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SAFE PRACTICES *in Patient Care*

Helping to promote a culture of safety

Over the past few decades, nutritional support has emerged as a vital component in the management of critically ill patients. Nutrition supplies vital nutrients that optimize recovery from illness. Patients in the ICU are predisposed to multiple risks. Malnutrition in the critically ill patient is associated with increased morbidity and mortality. Malnutrition increases the risk of infectious processes; compromises immune status, organ function, and wound healing; and extends hospital length of stay. In their article, Mses. Pash and Escuro provide the evidence supporting early enteral feeding in the ICU.

In the second article, Ms. Escuro describes how the use of feeding protocols, algorithms, and order sets to standardize practice can maximize nutrition support delivery and define practices surrounding route of feeding, enteral feeding access, and when to hold feeding for intolerance and procedures. Ms. Escuro notes that standardized protocols are not static documents; their content should be reviewed and updated regularly to ensure they remain evidence-based and applicable to clinical practice.

Early Enteral Feeding in the ICU

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The goal of nutrition therapy is to meet energy requirements while preserving lean body mass, which may be difficult to accomplish in critically ill populations.[1] An inability to consume adequate nutrition predisposes patients in the intensive care unit to multiple risks. Malnutrition in the critically ill patient is associated with increased morbidity and mortality. Malnutrition increases the risk of infectious processes; compromises immune status, organ function, and wound healing; and extends hospital length of stay. Of particular concern, malnutrition is also associated with increased healthcare resource use.[2]

Current estimates of the prevalence of adult malnutrition range from 15% to 60%, depending on the patient population and criteria used to identify its occurrence.[3] Evidence suggests that, in the presence of a functional gastrointestinal (GI) tract, initiating enteral nutrition (EN) within 48 hours of intensive care unit admission results in reduced hospital mortality and ICU length of stay, lower rates of wound infections, and preservation of immunocompetence of the GI tract.

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Pathophysiology behind Malnutrition in Critically Ill Patients

Soon after surgery, trauma, or any event that results in cardiopulmonary resuscitation, defibrillator shock, cardiac catheterization, and mechanical ventilation, changes in the body's metabolism occur. Overwhelming inflammatory processes can foil conventional techniques of supplying energy and protein to maintain lean tissue mass.[4] Malnutrition or starvation in patients on mechanical ventilators further compromises respiratory insufficiency.[5] Without adequate nutrition, the diaphragmatic, intercostals, and accessory breathing muscles are catabolized for energy, decreasing inspiratory capacity and possibly lengthening the time on the ventilator. A decreased protein intake also may cause a drop in serum albumin levels, lowering oncotic pressure and resulting in pulmonary edema. These factors suggest that adequate nutritional support is important to maintain normal pulmonary function in anticipation of being extubated.[5]

Acute stress from an accident, surgery, sepsis, or serious illness like a myocardial infarction can increase counter-regulatory hormones, cytokines and lymphokines. Weissman indicated that increases in counter-regulatory hormones can lead to catabolism and hypermetabolism.[6] Various stressors including myocardial infarctions and congestive heart failure alter lipid metabolism, which increases triglycerides activity, causing hypermetabolism during acute stress.[6] The body requires a constant supply of energy to accommodate this; if oral food cannot be consumed, then nutrition in other forms, including artificial nutrition support, needs to be provided.[7]

Multiple studies of organ failure have led to the recommendation that EN be started as soon as possible after surgery or in non-surgical pa-

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Early Enteral Feeding Protocols: Bedside Application of Evidence

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Clinical practice guidelines (CPGs), protocols, and pathways have been instrumental in the effective delivery of early nutrition. CPGs are intended to assist critical care practitioners in implementing new information and making informed decisions regarding feeding their patients. CPGs for feeding protocols are a key strategy to maximize the benefits and minimize the risks of enteral nutrition (EN) in the nutritional management of critically ill patients.

Clinical Practice Guidelines

CPGs offer basic recommendations that are supported by review and analysis of (1) pertinent recent literature, (2) other national and international guidelines, and (3) a blend of expert opinion and clinical practicality.[1] Practice guidelines are not intended as absolute requirements. The patient's individual circumstances must always take precedence in guiding the healthcare professional's clinical decisions.

