Peri-Surgical Nutrition

Perspectives and Perceptions

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• Nutrition • Immunonutrition • Arginine • Omega-3 fatty acids • Perioperative

KEY POINTS

- The enteral route is always preferred over the parenteral route because of the decreased infection complication rates.
- Enteral nutrition using immunomodulating agents, such as omega-3 fatty acids, arginine, and glutamine, may decrease infectious complication rates and shorten hospital stays based on human meta-analysis data.
- Esophagostomy and gastrostomy tubes are preferred tubes for long-term nutritional management.
- When instituting enteral or parenteral support, monitoring for refeeding is suggested, particularly after prolonged anorexia.

NUTRITION IN HOSPITALIZED SURGICAL PATIENTS

For many years medicine has recognized that deficiencies in essential nutrients and malnutrition may compromise healing and outcomes in hospitalized patients. In the last 30 years, a movement has been initiated to investigate the supplementation of nutritional elements that may provide an impact extending beyond the provision of nutrition alone, providing discrete therapeutic functions. The provision of specific nutrients in an attempt to beneficially modulate the immune system for certain injuries or disease states has been coined *immunonutrition*. This movement has not been translated particularly well to veterinary medicine because of the paucity of literature and the unique demands of dogs and cats, which make assimilation of the current information difficult, yet worth discussing. One dogma that has translated well to veterinary medicine is the idea that the gastrointestinal (GI) system, when functional, is the preferred route of nutrient administration. In veterinary medicine, the use of parenteral

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approaches remains in its infancy: there are few prospective veterinary clinical trials and a paucity of veterinary literature showing any substantial benefits other than in severely malnourished patients. This review focuses on the idea of immunonutrition in human medicine and its possible use in veterinary medicine, elaborates on the current options for and understanding of enteral support in our veterinary patients, and provides a cursory guideline into utilization of parenteral nutrition (PN) in surgical patients when deemed necessary.

ENTERAL SUPPORT AND IMMUNONUTRITION

The provision of nutrients with potential immune-modulating effects at either physiologic or supraphysiologic level may be used as a treatment or for prevention of disease.[1,2] These immunomodulating diets (IMDs) typically consist of a combination of nutrients that may include arginine, glutamine, omega-3 fatty acids (n-3 FAs), antioxidants, and nucleotides. Most recently, the term *pharmaconutrition* has been used when discussing the optimal nutrient profile for a specific patient's needs; however, defining this ideal profile currently remains an intangible goal, particularly in veterinary medicine.[3] Some of the discordance within the literature addressing IMD effects may be attributed to applying the same ingredient formula to a heterogeneous population.[4] Regardless, sufficient evidence exists supporting the use of immunonutrition in hospitalized patients for wound healing, elective GI surgeries, and critical or intensive care situations. The proposed mechanisms behind the most commonly used immune modulating nutrients and a brief review of some of the more pertinent literature addressing IMDs and their clinical outcomes for elective surgery and critical care patients are outlined further.

Arginine

Arginine is an amino acid that may be synthesized de novo in humans from citrulline by the kidney tubule epithelium[5] and plays a major role in the urea cycle.[1] Rapid depletion in times of severe stress and other circumstances that lead to a catabolic state may make arginine a "conditionally essential amino acid in humans,"[2] and it is known that arginine is essential in the diet of cats and dogs.[6–8] Arginine has specific functions in both acute and chronic phases of healing. It contributes to protein synthesis, cellular proliferation and differentiation, possesses antimicrobial effects and vascular effects, mediates progression of the immune response, increases insulin sensitivity, and influences growth factor and growth hormone signaling.[1–3,5,9]

Arginine acts through several different pathways to influence the immune system, as it is a precursor to proline, nitric oxide (NO), and ornithine. Inducible NO synthase (iNOS) is an enzyme that is upregulated during periods of T-helper 1 (Th1) cytokine response (influenced by interleukin 1 [IL-1], tumor necrosis factor [TNF]-α, interferon-γ, or other stimuli such as lipopolysaccharide) and converts arginine to NO.[9–11] NO provides direct antimicrobial activity through the oxidative burst and has vascular effects that allow leukocyte migration and increased blood flow to the local wound environment during acute injury.[1,12] NO also has several cellular signaling roles and may induce growth factor release (vascular endothelial growth factor and transforming growth factor [TGF]-β) to help transition from the inflammatory to proliferative pathways while promoting cellular protection, keratinocyte proliferation, and angiogenesis.[1,5,11] During a Th2 response, or following a shift from the inflammatory phase to the proliferative phase in normal wound healing, cytokines, such as IL-4, IL-10, IL-13, and TGF-β, are released. These signaling molecules tip the balance from iNOS toward arginase-1–driven enzymatic reactions.[3,10] Arginase-1