

# Nutrition Support Protocols: Enhancing Delivery of Enteral Nutrition

Colleen O'Leary-Kelley, RN, PhD  
Karen Bawel-Brinkley, RN, PhD, CNE

In critical care, malnutrition has a significant, negative impact on a patient's ability to respond to medical treatment. Enteral nutrition is known to counteract the metabolic changes associated with critical illness that increase the risk for serious complications and poor clinical outcomes. Inadequate delivery of nutrition support and underfeeding persist in intensive care units despite the availability of guidelines and current research for best practice. Recent studies have shown that nutrition support protocols are effective in promoting nutritional goals in a wide variety of intensive care patients. It is essential to find approaches that enhance early delivery of enteral nutrition that meets requirements and supports improved outcomes. Nurses are in a unique position to take an active role in promoting the best nutritional outcomes for their patients by using and evaluating nutrition support protocols. (*Critical Care Nurse*. 2017;37[2]:e15-e23)

**C**are of critically ill patients has become increasingly complex as a result of recent advances in technology and medicine. With this increasing complexity comes the potential for clinicians to lose sight of basic care issues such as nutritional management.<sup>1</sup> Nutrition support has long been viewed as supportive therapy in critical care. However, with the expansion of current research revealing a more direct impact of nutrition support on patients' outcomes, nutrition is now viewed as having a more therapeutic role.<sup>2</sup> Poor nutrition and negative energy balance combined with the catabolic stress and inflammation of acute illness and injury increase risk for complications. Complications may include increased length of stay, poor wound healing, aspiration, sepsis, and death.<sup>3,4</sup>

In critical care, malnutrition has a significant, negative impact on a patient's ability to respond to medical treatment.<sup>5</sup> Critical illness is associated with hypermetabolism and inflammation, which often lead to infection, organ dysfunction, and mortality. Nutrition intervention is known to counteract the metabolic changes associated with critical illness.<sup>4</sup> Many patients in intensive care units (ICUs) need mechanical ventilation and consequently require nutrition intervention to meet metabolic demands and supply their energy and protein needs. Current goals for nutrition support are focused on limiting catabolic response and systemic inflammation and promoting return to physiological baseline.<sup>1</sup> In critical illness, adequate intake of energy and protein is associated with improved clinical outcomes.<sup>4,6</sup>

**Table 1** Summary of current nutritional guidelines<sup>a</sup>

Assess patients on admission to the intensive care unit (ICU) for nutritional risk and calculate both energy and protein requirements to determine goals of nutrition therapy.

Initiate enteral nutrition (EN) within 24–48 hours following the onset of critical illness and admission to the ICU, and increase to goals over the first week of ICU stay.

Take steps as needed to reduce risk of aspiration or improve tolerance to gastric feeding (use prokinetic agent, continuous infusion, chlorhexidine mouthwash, elevate the head of bed, and divert level of feeding in the gastrointestinal tract).

Implement enteral feeding protocols with institution-specific strategies to promote delivery of EN.

Do not use gastric residual volumes as part of routine care to monitor ICU patients receiving EN.

Start parenteral nutrition early when EN is not feasible or sufficient in high-risk or poorly nourished patients.

<sup>a</sup> Reprinted from McClave et al,<sup>12</sup> by permission of SAGE Publications, Inc. Copyright © 2016 by SAGE.

As the philosophy around nutrition shifts from a supportive to a more therapeutic focus, the critical care team must use a coordinated approach to formulate decisions around nutrition support in order to provide adequate energy and protein, while avoiding the complications associated with nutrition support.<sup>1,3</sup> Practice guidelines provide clinicians with the best research evidence for maximizing the effectiveness of nutrition interventions.<sup>7–10</sup> Published guidelines can be used to develop standardized protocols for use in individual critical care units.<sup>8,11</sup> Guidelines provide expert consensus supported by analysis of the current literature; however, clinical decisions should always be patient-centered and guided by individual patients' situations.<sup>12</sup>

Nutrition therapy is defined specifically as either enteral nutrition administered via an enteral access device or parenteral nutrition administered via a central venous catheter.<sup>12</sup> Complications may include both overfeeding and underfeeding. Inadequate delivery of nutrition support and underfeeding continue to exist in ICUs despite the availability of guidelines and current research

for best practice.<sup>13,14</sup> Failure to provide enough nutrition early in acute illness often leads to energy and protein deficits, which increase the risk for serious complications and poor clinical outcomes.<sup>4</sup> Inadequate delivery of enteral nutrition may occur as a result of gastrointestinal intolerance, interruptions, procedures, lack of dietary personnel, and limited nutritional knowledge.<sup>15</sup> Table 1 shows a summary of the 2016 guidelines published by the Society for Critical Care Medicine (SCCM) and the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.).<sup>12</sup> The key points shown in Table 1 highlight nutrition assessment upon admission to the ICU, early initiation of enteral nutrition, and prevention of complications. The 2016 guidelines also stress the implementation of enteral nutrition protocols. This article provides a narrative review of selected research related to enteral nutrition protocols for critical care nurses and includes evidence-based recommendations for providing nutrition support in adult ICUs.

