Improving Nutrition in Mechanically Ventilated Patients

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ABSTRACT

Background: Although proper diet has been found to play an important role in patient outcomes, studies have shown that intensive care unit patients often receive inadequate nutrition. Moreover, it has been found that critically ill patients who are mechanically ventilated regularly receive even less nutrition. Inadequate nutrition has been associated with impaired immune response, increased susceptibility to infection, poor wound healing, and neuromuscular impairment. These factors lead to prolonged dependence on ventilators, protracted length of stay, and increased morbidity and mortality. This study investigates the use of an enteral nutrition (EN) protocol and its ability to prompt earlier initiation of feedings and more complete nutrition in mechanically ventilated patients to minimize such complications. **Methods:** In a sample of 51 mechanically ventilated patients admitted to an intensive care unit, percentage of prescribed calories received and percentage of feedings initiated with 24–48 hours of intubation were calculated before and after the initiation of an EN protocol. **Results:** In the postintervention group (n = 18), 83.3% received EN with the first 24–48 hours after intubation, compared with 54.5% in the preintervention group (n = 33). In the postintervention group, 77.8% received at least 60% of their prescribed feeding goal compared with 63.6% of the preintervention group. **Conclusion:** Findings show that the use of an EN protocol when caring for mechanically ventilated patients leads to earlier initiation of feedings as well as more complete nutrition.

Keywords: clinical practice guideline, critical care, enteral nutrition, evidence-based practice, intensive care, mechanical ventilation, protocol

There is an abundance of evidence showing the positive clinical outcomes associated with early initiation of nutritional support through enteral feedings in critically ill patients receiving mechanical ventilation. Unfortunately, it has been found that suboptimal nutrition is common among this population (Adam & Batson, 1997; Binnekade, Tepaske, Bruynzeel, Mathus-Vliegen, & de Hann, 2005; De Jonghe et al., 2001; Elpern, Stutz, Peterson, Gurka, & Skipper, 2004; Heyland, Dhaliwal, Drover, Gramlich, & Dodek, 2003; McClave et al., 1999; Reignier, 2013; Spain et al., 1999). This practice, often the result of underestimating patient nutritional needs by medical staff and frequent interruptions in enteral feedings for various reasons, is associated with a variety of negative effects, such as impaired immune response, increased susceptibility to infection, poor wound healing, and neuromuscular impairment (Artinian, Krayem, & DiGiovine, 2006; Barr, Hecht, Flavin, Khorana, & Gould, 2004; Dobson & Scott, 2007; Marik & Zaloga, 2001; Reignier, 2013). These factors lead to prolonged dependence on ventilators, protracted length of stay, and increased morbidity and mortality (Artinian et al., 2006; Barr et al., 2004; Dark & Pingleton, 1993). Interventions to ensure earlier initiation of feedings and more complete feedings in mechanically ventilated patients, such as the use of enteral nutrition (EN) protocols, have the potential to minimize such complications.

Background and Significance

During illness, increased basal metabolic rate and rate of protein catabolism occurs to increase the body's energy stores. Coupled with inadequate caloric intake, excessive protein breakdown and gluconeogenesis take place, commonly leading to a systemic inflammatory response in the critically ill patient. If this state is allowed to continue, it can lead to organ dysfunction, metabolic derangements, decreased body mass, increased susceptibility to infection, and increased morbidity and mortality (Cerra et al., 1997; Dobson & Scott, 2007; McClave et al., 2009).

The need for mechanical ventilation in critically ill patients poses a serious risk for underfeeding and progressive malnutrition, with studies finding that this population often receives less than required energy and protein (Kyle et al., 2006; O'Leary-Kelly, Puntillo, Barr, Stotts, & Douglas, 2005; O'Meara et al., 2008; Rice, Swope, Bozeman, & Wheeler, 2005). Because

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nutrition via the oral route is not an option for the mechanically ventilated, timely EN or parenteral nutritional support is required to prevent undernourishment. EN is preferred over parenteral nutrition (PN) because it is more physiologic and less likely to result in hepatobiliary dysfunction and electrolyte imbalance. In addition, when compared with EN, use of PN has been linked to higher incidence of infection, impaired wound healing, and gastrointestinal bleeding (Barr et al., 2004).