In critically ill patients, many benefits associated with EN are more likely to be realized when EN is initiated within 24 to 48 hours of injury or admission to the intensive care unit (ICU). Guidelines from the Society of Critical Care Medicine (SCCM), American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.), and the Canadian Clinical Practice Guidelines (CCPG) recommend that.[1,2] The Academy of Nutrition and Dietetics Evidence Analysis Library notes that such early initiation of EN may result in reduced rates of infection and reduced length of hospital stay.[3]

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Barriers to Feeding Critically Ill Patients

The development and dissemination of guidelines alone is not sufficient to ensure that they are adhered to at the bedside. To change clinical practice, development must be followed by systematic implementation strategies.[4] The provision of nutrition therapy in ICUs continues to be suboptimal due to variances between what the guidelines say "ought" to be done and what is actually happening in practice.[5,6] Recent literature suggests that, for guidelines to be successfully put into practice, we first need to understand the barriers to changing that practice. Poor standardization of elements contained within a feeding protocol and lack of support from physicians and nurses regarding the protocol may reduce its effectiveness. It is important to assess barriers to evidence-based nutritional strategies that are specific to a clinical area.

In a 2011 study, critical-care nurses were surveyed to identify barriers for enterally feeding ICU patients. The most important barriers identified were:[7]

- Insufficient supply of feeding pumps on the unit (51.2%)
- Lack of availability of enteral formula on the unit (49.2%)
- Other care issues that supersede nutrition (51.2%)
- Delays and difficulties in obtaining small-bowel access (44.4%)
- Inadequate or nonexistent dietitian coverage on weekends and holidays (42.8%)
- No feeding tube in place to start feedings (41.2%)
- Delays in physicians initiating orders to start EN (41%)
- Non-ICU physicians requesting that patients not be fed enterally (40.2%)
- Delays in initiating motility agents in patients not tolerating EN (38.8%)
- Waiting for the dietitian to assess the patient (36.1%)
- Current national guidelines not readily accessible when needed (35%)
- Feeding being withheld too far in advance of procedures (33.1%)

Overcoming these barriers is crucial to changing nutrition practice. The place to start is with a barriers assessment, which may be in the form of a questionnaire, interview, or focus group with the ICU staff—followed by a brainstorming session with key staff members to identify solutions for eliminating each barrier. A feasibility study may also be conducted to identify barriers to practice guidelines adherence. This offers the opportunity to tailor strategies for implementing the guidelines to achieve a consistent approach in practice.

Nutrition Support Protocols

Protocols, algorithms, and feeding order sets may differ in their content and methods of application. These are designed to standardize the delivery of nutrition support, reduce the risks of using EN, and automate the provision of EN. A feeding protocol may include specific recommendations on the following aspects of nutrition support:[8,9]

- Route of feeding (EN vs. PN)
- Initiating and advancing EN
- Delivery of goal volumes to meet patients' needs
- Monitoring gastrointestinal (GI) tolerance
- Managing high gastric residual volumes (GRVs)
- Initiating orders for promotility agents
- Obtaining a small-bowel feeding access in patients experiencing persistently high GRVs

To promote optimal EN delivery and maximize tolerance, the protocol should be evidence-based and clearly outline nursing actions in specific clinical situations. For example, initiating EN and advancing the goal in a timely manner are important elements to include in a nurse-driven protocol. Inclusion of the most recent evidence-based recommendations can empower the nurse to make changes to improve EN delivery.[8]

Enteral Order Sets

Many problems associated with EN orders result in inadequate delivery of formula to patients in critical care settings.[10] Such problems are attributed to under-ordering, frequent cessation of EN administration, and slow advancement to the goal rate.[8]

Patient-specific EN orders should include four elements: (1) patient identifiers, (2) formula type, (3) enteral access delivery site/device, and (4) administration method and rate.[10] Orders can be written as a single specific prescription, or they can be an order set encompassing a larger protocol that directs advancement of EN volume or rate to a goal.[10] Orders may also incorporate transitional feeding orders, which specify gradually adjusting EN rates down as oral intake increases. Ancillary orders may address additional patient care issues (such as head-of-bed elevation and flushing the EN access device).

