

When correctly implemented, specialized nutritional support (SNS) plays a major and often life-saving role in medicine. SNS is used for two main purposes: (1) to provide an appropriate nutritional substrate in order to maintain or replenish the nutritional status of patients unable to voluntarily ingest or absorb sufficient amounts of food, and (2) to maintain the nutritional and metabolic status of adequately nourished patients who are experiencing systemic hypercatabolic effects of severe inflammation, injury, or infection in the course of persistent critical illness. Patients with permanent major loss of intestinal length or function often require lifelong SNS. Many patients who require treatment in chronic-care facilities receive enteral SNS, most often because their voluntary food intake is deemed insufficient or because impaired chewing and swallowing create a high risk of aspiration pneumonia.

Enteral SNS is the provision of liquid formula meals through a tube placed into the gut. Parenteral SNS is the direct infusion of complete mixtures of crystalline amino acids, dextrose, triglyceride emulsions, and micronutrients into the bloodstream through a central venous catheter or (rarely in adults) via a peripheral vein. The enteral route is almost always preferred because of its relative simplicity and safety, its low cost, and the benefits of maintaining digestive, absorptive, and immunologic barrier functions of the gastrointestinal tract. Pliable, small-bore feeding tubes make placement relatively easy and acceptable to patients. Constant-rate infusion pumps increase the reliability of nutrient delivery. The chief disadvantage of enteral SNS is that many days may be required to meet the patient's nutrient requirements.

For short-term use, the feeding tube can be placed via the nose into the stomach, duodenum, or jejunum. For long-term use, these sites may be accessed through the abdominal wall by endoscopic or surgical procedures. The chief disadvantage of tube feeding in acute illness is intolerance due to gastric retention, risk of vomiting, or diarrhea. The presence of severe coagulopathy is a relative contraindication to the insertion of a feeding tube. In adults, parenteral nutrition (PN) almost always requires aseptic insertion of a central venous catheter with a dedicated port. Many circumstances can delay or slow the progression of enteral SNS, whereas parenteral SNS can provide a complete substrate mix easily and promptly. This practical advantage is mitigated by the need to infuse relatively large fluid volumes and the real risk of inadvertent toxic overfeeding.

## APPROACH TO THE PATIENT:

### Requirements for Specialized Nutritional Support

#### INDICATIONS FOR SPECIALIZED NUTRITIONAL SUPPORT

Approximately one-fifth to one-quarter of patients in acute-care hospitals suffer from at least moderate protein-energy malnutrition (PEM), the defining features of which are malnutrition-induced weight loss and skeletal muscle atrophy. Usually, but not always, other features further compromise clinical responses; these features include a subnormal adipose tissue mass, with the accompanying adverse consequences of weakness, skin thinning, and breakdown; reduced ventilatory drive; ineffective cough; immunodeficiency; and impaired thermoregulation. Commonly, PEM is already present at the time of hospital admission and remains unimproved or worsens during the ensuing hospital stay. Common reasons for PEM worsening during hospitalization are refusal of food (because of anorexia, nausea, pain, or delirium), communication barriers, an unmet need for hand-feeding of patients with physical or sensory impairment, disordered or ineffective chewing or swallowing, and prolonged periods of physician-ordered fasting—all potentially

**TABLE 98e-1** BODY MASS INDEX (BMI), MUSCLE MASS, AND PROTEIN ENERGY MALNUTRITION (PEM)

BMI (kg/m <sup>2</sup> )	Skeletal Muscle Mass	Nutritional Status
>30	Normal	Obese
25–29.9	Normal	Overweight
20–24.9	Normal	Normal
>18.5	Decreased	PEM despite adequate or excessive adipose tissue store
>18.5	Decreased	Moderate PEM
<16	Decreased	Severe PEM
<13	Decreased	Lethal in men
<11	Decreased	Lethal in women

taking place in a context of caregiver unawareness and inattention. Most patients who are suffering from in-hospital PEM do not, or ought not, to require SNS. A large proportion of these patients can be expected to improve with appropriate management of their primary disease. Others have a terminal disease whose downward course will not be altered by SNS. In yet other cases, the PEM is sufficiently mild that the benefits of SNS are exceeded by its risks. For patients who fall into this last category, the correct approach is to intensify and/or modify the patient's oral nutrition as directed by the unit dietitian.

PEM is often classified as minimal, moderate, or severe on the basis of weight for height (body mass index, BMI) and percentage of body weight recently lost. As shown in [Table 98e-1](#), the BMI (when corrected for abnormal extracellular fluid accumulation) is a crude but useful indicator of PEM severity. Note, however, that obesity does not preclude moderate or severe PEM, especially in older or bedridden patients; indeed, obesity can mask the presence of PEM if the patient's muscle mass is not specifically examined.

The decision to implement SNS must be based on the determinations (1) that intensified or modified oral nutrition has failed or is impossible, impractical, or undesirable; and (2) that SNS will increase the patient's rate and likelihood of recovery, reduce the risk of infection, improve healing, or otherwise shorten the hospital stay. In chronic-care situations, the decision to institute SNS is based on the likelihood that the intervention will extend the duration or quality of the patient's life. An algorithm for determining when to use SNS is depicted in [Fig. 98e-1](#).

The decision to enhance oral nutrition or—that attempt failing—to resort to SNS is based on the anticipated consequences of non-intervention. The mnemonic “in-in-in” (for inanition-inflammation-inactivity) can serve as a reminder of the three main factors that come into play when deciding whether or not it is acceptable to withhold SNS from a patient with PEM.

**Inanition** Key issues include whether normal food intake is likely to be impossible for a prolonged period and whether the patient can tolerate prolonged starvation. A previously well-nourished person can tolerate ~7 days of starvation without harm, even in the presence of a moderate systemic response to inflammation (SRI), whereas the degree of tolerance to prolonged starvation is much less in patients whose skeletal muscle mass is already reduced, whether from PEM, from the muscle atrophy of old age (sarcopenia), or from muscle atrophy due to neuromuscular disease. Excess body fat does not exclude the possibility of coexisting muscle atrophy from any of these causes. In general, unintentional weight loss of >10% during the previous 6 months or a weight-to-height ratio that is <90% of standard, when associated with physiologic impairment, crudely predicts that the patient has moderate PEM. Weight loss >20% of usual or <80% of standard makes severe PEM more likely.

**Inflammation** The anorexia that invariably accompanies the SRI reduces the likelihood that a patient's nutritional goals will be achieved by intensifying or modifying the diet, by providing counseling, or by hand-feeding. Furthermore, the protein-catabolic