ACG guideline:Nutrition therapy in adult hospitalized patient

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ACG Clinical Guideline: Nutrition Therapy in the Adult Hospitalized Patient

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The value of nutrition therapy for the adult hospitalized patient is derived from the outcome benefits achieved by the delivery of early enteral feeding. Nutritional assessment should identify those patients at high nutritional risk, determined by both disease severity and nutritional status. For such patients if they are unable to maintain volitional intake, enteral access should be attained and enteral nutrition (EN) initiated within 24–48 h of admission. Orogastric or nasogastric feeding is most appropriate when starting EN, switching to post-pyloric or deep jejunal feeding only in those patients who are intolerant of gastric feeds or at high risk for aspiration. Percutaneous access should be used for those patients anticipated to require EN for >4 weeks. Patients receiving EN should be monitored for risk of aspiration, tolerance, and adequacy of feeding (determined by percent of goal calories and protein delivered). Intentional permissive underfeeding (and even trophic feeding) is appropriate temporarily for certain subsets of hospitalized patients. Although a standard polymeric formula should be used routinely in most patients, an immune-modulating formula (with arginine and fish oil) should be reserved for patients who have had major surgery in a surgical ICU setting. Adequacy of nutrition therapy is enhanced by establishing nurse-driven enteral feeding protocols, increasing delivery by volume-based or top-down feeding strategies, minimizing interruptions, and eliminating the practice of gastric residual volumes. Parenteral nutrition should be used in patients at high nutritional risk when EN is not feasible or after the first week of hospitalization if EN is not sufficient. Because of their knowledge base and skill set, the gastroenterologist endoscopist is an asset to the Nutrition Support Team and

INTRODUCTION

The modern era of clinical nutrition began with the development of total parenteral nutrition (PN) by Dudrick in 1966,suggesting for the first time that clinicians could compensate for intestinal failure with the potential to supply nutrients to any hospitalized patient.

The response to these innovative concepts spurred the growth of nutrition support teams and PN-based therapy over the next two decades with the primary objective being to maintain lean body mass, achieve nitrogen balance, and prevent malnutrition.

Meta-analyses showed that, outside the setting of intestinal failure, in the absence of severe malnutrition, PN had little effect on clinical outcomes and actually had the potential to cause net harm.

Early meta-analyses showed that EN was both superior to PN-based therapy and more effective in improving outcome than standard therapy.

Recent clinical trials suggesting that short-term (4–7 days) low-dose “trophic” feeding (permissive underfeeding or hypo-caloric feeding) might be equally as effective as full feeding for the first week of hospitalization.

Support for the benefit of EN-based therapy on clinically important outcomes is derived from five distinct bodies of research in the literature.

Multiple RCTs comparing early vs. delayed EN suggest that feedings started within the first 24 to 36 h of admission to the intensive care unit (ICU) are associated with signifi cantly reduced infection, hospital length of stay, and mortality compared with feedings started after that time point.

RCTs comparing early EN vs. standard therapy (in elective surgery, surgical critical care, and patients being operated on for complications of pancreatitis)

It showed a significant correlation between enteral feeding initiated the day after the operation and reductions in infection, hospital length of stay, and mortality.

Nutrition therapy designed to reduce the caloric deficit has been associated with improved outcomes, as shown by

significant reductions in infection and mortality.

Finally, three decades of mechanistic data in animal models and clinical studies show that early EN helps maintain gut integrity, supports the role of commensal bacteria, reduces the gut/lung axis of inflammation, sustains the mass of gut-associated and mucosal-associated lymphoid tissue,and attenuates systemic inflammatory responses.

Although the intended target patient population of these guidelines is the hospitalized patient, most of the information on providing nutrition therapy is derived from the management of patients in the ICU

Successful nutrition therapy depends on the appropriate assessment of gut function, achievement of enteral access, the creation of protocols to standardize delivery, and an ongoing process to monitor tolerance.

METHODOLOGY

A list of questions and recommendations were compiled by the group of experts on the guideline committee.

The target population for these guidelines was the adult hospitalized patient, unable to sustain volitional intake, expected to remain in the hospital for >3 days.

Table 1. Derivation of rating for quality of evidence (25)

Study design	Initial quality of evidence	Quality adjustors	Final quality of evidence
Randomized trials	High (+++)	Decrease quality: risk of bias, inconsistency, indirectness, imprecision, publication bias	High ++++ Moderate +++
Observational studies	Low (++)	Increase quality: large effect, dose response, adjustment for all plausible residual confounders	Low ++ Very low +
Expert consensus			

Indications for nutritional therapy

Question: Which hospitalized patients should be considered for specialized nutrition therapy and by which route (enteral or parenteral) should it be provided?

Recommendations

1.Specialized nutrition therapy in the form of EN should be initiated promptly in the hospitalized patient who is at high nutritional risk and is unable to maintain volitional oral intake.