The EN order form should be adapted to meet the needs of each institution and may be handwritten in the medical record or entered through a Computerized Prescriber Order Entry system (CPOE).[10] Many ICU settings utilize CPOE systems. Detailed order sets with drop-down menus for each element of an EN order are designed to promote safety. Such menus may facilitate standardized advancement of initial administration to goal volumes, uniform EN access flushing volumes, and population-specific ancillary orders.[10]

Order sets also can assist in decision making by specifying a more consistent gastric residual volume (GRV) of two consecutive checks of 250 mL or one check of more than 500 mL before EN is discontinued.[1,8,10] Guidelines for use of promotility agents could be incorporated if a patient is experiencing persistently elevated GRVs.[8]

Studies Evaluating the Impact of Feeding Protocols

The basic design of a feeding protocol study compares the adequacy and clinical effects of nutrition therapy before and after protocol implementation, with goals of improving the timing and initiation of therapy. Such a study also tracks the increase in the number of patients who receive enteral feeding, the delivery volumes, and the total number of days in the first week of hospitalization when patients receive enteral feeding.[11,12]

A multicenter, multinational, observational study evaluated key nutrition practices in 269 ICUs in 28 countries that used a feeding protocol compared with those that did not.[8] Of the 269 ICUs participating in this study, 77% used a standardized feeding protocol. Sites that used a protocol performed better on key nutrition practices: more patients received EN, they received EN earlier, and their nutritional adequacy and intake from EN were higher than in ICUs without feeding protocols.[8]

In the ACCEPT (Algorithms for Critical Care Enteral and Parenteral Therapy) trial, ICUs that use an aggressive intervention of guideline-driven nurse protocols (1) increased the number of days that enteral feeding was delivered in the first week of hospitalization, (2) shortened the average hospital length of stay by 10 days, and (3) reduced mortality by 10% compared with control ICUs that had no protocol.[13]

Taylor and associates evaluated three aspects of an enteral feeding protocol: rapid vs. slow ramp-up rate, different levels for gastric residual volume, and gastric vs. small-bowel feeding. He reported that a more aggressive regimen nearly doubled the volume of enteral feeding delivered and improved patient outcomes.[14] The aggressive protocol (start at goal rate on Day 1; set the gastric residual volume at 200 mL, and attempt to infuse into the small bowel) reduced infections, overall complications, and hospital length of stay, in addition to hastening recovery of neurologic function in head-injured trauma patients compared with a conservative protocol (with slow ramp-up, lower residual volumes set at 150 mL, and infusing feeds into the stomach).[14]

Studies by Pinella et al.[15] and Montejo et al.[16] that assessed gastric residual volumes showed that raising the cutoff value of gastric residual volumes to 250–500 mL led to improved feeding tolerance and increased the volume of enteral feeding delivered, without increasing adverse effects such as aspiration and pneumonia.

In 2012, Kiss and associates[17] investigated the impact of a newly implemented nutrition support algorithm by evaluating pre- and post-implementation nutrition care outcomes. Implementing the algorithm resulted in improved provision of energy and protein delivery to ICU patients.[17] The authors also concluded that nutrition care outcomes may be further improved by including a dietitian or a nutrition support team in the ICU. The study's algorithm specifically targeted EN-eligible patients and addressed the timing of initiation, selection of the EN formula, determination of target energy requirements, incremental increases in feeding volume, assessment of GI intolerance, and strategies to improve tolerance or change feeding route. The feeding protocol also defined indications for PN, additives to PN, and the monitoring of tolerance. [17]

In the PEP uP (Enhanced Protein-Energy Provision via the Enteral Route Feeding Protocol in Critically Ill Patients) study, U.S. and Canadian sites evaluated the feasibility of using the PEP uP Protocol and nursing education package.[18] Unlike previous protocols that advocated ramping up slowly to goal, this protocol advocated starting at goal rate with automatic initiation of prokinetic agents and promotion of volume-based feeding. Use of the PEP uP protocol resulted in significantly more total protein and calorie delivery than baseline values and the control group in the follow-up phase. There were no differences in complication rates, and nurses considered the protocol to be safe and easy to use. Key components of the PEP uP Protocol follow:[18]

- Start tube feedings at the target rate. The protocol uses a volume-based goal in which nurses can increase the hourly rate, depending on how many hours are left in the day, to ensure the patient receives the 24-hour volume within the day.
- Initiate a "trophic or trickle EN" (10–30 mL/h) for patients deemed unsuitable for high-volume intragastric feedings. This is the minimal volume of EN needed to maintain GI structure and function; it is not designed to meet the patient's nutritional needs.
- Utilize a semi-elemental feeding formula to optimize tolerance in the early phase of critical illness. Then switch to a traditional polymeric formula after the patient is tolerating adequate amounts.
- Prescribe protein supplements when EN is initiated, and discontinue if EN is well tolerated.
- Start motility agents the same time EN is started. Reevaluate to see if it is necessary to continue.
- Liberalize the gastric residual volume (GRV) threshold.
- Monitor nutritional adequacy daily (volume of EN received in last 24-hour period divided by prescribed 24-hour target volume) and report this percentage intake on daily rounds.

