internists trained in nutrition support. In smaller hospitals, a dietitian and a pharmacist often perform the consultation, and then the physician writes the order based on their input. At the Cleveland Clinic, the nutrition support team is a consultative service, but this team manages all the IV nutrition in the hospital, except for in some of the intensive care units.

G&H How does parenteral nutrition affect a patient's quality of life?

DFK Many patients who are on long-term TPN report a quality of life similar to that of patients on dialysis. However, most patients only require dialysis 3 times a week, whereas IV nutrition or fluid management is a daily event. In the hospital, patients start with 24-hour TPN infusions; as they are being prepared for the transition to home TPN, the clinician will ideally cycle them down to infusions of 8–12 hours, depending on the function of their heart and lungs and the volume of fluid required.

Patients receiving TPN at home generally infuse at night. If the infusion rate is 200–300 mL per hour, however, patients often have to use the restroom 2–3 times during the night, so their sleep is frequently interrupted. Patients who work may choose to do their infusions while they are sitting at their desks, which allows them to sleep better and gives them a better quality of life. In general, TPN allows patients to live and function, but it can decrease their quality of life.

G&H What can clinicians do to reduce the duration of parenteral nutrition?

DFK Some patients may have partially functioning gastrointestinal tracts, and the Intestinal Rehabilitation Program at the Cleveland Clinic works with these patients to maximize their remaining gastrointestinal function. We try to work with patients' physiology to determine their optimal diet, and we use medications to slow down the bowel. If these patients can get some nutrition through their gastrointestinal tract, then their need for parental nutrition may be reduced. For some patients, a referral for an intestinal transplantation evaluation may be appropriate.

G&H Is parenteral nutrition adequately reimbursed?

DFK Reimbursement is actually a big problem. Patients on long-term TPN often need to have their solutions rewritten on a weekly basis, but this extra work is not usually covered by insurance. Registered Dietitians really do not receive adequate compensation for all the work they do to manage these very difficult patients, so there are not very many people who want to manage these patients.

G&H Have there been any recent advances in the understanding of parenteral nutrition?

DFK Shortly after TPN was first introduced in the late 1960s, there was much excitement about this technique, which may have resulted in its overuse. For example, I have witnessed some clinicians who would push to give 8,000 calories per day and would even have patients on dialysis to remove the extra fluid! What we have learned over the past 30 years is that parenteral nutrition is a great adjunct for the right patient, but it is also very important to use the gut as much as possible. For many years, clinicians thought of nutrition support as being all-or-none: Either the patient received all their nutrition via tube feeding and oral intake, or they received all their nutrition via TPN, with the hope that they could later transition from IV nutrition back to oral nutrition or tube feeding. Now, we aim to feed people as best we can, however we can. If some nutrition can be given enterally, that is better for the patient because the gut is the largest source of immune tissue in the body, and failure to feed the gut can cause an increase in infectious problems.

G&H Has this new paradigm resulted in better outcomes for patients?

DFK Yes, I think so. Nutrition studies cannot easily tease out the various factors involved in nutrition support, but research suggests that appropriate use of different options is essential for good outcomes. For this reason, having physicians who are trained in nutrition is very important. Unfortunately, few programs offer nutrition training, and there are also very few nutrition fellowships in the United States. At the Cleveland Clinic, we have 2 full-time nutrition fellows every year, and we also train our gastroenterology fellows in nutrition, but nutrition training is not included in many gastroenterology programs. Indeed, there are not enough gastroenterologists who are educated in nutrition to teach all of today's gastroenterology fellows. Thus, we are trying to increase nutrition

education, but this is an area where more help from the gastroenterology societies would be very beneficial.

G&H What further research is needed regarding parenteral nutrition?

DFK We need to continue to look for ways of preventing infections. Research regarding the ethanol lock is ongoing, and I think the tauridolone lock will also be researched further. In addition, we need better catheters in order to reduce problems related to breakage, and we need to decrease clotting in patients receiving parenteral nutrition. Some early studies have evaluated low-dose warfarin as a way to decrease the risk of clotting, but we do not yet have much data on this practice.

Probably the biggest area for research is determining optimal TPN formulations; specifically, we do not know which lipid or which fat emulsion is best for patients. In the United States, the only licensed fat emulsion is soybean-based, but this is a pro-inflammatory fat. In Europe, a fish oil-based fat is available, which may be better for patients, but further research is needed to address this question.

G&H Overall, what can clinicians do to improve outcomes in these patients?

DFK Using a team approach to manage nutrition support is key in larger institutions. This team can include a physician leader, pharmacists, registered dietitians, nurses, social workers, and/or exercise physiologists. If a team approach is not used, TPN may be implemented in patients who do not require it, which can result in wasted resources. Not only does a team approach pay for itself by minimizing unnecessary use of TPN, it also allows for better care. In addition to deciding on optimal venous access and an optimal formula for each patient, the team at the Cleveland Clinic works very hard to optimize quality of life in patients who are receiving IV nutrition, whether in the hospital or at home.

Suggested Reading

John B, Khan M, Speerhas R, et al. Ethanol lock therapy in reducing catheter related blood stream infections in home parenteral nutrition patients. *JPEN J Parenter Enteral Nutr.* 2011. In press.

Rhoda KM, Parekh NR, Lennon E, et al. The multidisciplinary approach to the care of patients with intestinal failure at a tertiary care facility. *Nutr Clin Pract.* 2010;25:183-191.

Opilla MT, Kirby DE, Edmond MB. Use of ethanol lock therapy to reduce the incidence of catheter-related bloodstream infections in home parenteral nutrition patients. *JPEN J Parenter Enteral Nutr.* 2007;31:302-305.

Shatnawei A, Parekh NR, Rhoda KM, et al. Intestinal failure management at the Cleveland Clinic. *Arch Surg.* 2010;145:521-527.

Wagner JJ, Rombeau JL. Nutritional support of surgical patients with inflammatory bowel disease. *Surg Clin North Am.* 2011;91:787-803, viii.

Wanten G, Calder PC, Forbes A. Managing adult patients who need home parenteral nutrition. *BMJ.* 2011;342:d1447.