Patient outcomes can be drastically improved with proper nutrition. Providing proper nutritional care for ventilator-dependent, critically ill patients has been found to reduce complications, decreasing length of stay and hospital costs. Studies show that early and adequate nutrition are linked to improved tissue healing, decreased physiological stress, and increased immunocompetence, which in turn lead to decreased rate of nosocomial infections and pressure ulcers (Marik & Zaloga, 2001). Various studies also suggest that improved nutrition decreases patient mortality (Dardaine, Dequin, Ripault, Constans, & Giniès, 2001; Dark & Pingleton, 1993; Heyland et al., 2003; Kreymann et al., 2006).

Kattelmann et al. (2006) conducted a detailed systematic evaluation of the evidence supporting enteral feeding practices for patients admitted to intensive care units (ICUs). Evidence showed that delivery of approximately 60%–70% of enteral feeding goal, an individualized amount prescribed based on height, weight, previous nutritional state, and current metabolic need, in the first 7 days of ICU admission is associated with decreased length of stay, decreased time on ventilators, and decreased infections, especially when begun within 48 hours of injury or admission. Conversely, Kattelmann et al. went on to cite evidence suggesting that achieving over 70% of goal may have detrimental effects, such as increased incidence of aspiration pneumonia and increased length of stay in medical ICU patients and obese patients when compared with those who received only 60%–70% of goal. Other studies suggest that initiation of EN in ICU patients within the 48–72 hours of admission improves immune response, enhances the cellular antioxidant system, decreases the hypermetabolic response to tissue injury, preserves intestinal integrity, and improves wound healing (Barr et al., 2004). The use of EN protocols has the potential to decrease delays in initiating feedings and increase delivery of much needed calories in mechanically ventilated patients. The goal of this study is to further investigate this topic to improve nutrition among this population.

Literature Review

A search of the literature was performed using Cumulative Index to Nursing and Allied Health Literature, Medical Literature Online, and the Cochrane Database of Systemic Reviews. Keywords utilized in the search were as follows: enteral nutrition (EN), feeding tubes, evidence-based, mechanical ventilation, nutrition, guideline, and protocol. Abstracts of studies that specifically addressed nutrition guidelines or protocols and ventilator-dependent patients were selected. Studies involving subjects younger than 18 years and studies greater than 10 years old were excluded. Studies addressing nutrition in critically ill patients not receiving mechanical ventilation were excluded. This search yielded seven pieces of evidence fitting the selected inclusion and exclusion criteria (see Appendix, available as Supplement Digital Content 1 at http://links.lww.com/JNN/A42).

The article examines the positive effects of proper nutritional care for critically ill, ventilator-dependent patients, including fewer complications, enhanced tissue healing, decreased physiologic stress, and improved immunocompetence. Clinical practice guidelines are discussed as well.

The Canadian Clinical Practice Guidelines

The Canadian Clinical Practice Guidelines (CPGs) for nutrition support in mechanically ventilated, critically ill adult patients, first developed in 2003 and then updated in 2007, 2009, and 2013, are clinical practice guidelines based on a review of 276 randomized trials focusing on critical care nutrition published after 1980 (Canadian Critical Care Clinical Practice Guidelines Committee, 2013). At the time of this study, the 2013 update of the CPG was unavailable, and therefore, the review was based on the 2009 version, which reviewed 209 randomized trials focusing on this topic. Critical appraisal of the CPG using the AGREE tool (AGREE Collaboration, 2001) was performed to assess the quality of the guidelines. On the basis of the AGREE analysis, the CPGs have addressed biases adequately, showed strong internal and external validity, and are feasible for practice. The CPG, level 1 evidence, provided the basis for the EN protocol utilized in this study. The updated version, along with

an interactive Web-based workshop, including implementation tools and other user-friendly public domain resources, can be found on the Web site www.criticalcarenutrition.com.

After the development of the CPG, the authors sought to validate them in clinical practice. Heyland, Dhaliwal, Day, Jain, and Drover (2004) conducted a prospective observational study that examined the association between five recommendations from the CPG and adequacy of EN. Set in 59 ICUs across Canada with a sample of 638 mechanically ventilated patients, the study probes the association between five recommendations from the CPGs and adequacy of EN. The five recommendations chosen were the ones most directly related to the provision of nutritional support (use of PN, feeding protocol, early EN, small bowel feedings, and motility agents). Adequacy was defined as the percentage of prescribed calories that patients actually received. Those that used PN had a lower adequacy of EN (32.9% vs. 52.7%, $p < .0001$). In all categories, use of feeding protocol (44.9% vs. 38.5%, $p = .03$), initiation of EN within 48 hours (48.1% vs. 34.4%, $p < .0001$), use of motility agents, and small bowel feeding (45.6% vs. 39.2%, $p = .04$, and 48.4% vs. 41.8%, $p = .16$, respectively) showed improved nutrition.