2.EN should be used preferentially over PN in hospitalized patients who require non-volitional specialized nutrition therapy and do not have a contraindication to the delivery of luminal nutrients.

3.Specialized nutrition therapy (EN or PN) is not required for hospitalized patients who are at low nutritional risk, appear well nourished, and are expected to resume volitional intake within 5 to 7 days following admission

4.PN should be reserved for the hospitalized patient under specific circumstances, when EN is not feasible or sufficient enough to provide energy and protein goals.

Summary of evidence

Malnutrition remains difficult to define and, therefore, poorly understood.

A multidisciplinary international committee recently divided malnutrition into three categories:

1.Starvation-related malnutrition occurs in the absence of calories and protein, has minimal to no inflammation, and is exemplified by the syndrome of anorexia nervosa.

2. Chronic disease-related malnutrition has a low-grade degree of inflammation and is characterized by disorders such as chronic obstructive pulmonary disease, cancer, and obesity

3. Acute disease-related malnutrition has a high degree of inflammation and is characterized by disorders such as burns, trauma, and sepsis .

In contrast, “nutritional risk” is an important relatively new concept that is more easily defined and is determined by both disease severity and poor nutritional status

Patients who are at high nutritional risk are those patients in a hospital setting who are in greatest need of nutrition therapy and are most likely to see an improvement in clinical outcome in response to aggressive enteral feeding.

Achievement of enteral access and provision of early enteral tube feeding have both non-nutritional and nutritional benefits.

Non-nutritional benefits,which are probably seen in all patients in the hospital setting and may be achieved at lower doses, involve the gastrointestinal (GI), immune, and metabolic responses to the provision of luminal nutrients.

Nutritional benefits are seen in those patients at high nutritional risk, who require higher doses closer to goal caloric/protein requirements, and are needed for protein synthesis and maintenance or restoration of lean body mass

Potential benefits of EN over PN have been suggested in the past by multiple meta-analyses over a wide range of patient populations including trauma, burn, head injury, major elective surgery,and pancreatitis.

More recent trials suggest that the differences in outcome between EN and PN may be diminishing as clinicians increasingly utilize moderate glucose control, better IV lipid formulations, avoidance of overfeeding, and protocolized management of risk (to prevent blood-stream infections, ventilator-associated pneumonia, thrombogenesis, and

so on)

Nonetheless,the risk/benefit ratio of PN is much narrower than that of EN.

Thus, the use of PN should be reserved for high-risk patients when EN is not feasible or sufficient enough to meet energy or protein goals

In a patient at low nutritional risk, provision of EN or PN is unlikely to change clinical outcome.

Absolute contraindications to enteral feeding include mechani-cal obstruction of the GI tract, uncontrolled peritonitis, and ischemic bowel.

Many conditions that were previously considered to be contraindications to enteral feeding may be situations where it is appropriate to provide EN with caution in order to improve outcome. Such conditions include ileus, open abdomen,recent gut anastomoses, GI bleeding, bowel-wall edema, and a stable patient on vasopressor therapy to maintain adequate mean arterial blood pressure

Table 4. Benefits of early enteral nutrition (24)

Non-nutrition benefits
Gastrointestinal responses
Maintain gut integrity
Reduced gut/lung axis of inflammation
Enhance motility/contractility
Absorptive capacity
Maintain mass of GALT tissue
Support and maintain commensal bacteria
Production of secretory IgA
Trophic effect on epithelial cells
Reduced virulence of endogenous pathogenic organisms
Immune responses
Modulate key regulatory cells to enhance systemic immune function
Promote dominance of anti-inflammatory Th-2 over proinflammatory Th-1 responses
Stimulate oral tolerance
Influence anti-inflammatory nutrient receptors in the GI tract (duodenal vagal, colonic butyrate)
Maintain MALT tissue at all epithelial surfaces (lung, liver, lacrimal, genitourinary, and pulmonary)
Modulate adhesion molecules to attenuate trans-endothelial migration of macrophages and neutrophils
Metabolic responses
Promote insulin sensitivity through the stimulation of incretins
Reduce hyperglycemia (AGEs), muscle, and tissue glycosylation
Attenuating stress metabolism to enhance more physiologic fuel utilization
Nutrition benefits
Sufficient protein and calories
Provide micronutrient and anti-oxidants
Maintain lean body mass by providing substrate for optimal protein synthesis
Support cellular and subcellular (mitochondria) function
Stimulate protein synthesis to meet metabolic demand of the host

AGEs, advanced glycolytic end products; GALT, gut-associated lymphoid tissue; GI, gastrointestinal; MALT, mucosal-associated lymphoid tissue.

Question: How should the hospitalized patient be assessed prior to initiation of specialized nutrition therapy, and how are energy and protein requirements determined?