## Assessment

Risk for malnutrition should be assessed early because many patients may be malnourished on admission.<sup>3</sup> Critical illness and prolonged hospitalization can lead to poor nutritional status as a result of inflammation, hypermetabolism, and increased catabolism.<sup>7,12</sup> Malnutrition screening tools can be used to score patients on factors such as history of recent weight loss, body mass index (calculated as weight in kilograms divided by height in meters squared), and illness severity to identify patients as malnourished or at risk for malnutrition.<sup>1,5</sup> Several tools for assessing risk for malnutrition have been developed. Many were developed in healthy persons and are

## Authors

*Colleen O'Leary-Kelley is a professor, The Valley Foundation School of Nursing, and director of the Clinical Simulation Laboratory, San Jose State University, San Jose, California.*

*Karen Bawel-Brinkley is a professor and medical-surgical simulation coordinator, The Valley Foundation School of Nursing, San Jose State University.*

*Corresponding author: Colleen O'Leary-Kelley, RN, PhD, The Valley Foundation School of Nursing, San Jose State University, One Washington Square, San Jose, California, 95192-0057 (e-mail: colleen.oleary-kelley@sjsu.edu).*

*To purchase electronic or print reprints, contact the American Association of Critical-Care Nurses, 101 Columbia, Aliso Viejo, CA 92656. Phone, (800) 899-1712 or (949) 362-2050 (ext 532); fax, (949) 362-2049; e-mail, reprints@aacn.org.*

not appropriate for use in critical care patients. According to the 2016 guidelines, the Nutritional Risk Screening (NRS-2002) or the NUTRIC score are suitable for ICU patients because both tools include nutrition status and illness severity.<sup>12,16</sup> The ICU team can use the scores obtained from the screening tool to determine level of nutritional risk. The next step is to develop an accurate nutritional plan and to determine energy requirements.<sup>7</sup>

In order to determine energy requirements accurately, measuring energy expenditure with indirect calorimetry when available is recommended.<sup>7,12</sup> Determination of energy expenditure correlates with an individual's daily energy requirements, and indirect calorimetry provides the most accurate measure.<sup>17</sup> In the ICU, variables such as medications, chest tube air leaks, and failure to achieve steady state can limit the accuracy of indirect calorimetry.<sup>1</sup> Indirect calorimeters or metabolic carts are expensive and may not be available in all ICUs. Trained personnel are needed to use the equipment and interpret the results.<sup>5,7</sup> Indirect calorimetry is considered a reference standard for determining energy requirements, but predictive equations, such as the Harris-Benedict equation or others, can be used.<sup>7,12,18</sup>

Predictive equations use variables such as age, weight, height, and different stress factors to determine daily requirements.<sup>12</sup> Most equations are derived from healthy or nonacutely ill populations and should be used with caution in ICU patients.<sup>1,19</sup> Estimates using standard equations may be less accurate than indirect calorimetry and may put the patient at risk for underfeeding or overfeeding complications. Accurate assessment using predictive equations can be especially difficult for critically ill patients who are obese.<sup>5,12,19</sup> Current guidelines support using a simple weight-based equation (25-30 kcal/kg daily) to determine energy requirements for most ICU patients if indirect calorimetry is not available.<sup>12</sup> To avoid complications associated with overfeeding, it is advised that caloric intake not exceed a maximum of 35 to 40 kcal/kg.<sup>19</sup>

In addition to calories, protein requirements must also be determined because protein is vital for wound healing, immune function, and maintenance of lean muscle mass.<sup>5</sup> Muscle wasting may occur rapidly in the early phase of critical illness, and some patients may lose up to half of their muscle mass.<sup>5,19</sup> Burns, trauma, immobility, and paralytic agents can lead to rapid deconditioning and loss of lean muscle. Minimizing

muscle wasting will promote improved function in the post-ICU recovery phase.<sup>5</sup> For patients with a body mass index less than 30, protein requirements range from 1.2 to 2.0 g/kg actual body weight per day.<sup>12</sup>

## Initiate Enteral Nutrition Early

Enteral nutrition is recommended for critically ill patients who are allowed nothing by mouth because of their illness or who are unable to take in enough nutrition to meet the body's needs.<sup>7,12</sup> Enteral nutrition maintains gut integrity, reduces stress, and supports immunity.<sup>19</sup> Guidelines support initiating tube feeding access and starting enteral nutrition within the first 24 to 48 hours of admission to the ICU. According to guidelines, fluid resuscitation should have been completed and the patient should be hemodynamically stable.<sup>7,8,12</sup> A recent study examined early enteral nutrition and clinical outcomes in patients receiving vasopressors.<sup>6</sup> A total of 1174 patients receiving mechanical ventilation were divided into 2 groups—those treated with early enteral nutrition (within 48 hours of the start of mechanical ventilation) and those who were not. The primary end points were overall ICU mortality and hospital mortality. Results showed that early enteral nutrition was associated with reduced ICU and hospital mortality.<sup>6</sup> Feedings started early (compared with feedings started after 72 hours) are associated with less gut permeability and reduced release of inflammatory cytokines.<sup>7,8,12</sup>

