Chapter 41
Nutrition

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BACKGROUND

Nutrition assessment should be a routine part of any preoperative evaluation. Malnutrition is associated with increased rates of postoperative infection, impaired wound healing [1], and increased length of stay [2]. The stress of surgery causes catecholamine and cortisol release, which results in a hypermetabolic state that can further exacerbate underlying malnutrition [3]. Identifying patients with malnutrition and stratifying them according to severity of malnutrition allows for perioperative interventions that reduce surgical complications. In select cases, it may be beneficial to delay surgery for 5 to 7 days to optimize nutritional status to bolster the immune system and prepare the body for the systemic stress response to surgery.

In the perioperative and postoperative period, both well-nourished and malnourished patients benefit from interventions focused on optimizing nutritional state, including immunonutrition and minimization of time spent nil per os (NPO). Additionally, the consulting internist should be aware of recommendations regarding initiation of nutrition postoperatively, with a focus on early advancement of diet or enteral feeding.

PREOPERATIVE EVALUATION

EVALUATION OF NUTRITION STATUS

While there are no universally accepted criteria, most experts require two of the following to diagnose malnutrition: inadequate caloric intake, unintentional weight loss, low BMI, visible loss of muscle mass or subcutaneous fat, or poor handgrip strength [4]. Note that...
serum hepatic proteins such as the negative acute phase proteins albumin and prealbumin are NOT valid indicators of nutritional status, rather they more accurately reflect severity of disease/inflammation [5]. Furthermore, low levels of these serum proteins are not responsive to nutrition intake during an active inflammatory state [4]. A routine preoperative evaluation for nutritional status should include the following:

- History of recent weight loss and adequacy of caloric intake.
- Identification of comorbid conditions that can influence nutritional status (i.e., prior GI surgery, chronic kidney disease, cancer, recent trauma, or infection).
- Identification of disease states that necessitate dietary restriction (e.g., congestive heart failure).
- Identification of significant alcohol or substance abuse history.
- Physical exam: height, weight (to allow body mass index calculation), evidence of muscle wasting, ascites/edema.
- Laboratory evaluation: if there is concern for malnutrition based on history and physical exam, order basic metabolic panel and phosphate level to evaluate for electrolyte abnormalities and renal dysfunction and a CBC to evaluate for anemia.

**RISK STRATIFICATION**

Preoperative nutrition evaluation addresses both current nutritional status as well as the risk for nutritional deterioration as a result of increased demands caused by metabolic stress [5]. The Nutritional Risk Screening 2002 (NRS 2002) is a validated method for identifying malnourished patients that may benefit from nutritional support [5]. This tool also helps to classify patients with mild, moderate, or severe malnutrition. Details of this screening tool are found in Tables 41.1 and 41.2.

**PREOPERATIVE MANAGEMENT**

**OPTIMIZING NUTRITION STATUS IN THE DAYS/WEKS PRIOR TO SURGERY**

**Preoperative Enteral and Parenteral Nutrition**

Patients with severe malnutrition (defined as nutritional risk screen [NRS] greater than three OR weight loss of 10–15 % of total body mass in the past six months or BMI <18.5) undergoing major elective surgery (i.e., gastrointestinal surgery, cardiothoracic surgery, complex
head and neck surgery) benefit from supplemental nutrition prior to surgery [6]. Just 5 to 7 days of adequate preoperative nutrition can prepare the body for the metabolic insult and stress of surgery and results in improved surgical outcomes including reduced rates of infection and surgical complications [7].

- Enteral nutrition is preferred to parenteral nutrition as it has lower risk of infection, is less expensive, and maintains the integrity of the gut mucosal lining. Supplemental nutrition (as oral supplements or by tube feeds) should provide 25 kcal/kg/day of calories and 1.5–2 g/kg/day of protein [7].

- If enteral nutrition is contraindicated (bowel obstruction, bowel ischemia, acute peritonitis) and the patient is severely malnourished, surgery should be delayed for 5 to 7 days to administer parenteral nutrition, if feasible.

- Parenteral nutrition should be stopped 2–3 h prior to surgery and then resumed the morning after surgery [8].

### Immunonutrition

Immunonutrition formulas, or immune-modulating diets, are enteral feeding formulas that contain specific amino acids, vitamins, and minerals that become conditionally essential in periods of illness and stress [9]. Supplementation with these nutrients prior to and after surgery helps to enhance immune function and modulate the inflammation created by surgery. Several pharmaceutical companies produce these immune-modulating beverages, which are available online and through select pharmacies. While the use of immune-modulating
diets is somewhat controversial, the following considerations are generally accepted:

- Formulas containing arginine, omega-3 fatty acids, and nucleotides can reduce length of stay, rates of infection, and wound complications such as dehiscence [9].
- Consider starting immunonutrition 5 to 7 days prior to major elective surgery and continue for 5 to 7 days postoperatively.
- These formulas should not be used in patients with severe sepsis, pregnant patients, or transplant patients on immunosuppressants [9].

