Nutritional Therapy for Critically Ill Patients

Robert G. Martindale, Malissa Warren, Sarah Diamond and Laszlo Kiraly

Early nutrition (EN) therapy in the critical care setting has been shown to improve outcome. Appropriate and early intervention can attenuate the hyperdynamic systemic response and depressed immune reactions to injury, serious illness and major surgery (table 1). Controversies limit its uniform application and potential benefits, including failure to accurately predict who will *need* nutritional intervention, lack of consensus on the optimal enteral formulation, over-reliance on parenteral nutrition (PN), failure to maximize use of early enteral feeding, and how much and how best to feed the morbidly obese population.

Historically, multiple reports have shown the significant physiologic value of EN over PN delivery. EN should be started as soon as possible to obtain its nonnutritional, immunologic benefits and minimize the development of the protein-calorie debt. The primary goal is to maintain lean body mass. When comparing early EN to standard therapy, patients receiving EN initiated the day after surgery had reduced infection and mortality, and shorter hospitalization.

Determining patient candidacy is challenging: not all critically ill patients are appropriate candidates. Those that are considered at high-risk nutritionally benefit most from early enteral feeds. Once initiated, the nutritional therapy strategy should focus on assuring that resuscitation goals continue to be met, risk for aspiration is minimized, and the rate of delivery is safely advanced quickly to goal.

While most patients in the critical care setting will tolerate a standard enteral formula, it is appropriate to consider use of various specialty formulas in the individual patient under specific circumstances. Recently, multiple reports have shown that when selected appropriately, specific nutrients such as fish oils, arginine, leucine, glutamine and antioxidants in quantities greater than needed for *normal* cell metabolism have yielded multiple benefits in patients in the intensive care unit (ICU). Many specialty formulations exist, but additional study is needed before routine use can be recommended.

Table 1. Advantages of EN over PN

Gastrointestinal benefits of EN
Maintains gut integrity
Reduced gut/lung axis of inflammation
Enhances motility/contractility
Improves absorptive capacity
Maintains gut-associated lymphoid tissue
Supports and maintains commensal bacteria
Reduces virulence of endogenous pathogenic organisms
Promotes the production of secretory IgA
Promotes trophic effects on epithelial cells
Immune benefits of EN
Modulates key regulatory cells to enhance systemic immune function
Promotes dominance of anti-inflammatory Th-2 over proinflammatory Th-1 responses
Influences anti-inflammatory nutrient receptors in the gastrointestinal tract (duodenal, vagal and colonic butyrate)
Maintains mucosa-associated lymphoid tissue at all epithelial surfaces (lung, liver, lacrimal, genitourinary and pulmonary)
Modulates adhesion molecules to attenuate transendothelial migration of macrophages and neutrophils
Metabolic benefits of EN
Promotes insulin sensitivity through stimulation of incretins
Reduces hyperglycemia (advanced glycation end products), and muscle and tissue glycosylation
Attenuates stress metabolism to enhance more physiologic fuel utilization

Numerous trials have shown a benefit from the provision of antioxidant cocktails to ICU patients on continuous feeding, as have the use of probiotics. Probiotic benefits appear to be species-specific, while probiotics have shown promise in limiting ventilator-associated pneumonia, antibiotic-associated diarrhea and *Clostridium difficile* infections.

A number of metabolically active ancillary agents have been proposed for use in the critically ill patient based on their appropriate physiologic effects, including β-blockers and anabolic agents. Use for these purposes in the ICU setting may be considered experimental, and rigorous, well-designed studies demonstrating benefit in clinical outcomes with any of these metabolically active ancillary agents are lacking.

Multiple factors impair adequate delivery of EN in the ICU. Barriers to implementation of EN protocols and aggressive early feeding derive from perceived lack of supporting evidence, poor implementation processes, system characteristics, individual provider behavior and patient

complexity. Adopting specific strategies to promote delivery of EN can change institutional practice, including a *top-down* nutritional approach. Protocols should be modified depending on local expertise, culture of the ICU and nursing practice.

PN has a more limited risk/benefit ratio than EN in the critically ill population, and the selection of patients requires considerable thought. It should only be considered when EN is not practical or possible.

Despite challenges and inconsistencies in today's critical care setting, specialized nutrition has evolved from metabolic *support* during critical illness to a primary therapeutic intervention designed, individualized and focused to achieve metabolic optimization and mitigation of stress-induced immune and hyperdynamic systemic responses. Protocols that aggressively promote early EN will result in lower mortality and a reduction in major complications. Though the complexity of the heterogeneous critically ill population will always be challenging, we are developing a better understanding of immunity, metabolic needs and catabolism associated with ICU admissions.