Although the PEP uP study was small, it brought several issues to light beside the care elements themselves. The guidelines were reasonably effective, but nurses followed them without proactively making inquiries or decisions. That underscores the need for comprehensive nursing education-directed intervention and greater buy-in for interdepartmental collaboration.

Elements of an ICU Feeding Protocol

Time to initiate/advance EN

To maximize clinical benefits while minimizing the risk of malnutrition and potential complications, clinicians must adopt evidence-based practices for timely initiation and advancement of EN. In critical illness, SCCM, A.S.P.E.N., CCPG, and the Academy of Nutrition and Dietetics Evidence Analysis Library recommend that EN be started early (i.e., within 24 to 48 hours of injury or admission to the ICU).[1-3] Guidelines suggest attempting to advance EN to at least 60% to 70% of the energy intake goal throughout the first week of hospitalization to achieve clinical benefits.[1]

Patient positioning (head-of-bed elevation)

Unless medically contraindicated, practice guidelines recommend elevating the head of the bed 30º to 45º when during EN infusion and for at least 30 to 60 minutes after bolus/intermittent feedings, to prevent aspiration and pneumonia.[19] Recognized contraindications to a semirecumbent position are an unstable spine, hemodynamic instability, prone positioning, and certain medical procedures (such as central venous catheter insertion).[20]

EN Interruption for Procedures

One barrier to optimal delivery of nutrition support is interruptions in EN infusion for procedures. Institutions routinely withhold EN beginning at midnight prior to scheduled procedures. Concerns that critically ill patients are at a higher risk for aspiration of stomach contents attributable to gastroparesis, reflux of bowel contents, or reduced airway protective defenses (with resultant pneumonia) perpetuate this practice of prolonged fasting prior to operative procedures.[21] The guidelines developed by the American Society of Anesthesiology are commonly used in making decisions about fasting periods prior to a procedure. These guidelines are available at http://www.asahg.org.

Procedures may be delayed or postponed, leaving the patient without nutrition for far longer than the standard 8-hour fast. If it becomes obvious the procedure will not be completed on the expected day, the patient may be ordered to resume feeding and start fasting again at midnight, only to have the process start again. Over the course of a few days, the patient may be starved for extended period of time and accumulate a significant caloric debt.[22]

In 2009, Pousman and colleagues showed that a reduced fasting protocol (i.e., discontinue feeding 45 minutes prior to selected procedures if receiving gastric feeds) was feasible, with trends toward improving nutrition delivery and no increase in adverse outcomes.[21] However, the results did not reach statistical significance. A 2012 pilot study of intubated surgical ICU patients showed that perioperative continuation of postpyloric EN was feasible in some critically ill patients and could result in additional calories provided.[23] Such an effort requires a close multidisciplinary effort: ICU, surgery, anesthesiology, nutrition therapy, and the operating room need to agree on, implement, and follow standardized guidelines for a reduced fasting protocol.

Gastric Residual Volume (GRV) and Use of Promotility Agents

In clinical practice, GRV is used as a surrogate for gastric motility and remains the most common method for assessing EN tolerance in critically ill patients.[24] McClave et al. suggested that an increasing trend over time in GRV may be the best marker of intolerance and feeding algorithms should be modified to reflect this.[25] Metoclopramide is currently the only FDA-approved promotility agent; however its use is limited by its potential for central nervous system side effects and resultant black box warning.

Although erythromycin is not FDA-approved for gastroparesis, it has been used as a promotility agent. In 2007, Nguyen and colleagues demonstrated that "rescue combination therapy" (dual metoclopramide and erythromycin administration) in critically ill adults intolerant to EN led to much higher rates of successful EN feeding compared to monotherapy.[26] Dickerson and colleagues subsequently confirmed this, where patients with GRV > 200 mL or emesis were given 10 mg intravenous metoclopramide every 6 hours, followed by a dose escalation to 20 mg every 6 hours if GRV did not improve. Combination IV therapy with metoclopramide and erythromycin 250 mg every 6 hours was instituted if increased GRV was observed after dose escalation of metoclopramide alone. The authors reported metoclopramide failure more frequently in patients with traumatic brain injury; therefore, they recommended combination therapy with erythromycin as first-line therapy for patients with gastric feeding intolerance.[27]

> GI function should be evaluated carefully when selecting the best route for feeding critically ill patients.