Heyland et al. (2004) concluded that ICUs whose practice is most consistent with the guidelines will have greatest success in the provision of EN; the study validated the CPG. A major weakness of this study is its observational design. A randomized clinical trial would have provided a higher level of evidence. The study measured adequacy of EN but did not look at patient outcomes. The study addresses these limitations and does not purport to claim that the guidelines will necessarily translate into better outcomes.

After the validation of the CPG, Jain et al. (2006) sought to identify the best practice for the dissemination of the guidelines. Results of a cluster randomized controlled trial compared the effectiveness of active with passive dissemination of the CPG. The primary end point of the study was nutritional adequacy of EN: The secondary end points measured were compliance to the CPG, glycemic control, length of stay, and 28-day mortality. Both active and passive groups showed improvements in nutritional adequacy of EN, but improvement was not significantly different between groups. There were no differences in clinical outcomes (ICU and hospital length of stay or 28-day mortality rate) between groups or across periods.

In discussing their findings, the authors cite the need for organizational change strategies and the inclusion of administrators in their study. They also questioned their choice of the dietician as change agent over the physician, who might have had a more positive impact on change in care. These are two very meaningful insights and will be used to guide this evidence-based project.

After the CPGs were developed, validated, and disseminated, some of the authors, concerned with the lack of significant findings between the active and passive implementation groups (Jain et al., 2006), sought to identify factors that affect the integration of the guidelines into practice and their impact on clinical outcomes. Jones, Suurdt, Ouelette-Kuntz, and Heyland (2007) compared the effectiveness of active with passive dissemination of the CPG. This level 2 evidence was a cluster-randomized trial conducted with outcome assessment at baseline and at 12 months. The investigators grouped 58 ICUs in Canada into 50 clusters. Clusters received computer-generated randomization to either active or passive dissemination groups. Dieticians in the active dissemination group were provided with multifaceted educational interventions including Web-based tools and an interactive workshop. Dieticians in the passive group received a mailed copy of the CPG. The primary end point of the study was nutritional adequacy of EN: The secondary end points measured were compliance to the CPG, glycemic control, length of stay in ICU and hospital, and 28-day mortality. Patients ($n = 623$) were evaluated at baseline and at the 12-month end point ($n = 612$). The study found that both groups showed improvements in nutritional adequacy of EN but that improvement was not significantly different between groups (8% [active] vs. 6.2% [passive], $p = .54$). However, in the active group, glycemic control increased 10.1% compared with 1.8% in the passive group ($p = .001$). There were some changes noted in subgroups where medical patients in the active groups improved more than those in the passive groups (8.1%, $p = .04$), but there were no such differences observed in the surgical subgroup. Overall, when all groups were combined at the end of the 12-month period, there was an increase in EN adequacy (from 43% to 50%, $p < .001$), an increase in the use of protocols (from 64% to 76%, $p = .03$), and a decrease in the number of patients on PN (from 26% to 21%, $p = .04$). There were no differences in clinical outcomes (ICU and hospital length of stay or 28-day mortality rate) between groups or across periods. In discussing their findings, the authors offer several possible explanations for their results and made recommendations for future dissemination of guidelines. Once again, the researchers cited the need for organizational change strategies and their lack of inclusion of administrators in the study and questioned their choice of the dietician as change agent over the physician.

Another study (Jones et al., 2007) consisted of multiple case studies at four ICU sites across Canada. The qualitative design sought to describe, understand, and

explain barriers and enablers. Sites were chosen to represent maximum variations in size, settings (academic or community), and different macro-organizational characteristics. Interviews were conducted at each site, and key themes were identified. Barriers that emerged were related to characteristics of the individual practitioners (resistance to change, lack of awareness of CPG, lack of critical care experience), the clinical condition of the patients, the institution (lack of resources, slow administrative process, heavy patient assignments), and criticism of the guidelines (too numerous, too complex, lacked convincing and timely evidence). Although present in all sites, these factors were of differing influence depending on the site characteristics (community or academic) and size (small or large). The barriers also varied by profession. Physicians reported disagreement with the guidelines and its recommendations, and nurses were more concerned with practical concerns such as workload, information overload, and patient tolerance to EN.