Recommendations:

5. Prior to initiation of specialized nutrition therapy (either EN or PN), a determination of nutritional risk should be performed using a validated scoring system such as the Nutritional Risk Score 2002 (NRS-2002) or the NUTRIC Score on all patients admitted to the hospital for whom volitional intake is anticipated to be insufficient.

6a. An additional assessment should be performed prior to initiation of nutrition therapy of factors that may impact the design and delivery of the nutrition regimen

6b.Use of "traditional" nutrition indicators (albumin, pre-albumin, transferrin, and anthropometry) should be avoided.

6c.Surrogate markers of infection or inflammation should not be used for nutritional assessment

7a.Caloric requirements should be determined and then be used to set the goal for delivery of nutrition therapy.

7b.One of the three strategies should be used to determine caloric requirements:

(i) Indirect calorimetry.

(ii) Simple weight-based equation.

(iii) Published predictive equation.

8.Protein requirements should be determined independently of caloric needs, and an ongoing assessment of protein provision should be performed

Summary of evidence:

Previous nutritional assessment tools have tended to focus only on evaluation of nutritional status.

These assessment tools, although appropriate for a non-ICU patient, have not been validated for use in critical care and the ICU setting.

The concept of nutritional risk, however, incorporates both nutritional status and disease severity, as both contribute to poor outcome and the need for nutrition therapy.

Nutritional risk is more easily defined than malnutrition,as objective parameters are used to determine both components of risk.

Nutritional status is determined by body mass index (BMI), percent weight loss, and reduced oral intake or the duration of hospitalization prior to being admitted to the ICU.

Disease severity is determined by a table of clinical exam-plesor by the Acute Physiologic and Chronic Health Evalua-tion (APACHE) II and Simplified Organ Failure Assessment scores.

Table 5. **Nutrition assessment scoring systems used to determine nutrition risk**

NRS-2002: factors used to determine score (30)

Impaired nutritional status		**Severity of disease**	
Absent score 0	Normal nutritional status	Absent score 0	Normal nutritional requirements
Mild score 1	Weight loss >5% in 3 months OR Food intake <50–75% of normal requirement in preceding week	Mild score 1	Hip fracture Chronic patients in particular with acute complications: cirrhosis, COPD Chronic hemodialysis, diabetes, oncology
Moderate score 2	Weight loss >5% in 2 months OR BMI 18.5–20.5+impaired general condition OR Food intake 25–50% of normal requirement in preceding week	Moderate score 2	Major abdominal surgery, stroke Severe pneumonia, hematologic malignancy
Severe score 3	Weight loss >5% in 1 month (15% in 3 months) OR BMI <18.5+impaired general condition OR Food intake <25% of normal requirement in preceding week	Severe score 3	Head injury Bone marrow transplantation Intensive care patients (APACHE II>10)

NUTRIC Score: factors used to determine score (29)

Factors	**NUTRIC points**			
	0	**1**	**2**	**3**
Age (years)	<50	50–74	≥75	—
APACHE II Score	<15	15–19	20–27	≥28
Baseline SOFA Score	<6	6–9	≥10	—
No. of comorbidities	0–1	≥2	—	—
Days in hospital to ICU admit	0	≥1	—	—
Interleukin-6 (μ/ml)	0–399	≥400	—	—

APACHE, Acute Physiologic and Chronic Health Evaluation; BMI, body mass index; COPD, chronic obstructive pulmonary disease; ICU, intensive care unit; NRS-2002, Nutritional Risk Score 2002; SOFA=Simplified Organ Failure Assessment.

If age≥70 years, add 1 point (for NRS-2002).

Total score=(Points for nutritional status)+(Points for disease severity)+(Points for age) (for NRS-2002).

Total score is from six separate factors (for NUTRIC Score).

In those patients at high nutritional risk with NRS-2002 scores≥5, receipt of sufficient nutrition therapy was associated with a significant 50% reduction in nosocomial infection and total complications.

In those patients determined to be at low nutritional risk (NRS-2002 score≤3),nutrition therapy was not associated with any change in outcome regardless of whether patients received sufficient or insufficient nutrition therapy.

The NUTRIC score was used in a large international observational study in an ICU setting to differentiate low

from high nutritional risk.

Patients with high nutritional risk (NUTRIC scores 6–10) showed a significant decrease in mortality the closer the receipt volume of nutrition therapy was to goal feeding.

In those patients at low nutritional risk (NUTRIC scores 0–5),there was no association between the amount of nutrition therapy received and mortality.

In an RCT of 132 patients at higher nutritional risk (NRS-2002 scores > 3), intervention with more aggressive nutrition therapy resulted in 30% greater receipt of calories

and protein, which was associated with significant reductions in total complications and the need for re-hospitalization compared with standard hospital care.

Additional assessment prior to initiation of nutrition therapy should include an evaluation of comorbid conditions, function of the GI tract, and risk of aspiration.