Gastric vs. Small-bowel Feeding

Patients who are critically ill may have gastrointestinal (GI) dysfunction due to metabolic changes seen in critical illness. GI function should be evaluated carefully when selecting the best route for feeding critically ill patients.[28] Intolerance to enteral feedings can pose an increased risk for pulmonary aspiration of the feedings and can increase the likelihood that the patient will not be provided with his or her goal nutrients in a timely manner, because feedings are always interrupted and withheld if pulmonary aspiration is suspected. Aspiration is the leading cause of pneumonia in the ICU setting and contributes significantly to the overall morbidity and mortality of critically ill patients.[19]

Heyland et al. compared 10 randomized, clinical trials of critically ill patients in which small-bowel and gastric feedings were initiated.[29] They concluded that small-bowel feeding, when compared to gastric feeding, may be associated with reduced gastroesophageal regurgitation, increased nutrient delivery, a shorter time to achieve desired target nutrition, and a lower rate of ventilator-associated pneumonia. The 2009 SCCM and A.S.P.E.N. guidelines state that it is acceptable to provide either gastric or small-bowel feeding in the ICU setting and that small-bowel feeding should be provided if a patient is at high risk for aspiration or shows intolerance to gastric feeding.[1] Patients with clinical conditions known to impair gastric motility and those who are experiencing persistent high GRVs may be good candidates for small-bowel feeding.[1]

When to use Parenteral Nutrition (PN)

Expert recommendations place parenteral nutrition (PN) as a last line resort among critically ill patients who are unable to attain EN for greater than 7 days, if their baseline nutritional status was normal.[30] The other article in this newsletter contains additional details and guidelines regarding circumstances that warrant choosing PN.

Summary

Adequate nutrition support is a key component in achieving favorable outcomes for the critically ill patient. Use of feeding protocols, algorithms, and order sets to standardize practice can maximize nutrition support delivery and define practices surrounding route of feeding, enteral feeding access, and when to hold feeding for intolerance and procedures. Standardized protocols are not static documents; their content should be reviewed and updated regularly to ensure they remain evidence-based and applicable to clinical practice.

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Early Enteral Feeding in the ICU—Continued

tients after admission to the intensive care unit.[6] Typically when insult to the body from injury or surgery is overwhelming, the physiological and immunological reserves are already impaired and multiple organ dysfunctions may occur.[4] Lungs are normally the first to be affected by a decrease in compliance and failure of gas exchange. The cardiovascular system follows, with myocardial depression and reduced peripheral vascular resistance, which may require inotropic and vasopressor support. Often the kidneys shut down, requiring hemodialysis. Then the liver fails, soon followed by GI tract and unconsciousness.[4]

Benefits of Early Enteral Feeding

Nutrition support in critically ill patients reduces protein catabolism and provides the body with nutrients for protein synthesis, immune and after system response, and energy needs. Early EN preserves intestinal integrity and functions, while reducing proteolysis, GI atrophy, multi-system organ failure, trauma, injury, and the rate of infectious (including septic) complications.[5,6,8,9]

EN is accepted as the most desirable form of nutrition support, largely because of evidence suggesting that enteral feeding is associated with reduced morbidity, complications, and costs when compared to parenteral nutrition (PN).[10] Berger et al. studied cardiac surgery patients that suffered complicated clinical courses requiring pharmacological and mechanical cardiac support with prolonged mechanical ventilation. The GI tract appeared functional in such patients and EN support was maintained, even in severe hemodynamic failure, when started after 24–48 hours.[11] Berger's study concluded that EN is possible after 24 hours post-operatively in cardiac-related intensive care.

Kesek et al. evaluated the effect of 73 patients eligible for EN in a cardiothoracic intensive care unit. The patients had surgery for valvular disease, coronary artery bypass grafting, thoracic or thoracoabdominal aortic aneurysms.[12] All patients were on ventilators, and EN was started on the first postoperative day or when it was obvious that the patient would remain on artificial ventilation for several days, showing that early EN is feasible in the post-op cardiac ICU setting.