Enablers to the implementation of the CPG were also identified. The chief enablers were determined to be agreement of the ICU team and buy-in of the physician. Because nutritional support was not the primary expertise of most of the key informants, the CPG offered a useful summary of current evidence in the field. Easy access to the guidelines, ease in their application, and incorporation into the daily routine also proved to be key factors. Reminders, checklists, protocols, and multidisciplinary rounds that included open discussion about nutrition support also aided successful implementation. Although only level 6 evidence, it presented important considerations that will be incorporated into the plan and design using the CPG at a suburban hospital (Jones et al., 2007).

Another significant study (Jones, Dhaliwal, Day, Ouellette-Kuntz, & Heyland, 2008) was a follow-up to the Jain et al. (2006) study on dissemination of the CPG and involved a secondary analysis of data collected during that study. This prospective observational cohort study (level 4 evidence) sought to identify factors associated with adherence to the CPG. Adherence was determined by adequacy of EN (calories received from EN divided by calories prescribed by the dietician multiplied by 100) received by patients. Predictors of success were determined to be hospital type (54.3% [academic] vs. 45.2% [community], $p < .001$), admission category of the patient (60.2% [medical] vs. 39.2% [surgical], $p < .001$), and gender (46.5% [male] vs. 52.8% [female], $p < .001$).

Implementation of Other Nutritional Protocols Similar to the CPG

Although the following studies do not use the CPG, they provide support for the implementation of a standardized protocol. In a study by Mackenzie, Zygun, Whitmore, Doig, and Hameed (2005), conducted in an ICU with no written guidelines or standardized approach to nutrition support, an interdisciplinary team developed its own evidence-based EN protocol. Study findings revealed that the percentage of patients receiving at least 80% of their estimated nutritional needs increased from 20% preprotocol implementation to 60% postprotocol implementation ($p < .001$). Furthermore, those in the postimplementation group received significantly more kilocalories per kilogram per day when compared with those in the preimplementation group (5.78 vs. 1.64, $p = .0001$). The study concluded that the use of an evidence-based nutrition support protocol improved the proportion of enterally fed ICU patients meeting their nutritional requirements. This is the only study found on the effect of a nutrition support protocol on the nutritional outcomes of mechanically ventilated patients.

Of great interest was a small aside by Mackenzie et al. (2005). The authors mentioned the challenges of maintaining compliance or adherence to a protocol. Six months after the study was completed, quality improvement data showed that, without ongoing rigorous education and monitoring, nutritional goal achievement decreased. After reinstating nursing in-services, implementing a contest among nursing teams, and creating pocket cards with protocol concepts for residents and other tools to encourage use of the protocol, the rate was again increased to over 80%. Regular audits are now conducted, and results are shared at the ICU quality council and other departmental meetings and on the internal Web site.

The final piece of evidence is a level 3 study conducted in the Netherlands by Strack van Schijndel et al. (2009). This was the first and only study that linked increased nutritional support to positive patient outcomes in mechanically ventilated patients. This Netherlands study found that optimal nutritional therapy improved ICU, 28-day, and hospital survival rates in female mechanically ventilated patients. Surprisingly, the study did not show the same benefits for men. This study considered both energy and protein goals. Routes of patient nutrition were enteral, parenteral, and a combination of both. Female patients who met nutritional goals had an 80% decreased chance of dying in the ICU, a 92% decreased 28-day mortality, and a 67% lower hospital mortality when compared with patients who did not reach their nutritional goals. In men, no significant effects of nutrition on outcomes were detected.

Although the results of this study have not yet been confirmed by other studies, it does support the positive patient outcomes that previous studies predicted. Nutritional support to mechanically ventilated patients improved patient outcomes. The study is limited in that it is only an observational study. Although the

study is greatly encouraging, more research and, especially, strong randomized controlled trials need to be conducted in this area.