Serum albumin, pre-albumin,and transferrin should not be used as markers of nutritional status but instead should be considered surrogate markers of risk and level of inflammation.

Serum albumin levels alone at the time of admission may provide valuable prognostic information prior to a surgical procedure.

Neither albumin nor pre-albumin should be used as a marker for adequacy of nutrition therapy, as their levels will only rise once the

inflammation and degree of oxidative stress abates.

C-reactive protein alone or in combination with pre-albumin may provide some useful information to the clinician with regard to changes in the level of inflammation and resolution of the systemic inflammatory response syndrome.

Aside from basic measures of height, weight, and BMI, anthropometric measures such as mid-arm muscle circumference, creatinine-height

index, and skin fold thickness are inaccurate, poorly reproducible, and provide little accurate information with regard to overall nutritional status for the hospitalized patient.

Additional markers such as procalcitonin,interleukin-1, tumor necrosis factor, interleukin-6, and citrulline are surrogate markers of critical illness and possible bowel compromise, are considered investigational, and should not be used routinely in patient care at this time.

In the future, the use of cross-sectional imaging such as computerized tomography scan, nuclear magnetic resonance imaging standardized at the level of the third lumbar vertebrae, and mid-thigh ultrasound may serve as important measures of lean body mass and appropriate tools to rule out sarcopenia.

Indirect calorimetry (IC) is the most accurate method to determine caloric needs and should be considered where available.

IC requires specialized equipment and support staff for accurate, consistent, and reliable results

In high-risk individuals, energy expenditure should be measured once or twice per week.

If IC is not available or easily accessible, a weight-based equation (e.g., 25 to 30 kcal/kg per day) can be used.

Recent evidence suggests that protein may be the most important macronutrient when compared with fat and carbohydrate,as the provision of adequate protein is more likely to improve outcome than adequate caloric delivery.

In the past, providing 1.2–1.5 g protein/kg per day was thought to be sufficient; however, recent studies suggest that the amount needed to optimize therapy may need to be higher in a range of 1.5–2.0 g/kg per day.

Protein needs may be even higher in patients with trauma or large wounds.

Besides the weight-based equation above, protein requirements may be determined by calculating the nitrogen balance using a 24-h urine collection to measure urine urea nitrogen (UUN) with the following calculation: protein g/day=[(UUN+4)×6.25]

Enteral access:

Question: How should enteral access be achieved, and at what level of the GI tract should EN be infused?

Recommendations:

9a. A nasogastric or orogastric feeding tube should be used as the initial access device for starting EN in a hospitalized patients.

9b. Radiologic confirmation of placement in the stomach should be carried out prior to feeding (except with the use of electromagnetic transmitter-guided feeding tubes).

Repeated periodic radiologic confirmation of correct tube position in the GI tract is not required unless there is concern for tube displacement because of nausea/vomiting, regurgitation, coughing, retching, or overt displacement

10a. Conversion to a post-pyloric feeding tube should be carried out only when gastric feeding has been shown to be poorly tolerated or the patient is at high risk for aspiration.

10b. Simultaneous aspiration/decompression of the stomach with jejunal feeding may be accomplished by using a dual lumen aspirate/feed nasoenteric tube, a combined percutaneous gastrojejunostomy (GJ) tube, or the use of both gastrostomy and jejunostomy tubes.

11. When long-term enteral access is needed in a patient with gastroparesis or chronic pancreatitis, a jejunostomy tube should be placed.

12. A percutaneous enteral access device should be placed, either via the gastric or the jejunal route, if enteral feeding is anticipated to be required for >4-week duration.

13. A percutaneous gastrostomy should be placed preferentially in the gastric antrum in order to facilitate conversion to a GJ tube in the event that the patient is intolerant to gastric feeding.

14. For the patient at high risk for tube displacement, steps should be taken proactively to secure the access device at the time of placement.

Summary of evidence:

Gastric feeding is successful in the vast majority of patients requiring nasoenteric feeding in the hospital, Although GI dysfunction occurs in 30–70% of ICU patients,most will tolerate gastric feeding.

Importantly, the presence of bowel sounds is not a sensitive marker of GI function and is not required to initiate EN.

Greater disease severity, however, is associated with a worsening degree of ileus and GI dysmotility, and, in those circumstances, there may be more of a need for small bowel feeding.

In a recent RCT involving patients with APACHE II Scores>20, the use of small bowel feeding significantly reduced hospital length of stay, decreased total complications, and increased EN delivery compared with gastric feedings.

The use of nasogastric feeding is more physiologic, expedites delivery of nutrition therapy, requires a low level of expertise for placement, and results in minimal delay in initiation of feeding.

Radiologic confirmation of placement of a nasoenteric or an oroenteric tube in the stomach or small bowel is required

New optical guidance feeding tubes have recently been approved by the Federal Drug Administration but will require further validation studies before radiologic confirmation can be avoided.