Target rates for enteral nutrition should be achieved within 48 to 72 hours. At least 50% to 65% of the goal number of calories should be provided in order to prevent complications and promote improved outcomes.<sup>4,7</sup>

Enteral nutrition should be advanced to goal

**Early nutrition intervention counteracts the metabolic changes associated with critical illness.**

rates in a timely manner. Heyland et al<sup>20</sup> found an association with 12-day caloric adequacy and 60-day hospital mortality when 80% to 85% of goal calories and protein were provided.

Enteral nutrition is more physiologic than parenteral nutrition and is therefore the preferred method.<sup>7,19</sup> Enteral access may be difficult to achieve in the early phase of illness, which may prevent the patient from reaching nutrition goals. The ability to reach goal rates and tolerate full requirements is often affected by several

issues, including delays in tube placement and patients' intolerance of enteral nutrition. Feeding interruptions in the ICU are also common and markedly affect nutritional adequacy.<sup>13-15</sup> Examples of common feeding interruptions include withholding feedings for surgical procedures or tests.

## Supplemental Parenteral Nutrition

Optimal timing of initiation of supplemental parenteral nutrition in patients who are unable to achieve their goal rate for enteral nutrition is controversial. Current guidelines support supplemental parenteral nutrition for patients receiving enteral nutrition who are unable to meet at least 60% of nutritional requirements after 7 to 10 days.<sup>12</sup> Patients who are receiving some amount of enteral nutrition but not yet at full goal rate should not receive supplemental parenteral nutrition earlier than 7 days as it is associated with added cost and no apparent benefit.<sup>7,8</sup> In order to limit complications associated with underfeeding, supplemental parenteral nutrition is recommended after day 10 if enteral nutrition is insufficient, although the decision should be made on an individual basis.<sup>12</sup> In a large (4640 patients), multicenter, randomized trial in Belgium, researchers examined this controversial issue of supplemental parenteral nutrition.<sup>21</sup> Patients were randomized to early parenteral nutrition (within 48 hours of ICU admission, n = 2312) and late parenteral nutrition (n = 2328). Compared with patients in the early parenteral nutrition group, patients in the late parenteral nutrition group were discharged earlier

from both the ICU and the hospital.

**Practice guidelines provide the best evidence for maximizing the effectiveness of nutritional support.**

Researchers found that late parenteral nutrition starting on day 8 was associated with fewer infections, shorter mechanical ventilation, and lower costs.<sup>21</sup> Although this single large study has been criticized for its sample inclusion criteria, lack of blinding, and other methodological limitations,<sup>22</sup> it does shed some light on the controversy. Single studies should not be used to change practice and should always be viewed with some degree of skepticism.<sup>23</sup>

## Implement Enteral Feeding Protocols

Despite strong recommendations for early initiation of enteral nutrition and infusion at target rates within

the first week of hospitalization, multiple barriers exist that prevent optimal delivery of enteral nutrition in the ICU.<sup>15,24</sup> As a result, ICU patients receiving enteral nutrition may have significant caloric deficits. The problems associated with delivery of enteral nutrition in the ICU have been well described.<sup>13,14</sup> Many factors exist in the ICU that may lead to inadequate nutrition. Barriers to nutritional adequacy for enterally fed patients include variation in physicians' practice, multiple interruptions, lack of knowledge, feeding tube issues, and gastrointestinal intolerance.<sup>14,15</sup> Enteral nutrition protocols have emerged in the past several years to address barriers in order to improve the adequacy of enteral nutrition delivery and improve outcomes for ICU patients.<sup>25,26</sup> Although it is difficult to provide 100% of goal calories by the enteral route, the implementation of nutrition protocols has shown promise in delivering a volume of enteral nutrition that more closely matches energy and protein requirements.<sup>7,27,28</sup>

Barr and colleagues<sup>26</sup> examined outcomes in critically ill patients before and after implementation of a nutritional management protocol in 2 adult medical-surgical ICUs. A prospective, sequential study design was used to examine clinical and nutritional outcomes. The study was conducted at 2 teaching hospitals; 100 patients were enrolled from each site before and after implementation of the protocol. Each site had an experimental group (n = 50) and a control group (n = 50). The protocol was developed by the researchers from an evidence-based search of the literature and was modified according to feedback from ICU staff. The protocol used an algorithm format and both enteral and parenteral nutrition. Caloric target estimates were determined by the dietitian using the Harris-Benedict equation. A clinical training session was provided and the final protocol was posted at bedside, nursing working stations, and physician work areas. The protocol was implemented for 1 month. Seventy-two percent of the patients required mechanical ventilation. Mean duration of mechanical ventilation was shorter in the postimplementation group (17.9 days) than in the preimplementation group (11.2 days;  $P = .03$ ). The time to feeding, caloric intake on day 4, and ICU or hospital LOS were not different between the groups. This study used a 1-time protocol education presentation, and compliance with the protocol was limited.