Summary

This review provides support for the use of the CPG. Studies conducted in three different countries, on different populations, in different healthcare organizations, and within different healthcare systems, all showed the need for evidence-based clinical guidelines. The literature supports the utilization of the CPG to increase patient nutrition in mechanically ventilated adults. It provides best practices for dissemination and implementation of the CPG into practice, and it supports the long-held hypothesis that improved nutrition leads to improved clinical outcomes for ventilated patients. These studies support a change in clinical practice to a practice that is current and evidence based. These studies guided the design and implementation of the evidence-based practice project.

Methods

Setting

The study took place in a regional suburban medical center in New Jersey, containing three acute care units, an ICU containing 20 beds, cardiac care unit containing 10 beds, and neurological ICU containing 10 beds. Unit administration consisted of two managers, one responsible for ICU and neurological ICU and another responsible for the cardiac care unit. Each unit also had clinical coordinators who reported to the unit managers as well as clinical nurse specialists who assisted with care. All personnel/staff on the three units were responsible for implementing the evidence-based EN protocol for ventilated patients. The researcher oversaw the implementation of the protocol and was available on the units weekly to provide support and open communication.

An outside investigator conducted the study. The study was initiated at the request of one of the unit nurse managers who felt that nutrition in ventilator-dependent patients was not receiving the attention that she suspected it deserved. She wanted to ensure that the care being given in the units was based on a careful critique of current research. Other staff nurses were also very supportive of the topic because they too suspected that early and complete nutrition would improve patient outcomes. The search for credible evidence on the timing and amount of EN for ventilator-dependent patients resulted from a desire by the staff nurses to put identified best practices into part of their routine care.

Formulating the EN Protocol

The Iowa Model of Evidence-Based Practice to Promote Quality, which incorporates the use of research, application of theories, expert opinions, and case reports to address problem-focused and knowledge-focused triggers to improve patient outcomes, was used to guide the project implementation (Titler et al., 2001). In the selected facility, the review of literature pertaining to the use of nutritional support guidelines in mechanically ventilated patients revealed that current practice was not consistent with identified best practices. Following the Iowa Model, a multidisciplinary committee, consisting of nurses, dieticians, and physicians, was assembled to oversee the implementation of the practice changes on pilot units. An evaluation of the process and outcomes was performed, and modifications were made as necessary. Staff, patient, and family satisfaction and fiscal concerns were also addressed. Five areas of the Canadian CPGs for nutrition support in mechanically ventilated, critically ill adult patients were utilized for the EN protocol (Table 1).

Sample

Before the implementation of the EN protocol, data were collected studying 33 patients intubated between October 23, 2010, and January 5, 2011. The ages of the patients in this preintervention group ranged from 30 to 88 years, with 58% being female. Postintervention data were collected studying 18 patients who were intubated between December 4, 2012, and January 30, 2012. Ages in this group ranged from 37 to 86 years, with 56% being female. Patients from all three acute care units at this facility were included to have a higher volume of ventilator-dependent patients. Patients of all disease states, body mass indexes, and length of anticipated duration of mechanical intubation and those prescribed with muscle relaxants or paralytics were included in the study.

As with all evidence-based practice, the evidence was integrated with clinician expertise and patient and family preferences. Deviation from the protocol based on changing hemodynamics or changes in patient and family wishes did not remove patients from the study because the interest was in identifying the actual practices of the units. Those mechanically ventilated patients younger than 18 years old were excluded from this study, and one patient whose life support was terminated within 24 hours of intubation was also excluded. To ensure the rights of those participating in this study, institutional review board approval was obtained. All data obtained were deidentified, and patient names were kept anonymous in accordance with the Health Insurance Portability and Accountability Act of 1996.

Data Collection and Analysis

Data collection forms addressing time intubated/extubated, time EN was ordered, time EN was initiated,