The incidence of reflux, regurgitation, and aspiration all decrease significantly as the level of infusion of formula is diverted lower in the GI tract, from the stomach to the proximal jejunum.

A meta-analysis of 12 RCTs showed a reduction in ventilator-associated pneumonia with small bowel compared with gastric feeding; yet, duration of mechanical ventilation ,hospital length of stay, and mortality did not change.

It is best to start with gastric feeds, take additional steps to promote tolerance, and to monitor closely while awaiting expertise for small bowel placement if subsequently required.

Long-term jejunal access is best achieved by the use of a jejunostomy tube placed endoscopically, radiologically, or surgically,depending upon available expertise.

Because of frequent displacement of the jejunal extension tube back into the stomach with a GJ device, this is generally not a good long-term option

If the duration of provision of EN is anticipated to exceed 4 weeks, then a percutaneous enteral access device is generally indicated.

The 4-week cutoff, although arbitrary, is based on the potential morbidity of a nasoenteric tube, which includes erosion of the nares, an increase in aspiration pneumonia, sinusitis, and esophageal ulceration or stricture.

More than any other patient population,those with a cerebral vascular accident benefit from percutaneous gastrostomy placement as a bridge to oral feeding, as the incidence of dysphagia may drop to less than half the initial rate at 4 months following an acute stroke.

In patients with amyotrophic lateral sclerosis, timing of gastrostomy placement is important, before the forced vital capacity drops below 50%.

Initial positioning of the gastrostomy tube in the gastric antrum (on the patient's right side close to the level of the umbilicus) may provide important benefits.

Most importantly, if the patient demonstrates intolerance and evidence of gastroparesis in the days following gastrostomy tube placement, the access device is better positioned to be converted to a GJ tube.

Extensive clinical experience does not support any of these concerns.

Ultimately, whenever possible, the reason(s) for inadvertent removal of the tube (e.g., delirium, dementia, pain,and so on) needs to be determined and corrected.

Initiating Enteral Nutrition:

Question: How soon, at what dose, and with which formula should enteral nutrition be initiated in the hospitalized patient?

Recommendations:

15. In the patient at high nutritional risk unable to maintain volitional intake, EN should be initiated within 24–48 h of admission to the hospital.

16a. Although early EN should be initiated within 24–48 h of admission, the timing by which to advance to goal is unclear,When tolerated, feeding should be advanced to goal within 48–72 h.

16b. With reduced tolerance, feeding should be advanced with caution to goal by 5 to 7 day.

17. Permissive underfeeding (i.e., hypocaloric feeding) is an acceptable alternative to full feeding and may be considered in three separate patient scenarios:

(i) Acute Lung Injury/Acute Respiratory Distress Syndrome (ALI/ARDS)

(ii) Obesity with BMI>30

(iii) Placement on PN over the first week of nutrition therapy

18a. A standard polymeric formula or a high-protein standard formula should be used routinely in the hospitalized patient requiring EN

18b. An immune-modulating formula containing arginine and omega-3 fish oil should be used for patients who have had major surgery and are in a surgical ICU setting.

18c. An immune-modulating formula containing arginine and omega-3 fish oil should not be used routinely in patients in a medical ICU.

Summary of Evidence:

The timing of initiation of EN in the hospitalized patient (especially critically ill patients in an ICU setting) is based on two categories of studies in the literature, early vs. delayed EN and early EN vs. standard therapy.

In meta-analyses by Marik and Doig comparing early vs. delayed EN, early feeds started within the first 24–48 h (average 36 h) of admission were associated with signifi

cantly reduced infection, hospital LOS, and mortality

compared with feeds started after that time point .

In patients at high-nutritional risk, delivery of ≥ 80% of goal

calories was associated with the lowest mortality in a large observational study in mixed ICU patients.

In a large multi-center randomized trial, patients with ARDS/ALI were shown to have equivalent outcomes whether they were randomized to trophic feeding at 20 ml/h (providing 25% of requirements) for the first 6 days then advanced to goal, or to full feeds from the time of admission

It is appropriate to place obese critically ill patients with a BMI>30 on a high protein, hypocaloric regimen providing 2.0–2.5 g protein/kg ideal body weight per day, and 60–65% of estimated or measured energy expenditure for total caloric delivery.

In ICU patients who are appropriate candidates for

PN over the first week of therapy, hypocaloric feeding providing 80% of caloric requirements while providing full protein delivery at 1.5–2.0 g/kg per day promotes mild weight loss and improves insulin sensitivity.

Such a regimen was shown to be associated with signifi

cant reductions in infection and hospital LOS compared with full caloric feeding.

Indications for use of specialized formulae are limited, and their use should be reserved for certain subsets of hospitalized patient populations.

The vast majority of hospitalized patients requiring EN will tolerate a standard polymeric formula with or without fiber.

