Parenteral Nutrition

Indications, Access, and Complications

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KEYWORDS

• Parental nutrition • Intestinal failure • Malnutrition • Central venous catheter
• Complications

KEY POINTS

- Parenteral nutrition (PN) is indicated in patients who are malnourished and have intestinal failure.
- Initiation and monitoring of PN is best done by a multidisciplinary team composed of physicians, nutritionists, pharmacists, and nurses who are specially trained in PN prescribing and compounding methods.
- Tunneled central venous catheters are the preferred access for delivery of long-term PN.
- Patients on PN need close monitoring to reduce the risk of thromboembolic, infectious, and metabolic complications.

INTRODUCTION

Parenteral nutrition (PN) is a mixture of solutions that include dextrose, amino acids, electrolytes, vitamins, minerals, trace elements, and lipid emulsions. The formulation is delivered via a catheter device placed directly into the venous system of patients with intestinal failure. The modern PN was clinically implemented in the 1960s, with a recent study estimating that approximately 25,000 patients receive home PN (HPN) in the United States.[1] This article reviews the indications and complications of PN and discusses the various types and indications for devices.

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PARENTERAL NUTRITION INDICATIONS

PN is indicated in patients who are malnourished and cannot tolerate enteral nutrition (EN). Malnutrition is defined as "an acute, subacute or chronic state of nutrition, in which a combination of varying degrees of over nutrition or under nutrition with or without inflammatory activity have led to a change in body composition and diminished function."[2] The European Society for Clinical Nutrition and Metabolism (ESPEN) released a consensus statement in 2015 further defining malnutrition as either a body mass index (BMI) less than or equal to 18.5 kg/m^2 or the combined findings of weight loss greater than 10% of habitual weight, greater than 5% over 3 months, and 1 of the following: (1) reduced BMI less than 20 kg/m^2, or less than 22 kg/m^2 in adults older than 70 years; or (2) reduced fat-free mass index, of less than 15 kg/m^2 in females or less than <17 kg/m^2 in men.[3]

Malnutrition may be from starvation or an acute or chronic disease state. The inflammatory response in acute disease or injury may cause high cytokine levels resulting in metabolic alterations; specifically, increased energy expenditure, muscle catabolism, fluid shifts, and hyperglycemia. All patients being admitted to the hospital or diagnosed with a chronic disease should be assessed for malnutrition risk and severity. The assessment should consider factors such as weight loss, muscle loss, subcutaneous fat loss, diminished hand-grip strength or another measure of functional status, visceral protein levels, albumin and/or prealbumin levels, and inflammatory markers such as C-reactive protein and/or interleukin-6 (IL-6). Multiple assessment tools have been validated to classify patients into low-risk and high-risk malnutrition groups, such as the Nutritional Risk Screening (NRS 2002) and Nutrition Risk in the Critically Ill (NUTRIC) score.

The NRS 2002 tool was developed from the retrospective review of 128 randomized controlled trials (RCTs) of hospitalized patients who were at risk for malnutrition.[4] Patients were included if they had at least 1 of the following: BMI less than 20.5 kg/m^2, weight loss within the last 3 months, reduced dietary intake during the last week, or severe illness. The degree of weight loss, impaired food intake, and severity of disease were all used to create a scale of 0 to 10 points. Patients were then classified into a high-risk group (score $\geq$3) that would benefit from supplemental nutrition.

The NUTRIC score was validated by a prospective, observational study in Europe of 597 patients in the intensive care unit (ICU) to classify critically ill patients into a low-risk or high-risk malnutrition group.[5] The NUTRIC score includes age, Acute Physiology And Chronic Health Evaluation (APACHE II) score, Sequential Organ Failure Assessment (SOFA) score, number of comorbidities, days from hospital admission, and IL-6 level. Score greater than or equal to 5 (without using IL-6) was associated with increased mortality and longer ventilation times and patients with those scores were most likely to benefit from aggressive nutrition therapy including PN.

Patients who are identified at high risk should be started on a nutrition care plan under the direction of a certified nutrition specialist who will assess enteral or parenteral supplementation. EN is always preferred to PN unless there is a contraindication to its use. Absolute contraindications to EN include bowel trauma, intestinal obstruction, active gastrointestinal hemorrhage, and ischemic bowel with hemodynamic instability. Other conditions that may limit EN include gastrointestinal inflammation or infection, severe malabsorption, and small bowel fistulas. If PN is used, the nutrition team should reassess the patient at regular intervals to consider initiating EN and oral feeding when clinically appropriate. PN can usually be discontinued when at least 60% of the patient's nutrition needs are met via EN or oral feeding.[6]

Patients who require PN may be classified as having intestinal failure. This term was recently redefined by ESPEN as "the reduction of gut function below the minimum