Perioperative Nutritional Support: Immunonutrition, Probiotics, and Anabolic Steroids

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Normal physiologic function requires continuous metabolism of substrates to provide energy to sustain life. This metabolism requires intake and absorption of carbohydrates, proteins, and lipids as well as water, vitamins, and trace elements. Although metabolic demands depend on physical activity and nutritional intake, the catabolic and anabolic pathways are usually balanced in a healthy adult. Surgical stress, trauma, and critical illness alter normal metabolic requirements and pathways, with a shift toward a catabolic state resulting in loss of weight, lean body mass, and fat; proteolysis; and expansion of the extracellular fluid compartment.

Perioperative nutritional support has traditionally focused on providing adequate calories in an attempt to attenuate the loss of lean body mass commonly observed after major surgery. With increasing understanding, it has become apparent that perioperative nutritional support is more complicated than just the administration of caloric support. Nutritional support can improve patient outcomes and decrease complications rates by preventing oxidative cellular injury, attenuating metabolic responses, and enhancing immune function.[1,2] Types of nutritional formulation, routes of delivery, and number of delivered calories all modulate physiologic and pathologic responses and thus affect patient outcome. In this article, the authors review the current state of nutritional support in the perioperative state and discuss the role of immunonutrition, probiotics, and anabolic steroids.

The authors have nothing to disclose.

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MEASUREMENT OF MALNUTRITION

Healthy well-nourished patients undergoing minor physiologic stress do not require nutritional support. However, those with preoperative protein-calorie malnutrition, especially if experiencing major physiologic stress, have increased mortality and morbidity with associated increases in hospital length of stay. It is therefore imperative to identify those at risk for the development of malnutrition, a challenging task, because currently there is neither a universally accepted definition of malnutrition nor a gold standard test for its identification. Commonly used screening parameters include a history of unintentional weight loss greater than 10% to 15% in the last 6 months or a body mass index less than 18.5 kg/m^2.[3] Laboratory markers frequently used in nutritional screening include albumin and prealbumin. Albumin is considered the most accurate laboratory indicator of basal protein stores, with a level less than 3.5 g/dL causing concern for malnutrition. Albumin, however, has a half-life of approximately 20 days and thus is more reflective of the nutritional status 3 weeks before the sample being drawn. Albumin levels are affected by acute inflammation and both acute and chronic diseases such as sepsis and renal and liver diseases.[4] Prealbumin, conversely, has a half-life of 1 to 3 days, and thus its levels change more rapidly with nutritional interventions. Prealbumin is commonly used as a marker of the effectiveness of nutritional support, with a level less than 15 mg/dL suggestive of malnutrition.[5] Several more sophisticated nutritional screening tools have also been developed, including the Nutritional Risk Screening, Malnutrition Universal Screening Tool, and the Mini Nutritional Assessment.[6,7]

PHYSIOLOGIC CHANGES WITH GASTROINTESTINAL TRACT DISUSE

In addition to its role in nutrient uptake and metabolism, the gastrointestinal (GI) tract is also an important part of the immune system. The GI tract is constantly exposed to and acts as a repository for multiple organisms. During the normal state, the combination of the predominant commensally anaerobic flora, the contractility of the GI tract, the production of secretory IgA (sIgA), the presence of bile salts that reduce bacterial adherence, and the action of antimicrobial secretions such as proteases and pancreatic enzymes prevent overgrowth of more pathogenic organisms. However, following a period of disuse, the GI tract demonstrates multiple structural and physiologic changes that affect its immune and metabolic functions.

Animal and human studies have demonstrated a reduction in mucosal mass and cellular proliferation as well as a decrease in villous height and brush border enzymes.[8] The production of intestinal sIgA rapidly diminishes,[9] and there is also a decrease in the production of counterinflammatory cytokines interleukin 4 and interleukin 10 with a shift toward helper T-cell subtype 1 proinflammatory cytokines.[10] Bacterial overgrowth from stasis and the altered mucosal defenses lead to bacterial translocation, which can be further exacerbated by the loss of structural integrity and increased gut permeability observed during gut disuse.[8]

DETERMINATION OF NUTRITIONAL SUPPORT

Critical illness and its treatment can profoundly alter metabolism and significantly increase resting energy expenditure (REE). Trauma, surgery, burns, brain injury, and pancreatitis have all been associated with hypermetabolism,[11,12] with reported relative metabolic rates of 116% to 158% in multiply injured patients.[12]

Accurate determination of REE is necessary in patients receiving nutritional support to ensure that their energy needs are met and to avoid the complications associated