Critically ill patients in the medical ICU will also generally tolerate a standard polymeric formula (or high-protein standard formula) and routine use of formulas designed to be immune-modulatory, elemental/semi-elemental, disease-specific (diabetes), and organ-specific (hepatic, renal, pulmonary) are discouraged.

Preoperative patients awaiting major elective surgery and critically ill patients admitted to a surgical ICU may benefit from an arginine-containing immune-modulating formula (also containing fish oil, glutamine, and antioxidants).

Monitoring tolerance and adequacy of EN

Question: How should adequacy and tolerance of EN be assessed in the hospitalized patient?

Recommendations:

19a. Hospitalized patients on EN should be monitored daily by physical exam.

19b. Patients on EN should be monitored for adequacy of provision of EN as a percent of target goal calories, cumulative caloric deficit, and inappropriate cessation of EN

20. In the patient at high risk for refeeding syndrome, feeding should be ramped up slowly to goal over 3 to 4 days, while carefully monitoring electrolytes and volume status

21a. Enteral feeding protocols should be used in hospitalized patients in need of nutrition therapy

21b. A validated protocol should be used, such as a volume-based feeding protocol or a multi-strategy (bundled) top-down protocol.

22. Gastric residual volume (GRV) should not be used routinely as a monitor in hospitalized patients on EN.

23a. Patients on EN should be assessed for risk of aspiration.

23b. For patients determined to be at high risk, the following steps should be taken to proactively reduce that risk

(i) Use a prokinetic agent.

(ii) Divert the level of feeding lower in the GI tract

(ii) Switch to continuous infusion

(iv) Use chlorhexidine mouthwash twice daily

24a. For the patient receiving EN who develops diarrhea, an evaluation should be initiated to identify an etiology and direct management.

24b. The patient receiving EN who develops diarrhea should be managed by one of the three strategies:

(i) Use of fermentable soluble fiber as an adjunctive supplement to a standard EN formula.

(ii) Switching to a commercial mixed fiber (soluble and insoluble) formula.

(iii) Initiating a small peptide/MCT oil formula

Summary of evidence:

Patients on EN should be monitored daily by physical exam to detect the presence of bowel sounds, passage of stool and gas, abdominal distention, and volume status.

Caloric and protein target goals should be clearly identified and intake and output should be followed to determine the percent of goal calories delivered.

Cumulative caloric deficit should be followed and documented in the chart, as increasing caloric deficit has been shown in five observational studies to be associated with increased adverse outcomes.

Increased delivery of calories to reduce the deficit is associated with improved outcome.

Patients at high risk for refeeding syndrome are those with low BMI<20 kg/m , recent weight loss prior to admission, or pro-longed period nil per os.

Such patients should be monitored closely for up to 5 days for elctrolyte,abnormalities(hypokalemia,hypophosphatemia, and hypomagnesemia), and volume status after feeding is initiated.

It is not clear whether risk of refeeding syndrome is more common with EN or PN.

A multi-strategy top-down protocol has been described for use in critically ill patients based on the presumption that these patients are at increased risk of feeding intolerance and that multiple strategies can be used with the initiation of EN to promote better tolerance.

GRV has been shown to be a poor marker of true gastric volume, gastric emptying, risk of aspiration, pneumonia, and poor outcomes

Furthermore, the practice of checking GRV is not well standardized and The sensitivity of GRV to detect aspiration is poor.

A number of risk factors identify those patients who are at increased risk for aspiration such as age >70 years,altered mental status, presence of an endotracheal or nasoenteric tube, prolonged supine position, and bolus infusion of formula.

Steps to reduce risk for aspiration include:

1.Elevation of the head of the bed,

2.Switching to continuous infusion of formula,

3.Diverting the level of infusion lower in the GI tract,

4.Initiating prokinetic agents,

5.Using chlorhexidine mouthwash,

6.Considering simultaneous aspiration/decompression of stomach contents with small bowel feeding

Diarrhea in the patient receiving EN is common, with an incidence ranging from 2 to 95%.

Although most cases are mild and self-limited, diarrhea in the hospitalized patient on EN may result in electrolyte imbalance, dehydration, perianal skin breakdown,and wound contamination.

The most common etiology of diarrhea in a patient receiving EN is the receipt of sorbitol-containing medications (which accounts for 55% of such cases).

Presence of Clostridium difficile infection is also important, accounting for 17–20% of diarrhea in patients on tube feeding.

When an underlying cause cannot be identified and diarrhea persists, the addition of a fermentable soluble fi

ber supplement (e.g., inulin, fructooligosaccharides, guar gum, achasia gum, and so on) to a standard enteral formula has been shown to more consistently reduce diarrhea.

Complications of enteral access:

Question: How should complications of enteral feeding in the hospitalized patient be assessed and treated?