A large cluster randomized controlled trial was conducted to examine the effect of evidence-based feeding

guidelines on nutritional outcomes and mortality in critically ill adult patients.<sup>29</sup> This trial expanded on an earlier Canadian study<sup>30</sup> that tested the use of algorithms for critical-care enteral and parenteral therapy (ACCEPT). The current study<sup>29</sup> took place in Australia and New Zealand between 2003 and 2004 and appraised research evidence using an explicit process that generated several systematic reviews and meta-analyses. The recommendations were evaluated at a consensus conference and distilled into 18 specific interventions that comprised the final guidelines, known as the ANZ guidelines.<sup>29</sup> After the guidelines were developed, 27 hospitals that met inclusion criteria were randomized into control or intervention (guideline) groups. Specific inclusion and exclusion criteria were reported, and a total of 1118 eligible ICU patients were enrolled during the 20-week guideline evaluation period.

Results showed statistically significant differences between patients in guideline ICUs compared with control patients. Significantly more patients in guideline ICUs received nutrition support during their stay ( $P < .001$ ) and more were fed within 24 hours of ICU admission.<sup>29</sup> No significant differences were found between groups in terms of hospital discharge mortality, ICU discharge mortality, mean hospital length of stay, or mean ICU stay. Although the practice changes observed in the ANZ guideline hospitals were similar to those in the earlier ACCEPT trial, no reduction in hospital mortality was found as had been seen in the ACCEPT study.<sup>29</sup> Overall, researchers found that developing and implementing an evidence-based practice change strategy promoted earlier feeding and greater nutritional adequacy.

Soguel and colleagues<sup>24</sup> performed a prospective interventional study examining implementation of a feeding guideline and the addition of a designated ICU dietitian. The nutrition protocol was based on recommendations from the European guidelines.<sup>9</sup> The prospective, nonrandomized, single-center study examined 572 patients who required more than 72 hours in the ICU. A 2-step program introducing a feeding protocol and a unit-specific ICU dietitian was used to examine energy delivery, feeding route (enteral nutrition, parenteral nutrition, or combined), length of ICU and hospital stay, and mortality. Results showed that this combined intervention resulted in a 31.6% improvement in caloric delivery.<sup>24</sup>

Heyland et al<sup>28</sup> reported a prospective cluster-randomized trial assessing a unique enteral nutrition

protocol—enhanced protein-energy provision via the enteral route feeding protocol (PEP uP)—for ICU patients receiving mechanical ventilation. The study was designed to improve enteral nutrition delivery in units with low baseline nutritional adequacy. The 18 participating North American ICUs had received/prescribed calorie ratios of less than 50% despite the availability of nutrition protocols. The study included 1059 critically ill patients receiving mechanical ventilation and used an intention-to-treat analysis. The primary end points were the received/prescribed ratios of calories during the first 12 ICU days. It included a novel feeding protocol combined with a nursing educational intervention. The protocol had several components: a 24-hour volume goal of enteral feeding instead of a rate-based goal, prokinetic agents, a high cutoff for gastric residual volume of 300 mL/h, protein supplementation, and a detailed nursing educational program.<sup>28</sup> The educational program was given at

each ICU site by the study team

**Early enteral nutrition is associated with reduced ICU and hospital mortality.**

using educational materials developed specifically by the team. The PEP uP study showed that the proportion of prescribed enteral nutrition delivered was greater at the intervention sites than at the control sites. The intervention sites had a similar improvement in protein and calories when parenteral nutrition was added. Mean differences between the experimental and control groups in calorie and protein delivery were 14% and 12%, respectively. These improvements did not have an impact on mechanical ventilation duration, ICU stay, or mortality.<sup>28</sup> A collaborative has been created, and there are plans to continue the PEP uP study in additional ICUs.

A more recent report by Taylor and colleagues<sup>31</sup> described a single-center, retrospective ICU quality improvement project built on the work of Heyland et al<sup>28</sup> in the PEP uP study. Researchers retrospectively examined 111 patients receiving mechanical ventilation in a surgical/trauma ICU (STICU) using standard practices for enteral nutrition and a volume-based system called the FEED ME (Feed Early Enteral Diet adequately for Maximum Effect) protocol. The project aimed to determine if the FEED ME protocol was more effective in the delivery of enteral nutrition volume, calories, and protein without an increase in gastrointestinal complications (emesis, gastric residuals, or diarrhea) compared with

the previous rate-based standard. Data were obtained before ( $n = 54$ ) and after ( $n = 56$ ) initiation of the protocol. Researchers found that the FEED ME protocol significantly increased the proportion of enteral nutrition volume and calories delivered to patients and also resulted in increased protein and body weight. Authors concluded that a change in standard of practice to an enteral nutrition volume-based feeding approach in a STICU led to a significant improvement in adequacy of calories and protein delivered, with only a slight increase in diarrhea. No significant differences were found between the groups in demographics or clinical characteristics. Patients in