In the past, delivery of nutrients to the ICU patient was considered a supportive measure. But more recently, with data showing an impact on patient outcome from early enteral feeding and the use of pharmaconutrition, that same nutrition intervention is being viewed as an additional opportunity for therapeutic intervention.[13] Goals of nutrition support therapy now focus on attenuating oxidative stress by downregulating the severity of the pro-inflammatory response and promoting an earlier return to a homeostatic baseline. It has become increasingly apparent that the underused gut can contribute to a pro-inflammatory state in critically ill patients, further emphasizing the role for early EN.[14]

Early Feeding and the Gastrointestinal Immune System

The intestinal epithelium represents a critical barrier against systemic absorption of microbes. Disruption of this barrier may result in translocation or passage of bacteria and their toxic products in the bloodstream.[6,11,15] During stress, intestinal blood flow decreases as blood is shunted to support the metabolic processes needed for tissue repair. That can damage the mucosa, reducing intestinal integrity and increasing the gastrointestinal tract's permeability to bacteria and toxins.[8] Additionally, lack of enteral intake among postoperative and critically ill patients is associated with villous atrophy.[15,16] In the stressed patient, proliferating gastrointestinal tissues may have an inadequate nutritional supply. Feeding the ICU patient may prevent GI proliferation and atrophy.

Evidence shows that preventing villous atrophy by continuously stimulating the small bowel with feeding may prevent translocation of bacteria through the epithelial mucosa to the portal and lymphatic circulation.[5,8] Bacterial translocation is associated with sepsis and multisystem organ failure, which increases the ICU length of stay, as well as time spent on the mechanical ventilation.[6]

GI tract abnormalities can be noticed as soon as four days without nutrition. In a study by Hernandez et al., 15 critically ill patients that fasted for an average of 7.8 days experienced a significant atrophy of the duodenal mucosa, demonstrated by a decrease in villus height and increase in crypt depth.[15] Atrophy in some patients occurred in as little as three days without nutrition.

Use of early EN may be increasing due to the greater availability of soft, small-bore feeding tubes, which simplifies the administration and maintenance of tube feeding. According to Popovich, EN is now accepted as the most desirable method of repletion, largely because of evidence suggesting that enteral feeding is associated with reduced morbidity, complications, and costs when compared to PN.[10] Thus, early EN is desirable in acutely ill patients because it will enhance the GI barrier function, prevent microbial translocation, reduce the hypermetabolic response to injury, and improve clinical outcomes.

Assessment of Malnutrition in the ICU

History behind assessments

In 1996, The Joint Commission mandated that nutrition screening be accomplished within 24 hours of admission. This spawned multiple criteria and methods for identifying malnutrition among hospitalized patients—criteria that were not always evidence-based.[3] Lack of national standardization resulted in widespread confusion and potential misdiagnosis. Also, recent evidence suggests that varying degrees of acute or chronic inflammation are key contributing factors in the pathophysiology of malnutrition associated with disease or injury.[17] Many current screening and assessment protocols fail to recognize the effect that the inflammatory response has on acute-phase protein levels, which are often used as primary indicators of nutrition status.[1,8,19] Measurements of visceral proteins (albumin, transferrin and prealbumin), although probable indicators of inflammation, do not specifically indicate malnutrition and do not typically respond to feeding interventions in the setting of active inflammatory response.[18,20,21]

Latest assessment guidelines

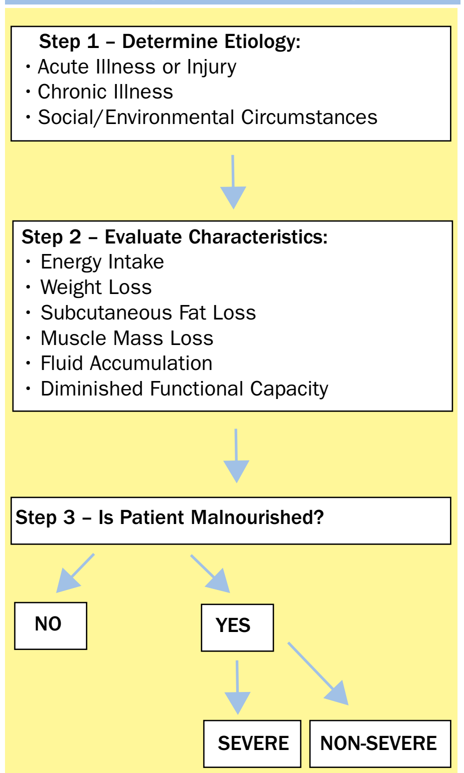
In May 2012, a joint committee of the Academy of Nutrition and Dietetics and the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) published a consensus statement recommending how nutrition status in adult patients should be assessed.[22] The proposed guidelines are a three-step process for determining potential malnutrition etiology and evaluating six clinical characteristics to support a diagnosis of malnutrition (Figure 1). A trained clinician can quickly and easily determine these characteristics at the bedside and by performing a nutrition-focused physical examination. Identification of two or more of the six characteristics is recommended for diagnosis of either severe or moderate malnutrition. The characteristics are routinely assessed on admission and at frequent intervals throughout the patient's ICU stay because the nutrition status may change as the clinical course changes.

