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In Brief



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In this monograph, we provide a comprehensive summary and synthesis of the rapidly evolving nutritional literature, starting from the preoperative assessment and extending through the postoperative period.

“Prehabilitation” describes the strategy of increasing the functional capacity of an individual prior to a stressor to improve tolerance and recovery. This is especially relevant in cases of major surgery where preoperative optimization through exercise, nutrition, and lifestyle changes have been shown to improve functional measures after surgery.

The prevalence of malnutrition in surgical patients is nontrivial, with up to 60% of patients undergoing elective surgery identified to be at risk for malnutrition. Targeted interventions for these high-risk surgical patients would thus have significant impact on patient outcomes and hospital costs. Ideally, full nutritional assessments and the initiation of interventions should occur several weeks prior to surgery. Unfortunately, preoperative nutritional screening is underutilized, malnutrition is often misclassified, and the majority of at-risk patients do not receive nutritional therapy. Studies have yet to show a consistent relationship between nutritional prehabilitation and traditional postoperative outcomes, likely because of significant heterogeneity in nutritional route, dose, duration, and patient selection. Although the minimum

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intensity and duration and the most sensitive and appropriate endpoints to measure are currently unknown, the overall theme is that preoperative nutritional interventions are most beneficial in malnourished surgical patients and likely neutral in well-nourished patients; the addition of immune-enhancing pharmaconutrients is of uncertain benefit and multi-modal bundles are probably more effective than single modality interventions. Additional adjuncts include glycemic control, hemoglobin optimization, smoking cessation, and anxiety management.

Gastric feeding is acceptable in most patients and there does not appear to be a major long-term benefit in patient-centered, clinically important outcomes with routine use of postpyloric feeding. The perceived risks of aspiration and pneumonia in patients receiving gastric feedings and the benefits of additional nutrient delivery with postpyloric feedings have probably been overemphasized. Patients with intolerance of gastric feeding and those at high risk of aspiration are appropriate candidates to receive postpyloric enteral nutrition (EN). There is little indication that postpyloric EN is associated with any increase in complications, although it does necessitate somewhat greater technical expertise for insertion of appropriate feeding tubes and may be associated with delay in EN initiation.

Acute pancreatitis is a disease resulting in large numbers of hospital admissions worldwide, ranging in severity from mild to severe cases. With the vast majority (upward of 80%) of cases falling under the mild classification, it is important to embrace the recent literature supporting the initiation of early oral feeding once abdominal pain is decreasing and inflammatory markers are improving in these patients. In cases ranging from moderately severe to severe acute pancreatitis, it is reasonable to delay nasogastric tube placement and initiation of EN in patients who have potential to meet nutritional requirements *ad lib* within a few days. However, if there is failure to meet nutritional needs through oral intake alone, a stepwise approach should be used starting with nasogastric tube feeding, the addition of promotility agents or nasojejunal feeding, and finally escalating to parenteral nutrition (PN) with continued EN as tolerated, if necessary. The impact of such practices has been demonstrated not only to be safe, but also to positively impact patient outcomes as well as being cost-effective.

The field of immunonutrition is promising based on the current understanding of the biochemical role of these nutrients, but questions remain regarding the timing, dose, delivery, and disease process to optimize care. Current guidelines recommend the use of immune-modulating formulas containing glutamine, arginine, and ω -3 polyunsaturated fatty acids only in trauma and critically ill postoperative patients who require EN support. Glutamine should not be given intravenously in patients receiving PN, and arginine should be avoided in sepsis. Additional studies on specific patient populations with harmonized formulations are required to determine the appropriate use of immunonutrition in surgical patients.

There are incredibly divergent opinions with regard to optimal protein provision in the various phases of critical illness. Limited convincing data exist to suggest that one is definitively more effective than another. Although both the “high protein” and “no protein” viewpoints present relatively compelling arguments as to why their approach is preferred, there are significant gaps in the support of both strategies.

During the acute resuscitative phase of critical illness, an early, but moderate feeding strategy is appropriate, although burn patients appear to behave differently and EN support should be initiated very early, even during resuscitation, in this patient population. Following initial stabilization, high protein, hypocaloric feeding strategies may be implemented. As organ function improves and clinical conditions progress, increased emphasis is placed on achieving protein and caloric goals as attempts are made to facilitate “full” feeding strategies. Supplemental modular protein is utilized in patients with high protein losses, such as those with burns and polytrauma where goals of 2 g/kg/d of protein are prescribed.

The success of enhanced recovery after surgery has revolutionized traditional perioperative practice, and is being applied to an expanding number of disciplines and scenarios. Awaiting the return of bowel sounds or passage of flatus before resuming oral/EN is strongly discouraged by multiple professional societies. Several randomized trials have demonstrated that routine nasogastric tube decompression after abdominal operation does not lower the risk of anastomotic

leak and is actually counterproductive by delaying return of bowel function and increasing pulmonary complications. Early oral intake or EN within 24 hours has been demonstrated in multiple randomized trials to be safe and beneficial after both upper and lower gastrointestinal operations. Early intraluminal nutrition proximal to a “fresh” anastomosis results in a stronger anastomosis. Progressing directly to solid food intake (without first transitioning through a liquid diet) after elective intestinal surgery is safe and advantageous. Early EN in the critically ill (within 48 hours after resuscitation is complete) is associated with substantial advantages in this already at-risk population and is endorsed by multiple professional societies.

Over the past two decades there has been an explosion of high-quality nutrition research clearly demonstrating that modern PN does not cause an increased infection risk, promote gut atrophy or bacterial translocation with short-term utilization, or result in significantly worsened outcomes. In fact, the bulk of more recent randomized trials have found that PN appears largely equivalent to EN in many patient populations, and should be considered a key component of critical care management. Achieving these optimal outcomes requires an active and continuously adapting nutritional therapy plan tailored to individual patients, their disease severity and physiology, and their dynamic response to their illness or injury.

Intravenous lipids provide a compact form of nutrition and are required to avoid essential fatty acid deficiency. Older generation intravenous lipid emulsions (IVLE) containing predominantly soybean oil are highly proinflammatory; newer generations incorporating alternative lipids such as coconut oil (medium-chain triglycerides), olive oil, and fish oil are less proinflammatory and provide a promising therapy with less risk (and perhaps even benefit) for patients unable to obtain adequate EN. The 2016 SCCM/ASPEN consensus guidelines recommend withholding soy-based IVLE administration during the first week of PN, unless there is a concern for essential fatty acid deficiency. However, where available, newer generation IVLE formulations should be initiated at the same time as PN.

As in any medical intervention, nutrition therapy must be delivered to the right patient, at the right time, by the right route, in the right dosage. It has been repeatedly demonstrated that the intensive care unit population is heterogeneous and that nutritional interventions seem to benefit only those at greatest risk. Some recent critical care nutrition trials enrolling primarily nourished and/or low-acuity patients unlikely to benefit from nutritional optimization. Thus, it is unsurprising that these trials were unable to detect a clinically important difference. Furthermore, it is questionable whether mortality is the most appropriate endpoint to focus upon when considering critical care nutrition practice. Although mortality is an objective and undeniably important clinical outcome, there are many potential confounding factors. Given the complexity of critical care illness and the multitude of factors affecting such a blunt outcome, it is not surprising that trials enrolling a heterogeneous population with a range of nutritional risk and evaluating a single nutritional intervention have reported “negative” results. Other patient-centric endpoints, such as functional status, discharge disposition, and quality of life may be more relevant and meaningful.