### Implementation of nurse-driven nutrition protocols is associated with delivery of enteral nutrition that more closely

the FEED ME group tended to stay longer in ICU; however, the groups did not differ significantly with respect to the duration of mechanical ventilation. Hours until the start of enteral nutrition and the grams of protein prescribed did not differ significantly between the groups either. The groups differed significantly with respect to the number of calories per kilogram prescribed for the BMI range of 25 to 29.9, with a mean of 20 kcal/kg in the rate-based group and 25 kcal/kg in the FEED ME group ( $P < .001$ ). Enteral feedings were withheld 122 times in the rate-based group and 96 times in the FEED ME group.<sup>31</sup>

In a retrospective study, Compton et al<sup>32</sup> evaluated the impact of a nutrition support protocol on initiating enteral feeding and time to reach target goals in a sample of 73 patients receiving mechanical ventilation in a medical ICU. A new nutrition protocol was developed by the multidisciplinary ICU team. The protocol included rapid advancement to goal rates and early placement of nasojunal feeding tubes in patients unable to tolerate gastric feeding. The researchers compared nutritional outcomes in patients before implementation ( $n = 38$ ) and after implementation ( $n = 49$ ) of the protocol. The only significant difference between groups was that patients in the postimplementation group had higher Simplified Acute Physiology Scores than did patients in the preimplementation group ( $P = .009$ ). When mechanical ventilation began, nutrition prescription and delivery were evaluated. The protocol included an evidence-based algorithm for initiation and advancement of feedings. Physicians and nurses received repeated formal education

about the new protocol. Copies of the protocol prepared in an algorithm format were available at the bedside with printed instructions. Standard 1-kcal/mL protein formula was used in both phases of the study. Supplemental parenteral nutrition was provided until the enteral feeding goal was reached. Data were retrieved from the electronic chart system used in the ICU and were analyzed retrospectively. Results showed that after implementation of the protocol, enteral nutrition was started significantly earlier ( $P = .007$ ) and target feeding goals were reached significantly faster (6 vs 10 days;  $P < .001$ ). This study also showed that the feeding goal after placement of a nasojunal feeding tube was achieved sooner (median, 4.3 vs 2.2 days;  $P = .002$ ). Overall, implementation of the protocol led to faster achievement of the nutrition goals in a sample of ICU patients receiving mechanical ventilation. The study was limited by the small sample size and retrospective design. A larger prospective study is planned in the future.<sup>32</sup>

## Discussion

Studies have shown that nutrition support protocols are effective in promoting nutritional goals in a wide variety of ICU patients.<sup>26,28,29,31,32</sup> Table 2 shows the studies reviewed and brief results. The quality of evidence in these and other studies provides support for use of enteral nutrition protocols in ICUs. The use of enteral nutrition protocols enhances delivery of enteral nutrition and increases adequacy of nutritional intake. However, despite the enhanced delivery of enteral nutrition, few studies have shown a positive effect of enteral nutrition protocols on patients' outcomes.

A comprehensive systematic review of enteral nutrition protocols showed better feeding optimization through use of protocols but no clear association with improved clinical outcomes.<sup>33</sup> Possible explanations for this include inadequate sample sizes for some outcomes, lack of a team approach, and other protocol variations. A bundled approach using groups of evidence-based interventions has been recommended to improve effects on relevant clinical outcomes.<sup>33</sup> The 2016 A.S.P.E.N. and SCCM nutrition guidelines recommend that "enteral feeding protocols be designed and implemented to increase the overall percentage of goal calories provided."<sup>12(p171)</sup> Table 3 lists key points important for critical care nurses who provide nutrition support for their patients.