Of note, determination of malnutrition etiologies (social/environmental, chronic illness, or acute illness/injury) may not always be clear-cut or may change. Characteristics may not be present in patients at high risk for malnutrition (e.g., trauma) but may be present in patients without malnutrition (e.g., edema). It is important for clinicians to disseminate their data to all members of the healthcare team and for physicians to consider this documentation when contemplating a diagnosis of malnutrition.

Safe initiation of EN During Hemodynamic Instability

EN is advocated as the primary route of nutrition support in patients with functional GI tracts, but its use involves certain risks. GI function is often compromised in the critically ill patient and is a major obstacle to the delivery of adequate nutrition in this population.[23] The clinician is often confronted with the decision of when to proceed with EN in critically ill patients who require vasopressors for hemodynamic support. For this reason, the guidelines set forth by the Society of Critical Care Medicine (SCCM) and A.S.P.E.N. recommend withholding EN from critically ill patients who are not fully resuscitated (as evidenced by abdominal

Figure 1. **Steps for Diagnosing Malnutrition (White et al., 2012)**



distention, increasing gastric residual volumes, rising lactate, and escalating dose of vasopressors).[14] Adequate resuscitation is accomplished by restoring blood volume with intravenous fluids or blood products, optimizing gas exchange through mechanical ventilation, and judiciously using vasopressor or inotropic medications to improve central circulation.[24]

The controversy surrounding the provision of EN to patients with hemodynamic instability is based on reports of bowel ischemia and necrosis.[25] Data addressing whether EN should be initiated in the hemodynamically unstable patient with a hypoperfused intestine are limited. Clinical studies addressing the safety and efficacy of EN during hemodynamic compromise are heterogeneous in design; they vary significantly in their methodology, selection of subjects, sample size, and outcome variables.

Most reports of bowel necrosis have been described in patients receiving EN via surgically placed jejunostomy tubes, regardless of hemodynamic stability or use of vasopressors.[26] For the majority of ICU patients, administration of EN into the stomach during low, stable dosing of vasopressors with close monitoring of intolerance or worsening hemodynamic instability poses very little risk of bowel necrosis.[26] For a critically ill patient on stable or declining doses of vasopressors, start trophic feeds of a 10–20 mL/hour of a standard, polymeric, fiber-free solution; leave at that rate for 24 hours, then reassess. If the patient is tolerating the slow EN rate and the clinical condition is improving, continue to increase the feeding infusion rate.

Indications for Parenteral Nutrition (PN)

As mentioned earlier, EN provides multiple benefits over PN.[10] Experts recommend PN as a last resort in ICU patients if their baseline nutritional status is normal.[27] However, PN has its place. Critically ill patients requiring PN are those who (1) are malnourished at baseline, (2) will not reliably ingest or absorb significant amounts of EN for longer than 7 to 10 days, and (3) are adequately resuscitated from any hemodynamic compromise.[27] Other scenarios where PN is indicated include patients who are hemodynamically stable and have a paralytic ileus, acute GI bleeding, or complete bowel obstruction.

In a recent study that examined PN practices in statewide hospitals, results indicated that nutrition support teams and certified nutrition support clinicians can help reduce the inappropriate use of PN while realizing significant cost savings. In this study, PN was inappropriately prescribed in 32% of the 278 PN cases reviewed, resulting in an extra 552 days and $138,000 in preventable hospital costs over a three-month period.[28]

The timing of when to initiate PN is controversial for critically ill adult patients in whom caloric targets cannot be met by enteral nutrition alone. Guidelines for this vary by continent. A three-year, randomized, unblinded, multicenter study showed that early initiation of PN to supplement insufficient EN during the first week after ICU admission appears to be inferior to the strategy of withholding PN until day 8. Late initiation of PN was associated with fewer infections, enhanced recovery, shorter length of stay, and lower health care costs.[29]

Summary

The delivery of early nutrition support therapy primarily using the enteral route is a proactive therapeutic strategy that may diminish infectious complications, reduce disease severity, decrease ICU length of stay, and favorably impact patient outcomes. The 2009 A.S.P.E.N. enteral nutrition practice consensus statement supports the initiation of enteral feeding postoperatively in surgical patients after placement of an enteral access device—without waiting for flatus or bowel movement within 24–48 hours (Grade A recommendation: prospective, randomized trials support the guideline).[30] Resort to a parenteral route only when absolutely necessary: when the enteral route is contraindicated or in patients who have failed a trial of enteral feeding.