Recommendations:

25. The percutaneous enteral access site should be monitored by cleaning daily with mild soap and water and maintaining correct positioning of the external bolster

26a. Prevention of tube clogging is important to successful EN and may be achieved by frequent water flushes delivered every shift and each time medications are given.

26b. When a clogged tube is encountered and the use of water flushes is unsuccessful at clearing, a declogging solution comprising a nonenteric-coated pancreatic enzyme tablet dissolved in a sodium bicarbonate solution should be used

26c. If still unsuccessful, a mechanical declogging device should be considered prior to exchanging the tube for a new one.

27a. A patient who inadvertently dislodges a recently placed percutaneous gastrostomy tube (<7–10-day old) should be brought back immediately to the endoscopy or radiology suite and a new tube placed endoscopically or radiologically through the same site on the abdominal wall

27b. If a percutaneous gastrostomy tube becomes dislodged that has been in place long enough for a partially formed tract to develop (>7–10 days), a tube of similar diameter should be placed blindly as expeditiously as possible to maintain patency and prevent closure of the tube tract.

In this latter circumstance, radiologic confirmation should be carried out prior to feeding if there is any question of inappropriate location of the tube

28a. For a patient with deterioration, breakdown, increased drainage/leakage, or enlarging stoma around the percutaneous tube site, an evaluation should be performed to determine etiology and appropriate management.

28b. Placement of a larger tube should not be used to manage leakage caused by an enlarging stoma around the percutaneous access device.

29. A percutaneous enteral access device that shows signs of fungal colonization with material deterioration and compromised structural integrity should be replaced in a non-urgent but timely manner.

Summary of evidence

Daily cleaning with mild soap and water is important to avoid the drying desiccating effects on the skin from hydrogen peroxide or scented alcohol-based soaps.

For the first 4 days following tube placement, the external bolster, if present, should be positioned up against the anterior wall with a single layer of gauze underneath against the skin.

In addition, we suggest minimizing side torsion or excessive traction on the tube tract wall, as this can lead to an enlarging stoma and excessive drainage/leakage.

Deterioration, breakdown, and increased drainage at the percutaneous access site should be evaluated carefully to rule out buried bumper syndrome, side torsion on the tract, absence of an external bolster, granulation tissue, or a tube site infection.

Hypergranulation tissue at the stomal-site should be treated with a topical high potency steroid ointment (e.g., 0.5% triamcinolone) or chemical cauterization with silver nitrate sticks.

We suggest treating tube site infections empirically using a broad-spectrum antibiotic administered either orally or through the tube (rarely is a parenteral antibiotic needed).

Because of the high risk of contamination with skin organisms, culture of the tract or tissue is not recommended in routine situations.

For the patient with increased leakage to the point of severe skin injury,we suggest high-dose acid suppression, diverting the level of infusion of formula lower in the GI tract, simultaneous jejunal feeding with gastric aspiration, and involvement of a wound-care expert.

Parenteral nutrition

Question: When and how should PN be utilized in the hospitalized patient?

Recommendations:

30a. If early EN is not feasible and the patient is at low nutritional risk upon admission, no specialized nutrition therapy should be provided and PN should be withheld for the first week of hospitalization.

30b. If a patient is at high nutritional risk on admission to the hospital and EN is not feasible, PN should be initiated as soon as possible.

31. Supplemental PN should be considered for the patient already on enteral tube feeding only after 7 to 10 days, when unable to meet >60% of energy and/or protein requirements by the enteral route alone. Initiating supplemental PN prior to this 7–10-day period in those patients already receiving EN does not improve outcomes and may be detrimental to the patient.

32. In hospitalized patients receiving PN, mild permissive underfeeding (delivery 80% of energy requirements with full protein provision) should be considered initially for the first 7 to 10 days. Following this first week (if long-term PN is required), energy provision should be increased to meet energy goals.

33. Peripheral PN (PPN) should not be used, as it leads to inappropriate use of PN, has a high risk of phlebitis and loss of venous access sites, and generally provides inadequate nutrition therapy.

34a. Careful transition feeding should be used in the patient on PN, for whom EN is now being initiated. As tolerance to EN improves and volume of delivery increases, PN should be tapered to avoid overfeeding

34b. PN should be stopped when the EN provides >60% of energy and protein goals

Summary of evidence :

The clinical benefit of PN in hospitalized patients (other than those with PN-dependent intestinal failure,such as short bowel syndrome, chronic intestinal pseudo-ob-

struction, high-output enterocutaneous fistula) has been difficult to demonstrate

In a multi-centered ICU trial of nearly 2,400 pa-tients comparing EN with exclusive PN, there was no difference

between the groups in clinical outcome.

Although the latter reports demonstrate that, under well-controlled protocolized conditions, PN can be administered safely and may even approach the outcomes seen with receipt of EN, PN offers no clear advantage over EN with regard to mortality or infections.

In a well-nourished patient, particularly in the first week of hospitalization, the use of PN appears to provide no benefit over standard therapy and may actually cause net harm.

