Strategies for Efficient Delivery of Enteral Nutrition Therapy

Nutrition therapy is a vital component of the management of critically ill patients. Early studies had indicated that patients who accumulate a 10,000-calorie deficit have a three-fold increase in mortality, require a longer period on mechanical ventilation, and necessitate an increased length-of-stay (LOS) in the ICU. Evidence from two recent European studies has shown that a deficit of as little as 4,000 calories may worsen outcome. This applies pressure on multidisciplinary nutrition teams to minimize caloric deficit in these patients.

Early enteral feeding improves clinical outcome

Enteral nutrition (EN) contributes to improved outcomes in ICU patients by ensuring delivery of adequate caloric requirements while simultaneously modulating systemic immune responses. Early initiation of EN is currently thought to contribute to improved clinical outcome; data from a meta-analysis of six randomized controlled trials (RCTs) demonstrated that EN initiated within 24 hours of admission to the ICU reduced the risk of mortality (odds ratio [OR]=0.34, 95% confidence interval [CI]: 0.14–0.85) and pneumonia (OR=0.31, 95% CI: 0.12–0.78).

However, providing EN in the ICU can be difficult. A recent study showed that out of 1,192 patients admitted to the ICU over a three-month period, 22.6% were nil per os (NPO) for more than 3 days, whereas the mean duration of NPO was 5.2 days. Moreover, actual caloric delivery usually falls short of what is required, with values ranging from 27.9% to 71.4% of intended delivery.

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Caloric deficit is a major challenge in critically ill patients

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Strategies to improve delivery of EN therapy

1) Volume-based versus rate-based feeding

Enteral feeding is usually rate-based, with patients receiving a predetermined amount of calories at a constant infusion rate. Feeding interruptions, such as those due to surgical procedures or radiological examinations, can increase the daily caloric deficit. In volume-based feeding, the predetermined daily caloric volume is delivered within 24 hours by increasing the rate of infusion as required to compensate for feeding interruptions. For patients with interrupted feeding, the feeding rate can be adjusted and increased up to a maximum of 280 mL/hour in the stomach and 150 mL/hour in the small bowel to make up for the daily caloric requirement. These adjustments depend on the caloric deficit and the remaining hours to deliver feeding on that day. Evidence from a study comparing rate-based with volume-based feeding showed that volume-based feeding increased overall caloric delivery from 81% to 93%. During days when EN therapy was interrupted, volume-based feeding increased caloric delivery from 61% to 95%; consequently, the caloric deficit in these patients was reduced from 1,934 kcal to 776 kcal.

2) A top-down approach to improving caloric delivery

Top-down therapy comprises an initial intensive period of EN followed by a period of reduced intensity. The elements comprising this strategy are shown in Table 1.

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Table 1. Implementation of top-down therapy elements increases caloric delivery

<table>
<thead>
<tr>
<th>Elements of top-down therapy</th>
<th>Increase caloric delivery</th>
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<tbody>
<tr>
<td>Rapid advancement (start at goal rate)</td>
<td>Volume-based feeding</td>
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<tr>
<td>Initiation of prokinetics</td>
<td>Recording of cumulative caloric balance</td>
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<tr>
<td>Use of small-peptide/medium-chain triglyceride (MCT) formulas</td>
<td>Use of protein supplements</td>
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<td>Small-bowel feeding</td>
<td>Elevation of head of bed</td>
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In this approach, intensive treatment is gradually reduced with the development of tolerance. Results of the Canadian PEP-uP study showed that employing this approach increased caloric delivery from 58.8% to 83.2% (p<0.02) (Figure 1).13

3) Nurse-driven protocols improve provision of nutritional support

Engagement of ICU nurses to assist in the implementation of EN protocols may result in a more efficient delivery of EN. A study by Martin and colleagues showed that nurse-driven implementation of EN protocols in hospitals improved provision of nutritional support and was associated with improved patient outcomes compared with control.14 Introducing an element of enforcement results in even better outcomes; data from a 2012 European study showed that the presence of an ICU dietitian monitoring compliance to a designated EN protocol resulted in further improvements in caloric delivery, caloric deficit and hospital LOS compared with mere implementation of the protocol.15

4) Modification of existing protocols may reduce caloric deficit

According to the American Society of Anesthesiologists practice guidelines, the recommended preoperative fasting period for healthy patients undergoing elective procedures is 2 hours for clear liquids and 6 hours for light meals.16 However, a meta-analysis of 22 prospective RCTs showed that a shortened fluid restriction period did not increase the risk of aspiration or related morbidity compared with standard policy of NPO.17 Hospitals should examine their preoperative fasting protocols and consider adjustment of fasting periods, as shorter feeding interruptions will reduce the caloric deficit of preoperative patients.

5) Improving nutrition outcomes through implementation of a nutritional bundle

A novel concept in ICU care, a ‘bundle’ refers to a set of action statements which, when implemented fully, has been shown to improve outcome. Effective bundles have been developed for conditions such as ventilator-associated pneumonia, deep venous thrombosis, pressure sores, surgical site infections and bloodstream infections. A bundle for nutrition therapy should also be considered in ICU care. In a prospective RCT, an effective nutrition bundle was developed to educate physicians (Table 2). Results showed that the nutrition bundle strategy reduced caloric deficit from 8,817 kcal to 6,795 kcal (p<0.05), ICU days from 5.2 to 3.5 (p=0.13), ventilation days from 2.8 to 1.6 (p=0.13), and infection from 23.6% to 10.6%. In addition, the mean percentage of goal calories infused was increased from 22.2% to 30.1% (p<0.05).18

Early initiation of feeding and avoidance of interruptions may be more important than dose

Recently, two RCTs compared trophic feeding (10 or 20 mL/hour for the first six days, then increased to full feeding) with full feeding from the first day in patients with acute respiratory distress syndrome (ARDS). At the end of the studies, patients in the trophic feeding groups had received approximately 15–25% of daily goal calories while patients in the full feeding groups had received approximately 75–80% of daily goal calories. Despite these differences, results showed no differences in mortality rates, ventilation-free days, ICU-free days and infection rates between trophic feeding and full feeding groups.19,20 Although these findings may be unique to patients with ARDS, they suggest that early initiation of feeding and avoidance of interruptions may be more important than dose.

Summary

Nutrition therapy is a vital component of the management of critically ill patients. EN contributes to improved outcomes in ICU patients by ensuring delivery of adequate caloric requirements while simultaneously modulating systemic immune responses. Unless contraindicated, EN should be initiated as early and as aggressively as possible, with ICU physicians making sure to avoid therapy interruptions and implement appropriate protocols. Physicians should develop an effective EN program with established protocols, re-evaluate policies and focus on optimization of EN delivery, with judicious use of PN. They should also have skill sets, expertise and strategies to be activated when necessary, and take advantage of opportunities to deliver early EN.

References