**Table 2** Studies of enteral nutritional protocols reviewed

Reference, year	Patients	Study design	Aim of study	Major findings
Barr et al, <sup>26</sup> 2004	Total of 200 medical intensive care unit (ICU) patients: 100 before protocol, 100 after protocol; 2 ICUs	Prospective	Examined effects of evidence-based ICU nutritional management protocol on nutritional and clinical outcomes	After implementation of protocol, patients were fed more frequently via the enteral route and duration of mechanical ventilation was significantly shorter once age, sex, and illness severity were adjusted for.
Doig and Simpson, <sup>29</sup> 2008	Total of 1118 patients. 561 using guidelines, 557 control; 27 ICUs	Cluster randomized controlled trial	Compared evidence-based guideline on feeding process measures and clinical outcomes	Patients in guideline hospitals were fed earlier and achieved nutrition goals more often than controls. No differences in hospital mortality or length of stay in hospital or ICU.
Soguel et al, <sup>24</sup> 2012	Total of 572 mixed ICU patients in 1 ICU	Prospective	Examined use of feeding guideline and presence of ICU dietitian; measured at baseline, 3 months, and 1 year after intervention	Improved energy delivery and balance using enteral and combined enteral and parenteral routes; presence of ICU dietitian provided additional progression of nutrition goals.
Heyland et al, <sup>28</sup> 2013	Total of 1059 patients with low baseline nutritional adequacy from 18 ICUs	Prospective, cluster randomized trial	Compared feeding protocol vs usual care. Main outcome: proportion of nutrition received; secondary outcomes: vomiting, aspiration, pneumonia	Enteral delivery and start of enteral nutrition was significantly greater at intervention sites than at control sites. Supplemental parenteral nutrition was used. No difference in complication rates between groups.
Taylor et al, <sup>31</sup> 2014	Total 110 patients: 54 before and 56 after protocol; 1 ICU	Retrospective, quality improvement project	Evaluate the effect of "volume-based" feeding protocol on nutritional adequacy and enteral delivery	Change to a volume-based protocol led to significant improvement in calories and protein delivered
Compton et al, <sup>32</sup> 2014	Total 160 patients, 73 before and 87 after protocol	Prospective	Examined effect of protocol on nutrition prescription and delivery	Enteral nutrition started earlier, goal rate achieved faster, enteral delivery increased

Critically ill patients represent a mixed group, and a one-size-fits-all method for nutrition support is not appropriate. Advantages of protocols include simplifying care, cost containment, and less variability in care.<sup>11</sup> Some clinicians have advocated for a bundled approach—selecting several of the strongest nutrition support recommendations and using them consistently in daily management of critically ill patients.<sup>27</sup> The more effective nutrition protocols incorporate a team approach in increasing the overall percentage of enteral nutrition provided for the patient. This goal may involve direct promotion of the protocol with staff using targeted education of physicians and nurses,<sup>27,28,31</sup> using a

combination of enteral nutrition and supplemental parenteral nutrition to meet nutrition goals,<sup>26,28,31</sup> nurse-driven advancement using the volume-based method instead of the rate-based method,<sup>24,28,31</sup> and addition of a full-time ICU dietitian.<sup>24</sup> Limited knowledge of nutrition support has been identified as a key problem and may need to be addressed in the protocols.<sup>27,34</sup>

### Implications for Nursing

Nurses play a key role in promoting adequacy of delivery of enteral nutrition in ICUs. Nursing involvement is relevant, from identifying patients who may be malnourished on admission or at high risk of becoming

**Table 3** Recommendations for feeding in the intensive care unit<sup>a</sup>

Recommendation	Details
Nutrition risk assessment	Evaluate nutrition risk and disease severity on admission Nutritional Risk Screening (NRS) 2002 score >3 = risk; ≥5 = high risk NUTRIC score ≥5 = high risk Patients at low nutrition risk and disease severity (NRS 2002 score ≤3 or NUTRIC score ≤5) do not require specialized nutrition support during the first week of hospitalization.
Determine energy and protein requirements	Energy (calories): use indirect calorimetry when available to determine energy requirements, otherwise use weight-based calculation 25-30 kcal/kg of actual body weight per day Protein: 1.2-2.0 g/kg actual body weight per day; increase protein in burn or multitrauma patients
Initiation and advancement of enteral nutrition	Initiate enteral nutrition within first 24-48 hours of admission to intensive care unit; no need to wait for signs of gastrointestinal motility Withhold enteral nutrition until the patient is fully resuscitated and/or hemodynamically stable Low aspiration risk → gastric feeding; high aspiration risk → small-bowel feeding Gastric feeding: start at 100 mL/h, increase in 50-mL/h increments every 4 hours to goal Small-bowel feeding: start at 20 mL/h, increase in 10-mL/h increments every 4 hours to goal
Dosing of enteral nutrition	High nutrition risk → advance toward goal rate as tolerated for 24-48 hours; monitor for refeeding syndrome; achieve >80% goal calories/protein within 48-72 hours within the first week Trophic feedings (10-20 mL/h) can be used to maintain gut integrity in low-risk to moderate-risk patients, but are insufficient in high-risk patients Supplemental parenteral nutrition after 7-10 days if unable to meet >60% of goal requirements by enteral nutrition alone
Monitoring tolerance and adequacy of enteral nutrition	Avoid inappropriate cessation of enteral nutrition; minimize nothing-by-mouth status surrounding tests/procedures Do not use gastric residual volumes (GRVs) to monitor tolerance; if used by policy, do not withhold feedings for GRVs <500 mL in the absence of other signs of gastrointestinal intolerance Use a volume-based or multistrategy feeding protocol to maintain adequacy of nutritional intake Target 24-hour volumes: use prokinetic agents, postpyloric feeding if needed to achieve goal rates Makeup rate calculation: based on enteral nutrition goal rate, hours enteral nutrition withheld, and hours remaining in 24 hours