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Upon completion of this offering, the learner will be able to:

1. Determine strategies to optimize delivery and minimize risks of early enteral feeding.
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1. The Society of Critical Care Medicine (SCCM) and the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) recommend initiation of enteral feeding within how many hours of injury or admission to the ICU?

A. 4 to 6 hours
B. 24 to 48 hours
C. 72 hours
D. 120 hours (5 days)

2. Reasons for providing early enteral nutrition are to:

A. Modulate stress and systemic immune response
B. Maintain gut integrity
C. Attenuate disease severity
D. All of the above

3. Which of the following is not a perceived benefit of early enteral feeding in postoperative critically ill patients?

A. Prevents the occurrence of translocation of gut bacteria
B. Encourages atrophy of intestinal villae
C. Limits fewer infectious complications than parenterally fed patients
D. Decreases alteration in intestinal permeability

4. Enteral feeding-associated small-bowel necrosis presents with which of the following combinations of clinical symptoms?

A. Nausea and bloody emesis
B. Fever and constipation
C. Gastrointestinal bleeding and diarrhea
D. Abdominal distention and hypotension

5. Which of the following is an absolute indication for the use of parenteral nutrition (PN)?

A. High-output fistula
B. Crohn's disease
C. Pancreatitis
D. Hyperemesis gravidarum

6. An 85-year-old nursing home resident was transferred to the ICU with anorexia, malnutrition, and respiratory failure with probable aspiration pneumonia. On admission his WBC is 14,000 cells/mcL and creatinine is 1.3 mg/d. Which of the following nutrition plans would be most appropriate for this patient?

A. Start the patient on a regular diet with supplements.
B. Establish central access with a PICC line and initiate parenteral feedings.
C. Establish peripheral access and initiate peripheral parenteral nutrition until enteral feedings can be established.
D. Determine the most appropriate enteral feeding route and establish tube feeding.

7. Compared to gastric feeding, small-bowel feeding is associated with which of the following outcomes in critically ill patients?

A. Longer time to achieve target nutrition
B. Increased nutrient delivery
C. Increased gastroesophageal regurgitation
D. Increased rate of ventilator-associated pneumonia

8. What are some of the evidence-based strategies to optimize delivery of early enteral nutrition?

A. Use a feeding protocol
B. Use promotility agents for persistently elevated gastric residual volumes
C. Small-bowel feeding for high aspiration risk and gastric feeding intolerance
D. All of the above

9. Which of the following is a major risk factor for aspiration in critically ill patients?

A. Gastric residual volume <150 mL
B. Age
C. Decreased level of consciousness
D. Small diameter of feeding tube

10. Which of the following is most likely to improve tolerance of enteral feeding in a postoperative patient with documented high gastric residuals receiving bolus feedings?

A. Hold every other feeding
B. Placing a small bowel feeding tube for continuous feeding
C. Putting the patient in the prone position
D. Starting the patient on cisapride to aid with motility

Participant's Evaluation

What is the highest degree you have earned? (circle one) 1. Certificate 2. Associate 3. Bachelor's 4. Master's 5. Doctorate

Indicate to what degree did this program meet the objectives: Using 1 = strongly disagree to 6 = strongly agree rating scale, please circle the number that best reflects the extent of your agreement with each statement.

At the end of the session the participant will be able to:

	Strongly Disagree					Strongly Agree
1. Determine strategies to oiptimize delivery and minimize risks of early feeding	1	2	3	4	5	6
2. Identify potential barriers to feeding critically ill patients	1	2	3	4	5	6
3. Discuss the pathophysiology behind malnutrition caused by critical health issues	1	2	3	4	5	6
4. Identify clinical charachteristics for asessing malnutrition in ICU patients using the 2012 ASPEN. consensus statement guidelines.	1	2	3	4	5	6

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2	☐	☐	☐	☐
3	☐	☐	☐	☐
4	☐	☐	☐	☐
5	☐	☐	☐	☐
6	☐	☐	☐	☐
7	☐	☐	☐	☐
8	☐	☐	☐	☐
9	☐	☐	☐	☐
10	☐	☐	☐	☐
11	☐	☐	☐	☐
12	☐	☐	☐	☐
13	☐	☐	☐	☐
14	☐	☐	☐	☐
15	☐	☐	☐	☐
16	☐	☐	☐	☐

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