Most societal recommendations indicate a reluctance to extend standard therapy beyond the first week of hospitalization, suggesting instead initiating PN in the patient at low nutritional risk beginning the second week of hospitalization.

In the patient at high nutritional risk with increased disease severity and evidence for deterioration of nutritional status, priorities of therapy change. If EN is not feasible, PN is more likely to benefit these patients than standard therapy.

The addition of supplemental PN during the first week of therapy to patients already receiving EN, where the enteral feeding is not meeting caloric goals, appears to provide little benefit and may cause net harm.

The optimal timing for adding supplemental PN is not clear but should be considered after the first week of hospitalization in patients receiving <60% of goal calories

by the EN route alone.

In the patient who is determined to be an appropriate candidate for PN, the risk/benefit ratio of this nutrition therapy over the first week of hospitalization may be improved by providing hypocaloric nutrition therapy (80% of goal calories).

Such strategy may result in some weight loss, but leads to better insulin sensitivity,avoids the effects of overfeeding, and may improve outcome.

Once the patient is more stabilized in the second week of hospitalization, PN delivery should be increased to meet 100% of goal calories and protein requirements

The use of PPN is severely limited by intolerance of peripheral veins to the osmolarity of any solution >800–900 mosm/l (central venous access allows tolerance of solutions up to 2,000 mosm/l)

Routine use of PPN is associated with increasing loss of venous access sites and abuses derived from inappropriate short-term PN.

In a patient receiving both EN and PN, careful transition feeding is necessary to avoid overfeeding as EN tolerance improves and the need for PN is decreased. By convention, PN may be stopped when EN provides >60% of goal energy and protein

Nutritional Therapy at End-of-Life

Question: Should specialized nutrition therapy be provided to a hospitalized patient at end-of-life?

Recommendations:

35a. The decision to place a gastrostomy tube in an end-of-life situation should be determined by patient autonomy and the wishes of that patient and their family, even though the nutrition therapy may do little to change traditional clinical outcomes.

35b. Regardless of prognosis, placement of a gastrostomy device should be based on whether achieving enteral access and initiating EN successfully meet the goals of the patient and/or their family.

Percutaneous gastrostomy placement should be considered even if the only benefit is to provide improvement in the quality of life for the family, increased ease of providing nutrition, hydration, and medications, or to facilitate transfer out of the hospital setting to a facility closer to home.

36. The clinician is not obligated to provide hydration and nutrition therapy in end-of-life situations.

The decision to initiate nutrition therapy is no different than the decision to stop therapy once it has started (thus, clinicians are not obligated to provide therapy that is unwarranted)

37a. If requested, nutrition therapy in end-stage malignancy should be provided by the enteral route.

37b. Use of PN in this setting may cause net harm and should be highly or aggressively discouraged.

38. The clinician who has ethical concerns of his own in a difficult end-of-life situation should excuse himself from the case, as long as he can transfer care to an equally qualified and willing health-care provider.

Summary of evidence:

Traditional outcome parameters (infection, organ failure, hospital length of stay, and mortality) are not likely to change in response to nutrition therapy in dementia, metastatic malignancy, or end-of-life situations.

In end-stage dementia, placement of a percutaneous gastrostomy and provision of EN are not likely to improve the patient's quality of life, heal pressure sores, reduce risk of aspiration pneumonia,or reduce mortality.

However, nutrition therapy is likely to improve a cancer patient managed surgically who is cured from the malignancy but has altered GI anatomy or function post-operatively.

The use of PN in the non-operative management of malignancy should be avoided, as it may lead to worse outcomes compared with standard therapy with no nutrition support.

Clinicians are never obligated to provide nutrition therapy to a patient at end-of-life and they certainly are not “stuck” providing nutrition therapy once initiated, as the courts have clarified that there is no difference between stopping therapy on any day and the original decision to initiate therapy in the first place.

A patient with malignant obstruction of the GI tract may benefit from gastrostomy placement through palliative decompression to reduce nausea and vomiting.

Gastroenterologists are trained to recognize indications and contraindications for a procedure.

Placing a percutaneous gastrostomy in a patient with poor prognosis at high risk for mortality seems like an exercise in futility to the clinician, especially when allocation of health-care resources is limited.

With regard to futility, refusal to place a percutaneous endoscopic gastrostomy generates a clash of values between the family and the caregiver.

With regard to justice, patients should never become aware that their low socio-economic status, lack of insurance, or

low points on a survival scoring system has ultimately led to the denial of the procedure by health-care providers.

Patients or their surrogate decision maker/family member decides whether to accept or refuse medical therapy.

Decisions on gastrostomy placement and provision of nutrition therapy at end-of-life often have little to do with scientific data or medical evidence derived from RCTs.

Decision making in end-of-life situations is often influenced by both the health-care literacy and the spiritual literacy of the patient and their families.