<sup>a</sup> Based on information from McClave et al<sup>21</sup> and Taylor et al.<sup>31</sup>

malnourished, to actually ensuring delivery of enteral nutrition. Nurses' involvement may include participation on an interprofessional team for developing unit standards or protocols and surveying staff knowledge of key practice issues related to nutrition.<sup>35,36</sup> Critical care nurses understand the complexities of care required to manage their patients. Delivery of enteral nutrition is a common, but essential treatment that requires specialized nursing knowledge and skill to prevent nutritional and clinical complications.<sup>34,36,37</sup> Protocols for enteral nutrition enable ICU nurses to address the needs of their enterally fed patients using a systematic, evidence-based approach. The protocols derived from current research focus on when to start enteral nutrition, formula selection, prokinetic use, supplemental parenteral nutrition, handling gastric residual volumes, and conditions or problems that may require enteral nutrition to be adjusted or stopped.<sup>12</sup> Care protocols used for a wide variety of conditions including sepsis, glucose control, and others have become common in ICUs.<sup>11</sup> Nurses who actively

seek to prevent underfeeding and loss of lean muscle mass can help promote early mobility and recovery.<sup>5</sup> If 60% to 80% of enteral nutrition goals can be achieved within the first week, patients may have improved chances of recovery.<sup>4,16,38</sup> Nurses can take an active role in implementation of enteral nutrition protocols through use of volume-based and nurse-driven protocols to ensure that patients receive their prescribed enteral nutrition despite frequent interruptions. Nurses are in a unique position to take an active role in promoting the best nutritional outcomes for their patients by using and evaluating enteral nutrition protocols.<sup>35,36</sup>

## Conclusion

Nutritional management of critically ill patients is no longer recognized as supportive therapy.<sup>2</sup> Malnutrition has a significant negative impact on patients' outcomes, and adequate delivery of enteral nutrition counteracts the metabolic changes associated with critical illness.<sup>4</sup> Barriers to adequate delivery have plagued critical care



for many years. Protocols provide a means to incorporate and apply best practices in critical care units.<sup>11</sup> Evidence-based, well-designed protocols for enteral nutrition that promote team communication and provide for individualized patient management are supported by research evidence and must be recognized as a standard of care in the ICU. **CCN**

Financial Disclosures  
None reported.

## eLetters

Now that you've read the article, create or contribute to an online discussion about this topic using eLetters. Just visit [www.cconline.org](http://www.cconline.org) and select the article you want to comment on. In the full-text or PDF view of the article, click "Responses" in the middle column and then "Submit a response."