TABLE 1. Enteral Nutrition Protocol

- Consult with physician (MD) and registered dietician to initiate enteral nutrition (EN) within 24–48 hours. Verify orders.
- Obtain baseline weight, and weigh daily.
- Insert nasogastric/orogastric feeding tube.
  - [ ] Mark with pink tape and secure
  - [ ] Chest x-ray to confirm initial feeding tube placement
- Elevate and maintain head of bed at 45°.
- Initiate EN at 25 ml/hr, and advance as per orders to goal rate.
- Verify tube placement by:
  - [ ] Withdrawal of gastric contents before each medication administration
  - [ ] Withdrawal of gastric contents every 8 hours for continuous use
- Assess for clinical signs of intolerance at least 4 hours after initial feeding and at least every 8 hours thereafter. Stop feeding, and reevaluate if the following are present:
  - [ ] Abdominal cramping, distention, or rigidity
  - [ ] Vomiting/aspiration
  - [ ] Diarrhea/constipation
  - [ ] Gastric residual volume (GRV) > 250 ml
    - ( ) GRV < 250 ml: replace, continue feeding, and recheck in 8 hours
    - ( ) GRV > 250 ml: replace 300 ml of aspirate, irrigate the tube, hold feeding for 2 hours, and then recheck
- Intervene on risk factors that may delay gastric emptying:
  - [ ] Maintain tight glycemic control
  - [ ] Assess and correct electrolyte abnormalities (especially potassium, magnesium, and phosphorus)
  - [ ] Minimize use of narcotics and sedation
- For patients with persistent inability to tolerate feeding, notify and consult with MD. Consider use of prokinetics.

prescribed EN goal, amount of EN received, and amount of time EN was infused were completed by the clinical coordinators of each unit after an in-service staff on the protocol, and data collection methods were conducted by the chief investigator. Prescribed EN goal is an amount prescribed by the physician based on the patient's weight, height, nutritional status, and current metabolic needs. On the basis of literature reviewed regarding this topic, 60% of prescribed EN goal was determined to optimal. Percentage of prescribed EN goal is the total amount of EN received by the patient divided by the prescribed EN amount ordered. Improvement in nutrition was indicated by an increase in the percentage of patients who received EN within 24–48 hours after intubation and an increase in the percentage of patients who received at least 60% of their prescribed enteral feeding goal while intubated.

Results

In the postintervention group, 83.3% of patients received EN within the first 24–48 hours after intubation, compared with 54.5% in the preintervention group (Table 2). The postintervention group was also found to receive more nutrition than the preintervention patients, with 77.8% of the postintervention group receiving at least 60% of their prescribed enteral feeding goal compared with 63.6% of the preintervention group (Table 3).

Discussion

Utilization of the EN protocol resulted in better nutrition for mechanically ventilated patients as evidenced by earlier initiation of feedings and a higher percentage of patients reaching optimal feeding goals. Without an EN protocol, variation in time to initiation of feedings, frequent interruptions in ordered feedings, and lack of standardization in nursing practice appear to lead to inconsistent nutritional support of patients. The education provided to the multidisciplinary staff helped to reinforce and highlight the importance of proper nutrition. By identifying credible evidence, the nurses, in particular, felt empowered to discuss nutrition with other members of the healthcare team. They were now able to more effectively advocate for their patients. Visual cues on the unit also provided a reminder that data were being maintained on nutrition and ventilated patients. This resulted in positive peer reinforcement of best practices for patient care. Although initially not a focus of administration, nutrition became an important patient goal. It is fair to question if this remained a priority goal once the study was concluded and data were no longer being analyzed.

Although patient outcomes were not measured in this study, based on research discussed earlier regarding the complications of inadequate nutrition and the positive results associated with earlier initiation of feeding and more complete feedings, it can be concluded that having an EN protocol in place, such as the one used for this study, has the potential to greatly benefit patient care. Since the time this research was conducted, this EN protocol has been accepted for permanent use by the facility, containing automatic triggers for the ordering of referrals, laboratory testing, and medical orders.

TABLE 2. Timing From Patient Intubation to Start of Enteral Feeding

	Feeding Started Within 48 Hours, *n* (%)	Feeding Started After 48 Hours, *n* (%)
Preintervention	18 (54.5)	15 (45.5)
Postintervention	15 (83.3)	3 (16.6)

TABLE 3. Percentage of Patients Receiving 60% of Prescribed Enteral Feeding Goal

	Received 60% of Goal, *n* (%)	Received Less Than 60% of Goal, *n* (%)
Preintervention	21 (63.6)	12 (36.3)
Postintervention	14 (77.8)	4 (12)

Because of the possible barriers to providing continuous EN to critically ill patients who are mechanically ventilated, such as frequent testing and hemodynamic instability, continued research needs to be conducted on alternate methods of providing EN. As of 2014, there is little research comparing the use of continuous feeding versus bolus feeding (Canadian Critical Care Clinical Practice Guidelines Committee, 2013). Because of the abundance of research showing the importance of proper nutrition in the population, further investigation is required regarding the feasibility of bolus feedings as opposed to continuous feeding.

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