## References

1. Miller KR, Kiraly LN, Lowen CC, Martindale RG, McClave SA. "CAN WE FEED?" A mnemonic to merge nutrition and intensive care assessment of the critically ill patient. *JPEN J Parenter Enteral Nutr.* 2011;35(5):643-659.
2. Hegazi RA, Wischmeyer PE. Clinical review: optimizing enteral nutrition for critically ill patients—a simple data-driven formula. *Crit Care.* 2011;15(6):234.
3. DeLegge MH. Nutrition support in the intensive care patient. *J Infus Nurs.* 2013;36(4):262-268.
4. Alberda C, Gramlich L, Jones N, et al. The relationship between nutritional intake and clinical outcomes in critically ill patients: results of an international multicenter observational study. *Intensive Care Med.* 2009;35(10):1728-1737.
5. Cherry-Bukowiec JR. Optimizing nutrition therapy to enhance mobility in critically ill patients. *Crit Care Nurs Q.* 2013;36(1):28-36.
6. Khalid I, Doshi P, DiGiovine B. Early enteral nutrition and outcomes of critically ill patients treated with vasopressors and mechanical ventilation. *Am J Crit Care.* 2010;19(3):261-268.
7. McClave SA, Martindale RG, Vanek VW, et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). *JPEN J Parenter Enteral Nutr.* 2009;33(3):277-316.
8. Heyland D, Dhaliwal R, Drover J, Gramlich L, Dodek P. Canadian clinical practice guidelines for nutrition support in mechanically ventilated, critically ill adult patients. *JPEN J Parenter Enteral Nutr.* 2003;27(5):355-373.
9. Kreymann KG, Berger MM, Deutz NE, et al. ESPEN Guidelines on enteral nutrition: intensive care. *Clin Nutr.* 2006;25(2):210-223.
10. Singer P, Berger MM, Van den Berghe G, et al. ESPEN guidelines on parenteral nutrition: intensive care. *Clin Nutr.* 2009;28(4):387-400.
11. Chang SY, Sevransky J, Martin GS. Protocols in the management of critical illness. *Crit Care.* 2012;16(2):306.
12. McClave SA, Taylor BE, Martindale RG, et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). *JPEN J Parenter Enteral Nutr.* 2016;40(2):159-211.
13. McClave SA, Sexton LK, Spain DA, et al. Enteral tube feeding in the intensive care unit: factors impeding adequate delivery. *Crit Care Med.* 1999;27(7):1252-1256.
14. O'Leary-Kelley CM, Puntillo KA, Barr J, Stotts N, Douglas MK. Nutritional adequacy in patients receiving mechanical ventilation who are fed enterally. *Am J Crit Care.* 2005;14(3):222-231.
15. Stewart ML. Interruptions in enteral nutrition delivery in critically ill patients and recommendations for clinical practice. *Crit Care Nurse.* 2014;34(4):14-21.
16. Heyland DK, Dhaliwal R, Jiang X, Day AG. Identifying critically ill patients who benefit the most from nutrition therapy: the development and initial validation of a novel risk assessment tool. *Crit Care.* 2011;15(6):R268.
17. McClave SA, Kleber MJ, Lowen CC. Indirect calorimetry: can this technology impact patient outcome? *Curr Opin Clin Nutr Metab Care.* 1999;2(1):61-67.
18. Savard JF, Faisy C, Lerolle N, Guerot E, Diehl JL, Fagon JY. Validation of a predictive method for an accurate assessment of resting energy expenditure in medical mechanically ventilated patients. *Crit Care Med.* 2008;36(4):1175-1183.
19. Singer P, Doig GS, Pichard C. The truth about nutrition in the ICU. *Intensive Care Med.* 2014;40(2):252-255.
20. Heyland DK, Cahill N, Day AG. Optimal amount of calories for critically ill patients: depends on how you slice the cake! *Crit Care Med.* 2011;39(12):2619-2626.
21. Casaer MP, Mesotten D, Hermans G, et al. Early versus late parenteral nutrition in critically ill adults. *N Engl J Med.* 2011;365(6):506-517.
22. Kerrie JP, Bagshaw SM, Brindley PG. Early versus late parenteral nutrition in the adult ICU: feeding the patient or our conscience? *Can J Anaesth.* 2012;59(5):494-498.
23. Savel RH, Munro CL. Evidence-based backlash: the tale of drotrecogin alfa. *Am J Crit Care.* 2012;21(2):81-83.
24. Soguel L, Revelly JP, Schaller MD, Longchamp C, Berger MM. Energy deficit and length of hospital stay can be reduced by a two-step quality improvement of nutrition therapy: the intensive care unit dietitian can make the difference. *Crit Care Med.* 2012;40(2):412-419.
25. Spain DA, McClave SA, Sexton LK, et al. Infusion protocol improves delivery of enteral tube feeding in the critical care unit. *JPEN J Parenter Enteral Nutr.* 1999;23(5):288-292.
26. Barr J, Flavin KE, Amparo Khorana M, Gould MK. Outcomes in critically ill patients before and after the implementation of an evidence-based nutritional management protocol. *Chest.* 2004;125(4):1446-1457.
27. Hurt RT, McClave SA, Evans DC, et al. Targeted physician education positively affects delivery of nutrition therapy and patient outcomes: results of a prospective clinical trial. *JPEN J Parenter Enteral Nutr.* 2015;39(8):948-952.
28. Heyland DK, Murch L, Cahill N, et al. Enhanced protein-energy provision via the enteral route feeding protocol in critically ill patients: results of a cluster randomized trial. *Crit Care Med.* 2013;41(12):2743-2753.
29. Doig GS, Simpson. Effect of evidence-based feeding guidelines on mortality of critically ill adults: a cluster randomized controlled trial. *JAMA.* 2008;300(23):2731-2741.
30. Martin CM, Doig GS, Heyland DK, Morrison T, Sibbald WJ, Southwestern Ontario Critical Care Research Network. Multicentre, cluster-randomized clinical trial of algorithms for critical-care enteral and parenteral therapy (ACCEPT). *CMAJ.* 2004;170(2):197-204.
31. Taylor B, Brody R, Denmark R, Southard R, Byham-Gray L. Improving enteral delivery through the adoption of the "Feed Early Enteral Diet Adequately for Maximum Effect (FEED ME)" protocol in a surgical trauma ICU: a quality improvement review. *Nutr Clin Pract.* 2014;29(5):639-648.
32. Compton F, Bojarski C, Siegmund B, van der Giet M. Use of a nutrition support protocol to increase enteral nutrition delivery in critically ill patients. *Am J Crit Care.* 2014;23(5):396-403.
33. Ventura AM, Waitzberg DL. Enteral nutrition protocols for critically ill patients: are they necessary? *Nutr Clin Pract.* 2015;30(3):351-362.
34. Metheny NA, Mills AC, Stewart BJ. Monitoring for intolerance to gastric tube feedings: a national survey. *Am J Crit Care.* 2012;21(2):e33-e40.
35. Racco M. An enteral nutrition protocol to improve efficiency in achieving nutritional goals. *Crit Care Nurse.* 2012;32(4):72-75.
36. Bell L. Monitoring patients receiving enteral feedings. *Am J Crit Care.* 2012;21(2):133.
37. Bell L. Early enteral nutrition in critically ill patients. *Am J Crit Care.* 2010;19(3):269.
38. Cahill NE, Dhaliwal R, Day AG, Jiang X, Heyland DK. Nutrition therapy in the critical care setting: what is "best achievable" practice? An international multicenter observational study. *Crit Care Med.* 2010;38(2):395-401.