<table>
<thead>
<tr>
<th>Impaired nutritional status</th>
<th>Severity of disease (≈ increase in requirements)</th>
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<tbody>
<tr>
<td>Absent</td>
<td>Normal nutrition status</td>
</tr>
<tr>
<td><strong>Score 0</strong></td>
<td>Absent</td>
</tr>
<tr>
<td>Mild</td>
<td><strong>Score 1</strong></td>
</tr>
<tr>
<td>Wt loss &gt; 5% in 3 months or food intake below 50-70% of normal requirement in preceding week</td>
<td>Mild patients with acute complications; cirrhosis; COPD; chronic hemodialysis; diabetes, oncology</td>
</tr>
<tr>
<td>Score 1</td>
<td>Hip fracture; chronic patients with acute complications; cirrhosis; COPD; chronic hemodialysis; diabetes, oncology</td>
</tr>
<tr>
<td>Moderate</td>
<td><strong>Score 2</strong></td>
</tr>
<tr>
<td>Wt loss &gt; 5% in 2 months or BMI 18.5-20.5 + impaired general condition or food intake 25-60% of normal requirement in preceding week</td>
<td>Major abdominal surgery; stroke; severe pneumonia; hematologic malignancy</td>
</tr>
<tr>
<td>Score 2</td>
<td>Head injury; bone marrow transplantation; intensive care patients (APACHE &gt; 10)</td>
</tr>
<tr>
<td>Severe</td>
<td><strong>Score 3</strong></td>
</tr>
<tr>
<td>Wt loss &gt; 5% in 1 month or BMI &lt; 18.5 + impaired general condition or food intake below 50-70% of normal requirement in preceding week</td>
<td>Head injury; bone marrow transplantation; intensive care patients (APACHE &gt; 10)</td>
</tr>
</tbody>
</table>

**Score:** [Nutritional status score] + [Disease severity score] = Total score

**Age**

If ≥ 70 years: add 1 to total score above = Age-adjusted total score

**Score ≥ 3:** the patient is nutritionally at risk and a nutritional care plan is initiated

**Score < 3:** weekly rescreening of the patient. If the patient, e.g., is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.
MANAGEMENT OF NUTRITION IMMEDIATELY PREOPERATIVELY

NPO Status Prior to Surgery

Patients are routinely made NPO after midnight on the day prior to surgery based on the long-standing belief that the stomach must be empty of food to prevent aspiration during induction of anesthesia, but there is little data to support such a prolonged period of fasting. Due to delays in operating room scheduling, patients often end up fasting twelve or more hours, which has been shown to increase insulin resistance [10]. The most recent guidelines from the American Society of Anesthesiologists (ASA) recommend “cessation of fried and fatty foods for eight hours prior to surgery, cessation of solid food six hours prior to surgery, and cessation of clear liquids two hours prior to surgery” [11]. Outpatients presenting for elective surgery can be instructed to follow these dietary guidelines prior to presenting for surgery. For inpatients, consultants should discuss with surgeons if they are comfortable permitting patients to have a more limited period of NPO.

POSTOPERATIVE MANAGEMENT

Traditionally, diet advancement following surgery occurs only after return of bowel function as evidenced by bowel sounds, flatus, or a bowel movement; however, there is no evidence that these indicators of bowel function truly correlate with bowel activity or tolerance of oral intake [12]. Prolonged NPO status may result in endothelial microvilli atrophy, increased risk of bowel dysfunction, and infection [13]. Enteral nutrition given within 24 h postoperatively has numerous documented benefits, including:

■ Maintenance of intestinal mucosal barrier [12, 13].
■ Decreased septic and infectious complications [12–14].
■ Less weight loss after surgery [12].
■ Improved wound healing [12, 14].
■ Reduced insulin resistance [14].
■ Improved muscle function [14].
■ Reduced mortality [13, 14].
■ Shorter length of hospital stay [13]

Evidence-based guidelines advise starting enteral feedings within 24 to 48 h postoperatively. Feeding into the small bowel may be best tolerated, as small bowel motility returns most quickly [12]. The consulting internist should recommend to the surgical team that patients be permitted to eat as soon as postoperative nausea resolves [13].
While enteral nutrition is preferred, parenteral nutrition (PN) may be required in patients with postoperative ileus. Aggressive parenteral nutrition support is only validated for malnourished patients. Since there is no outcome effect of short-term provision of PN, PN should be delayed until 5 to 7 days postoperatively (after a diet has been attempted and not tolerated or the diagnosis of an ileus has been confirmed) for patients who are well nourished at baseline. Additionally, PN should only be started if the anticipated duration of use is at least 7 days. Short-term provision of PN for less than 5 days does not improve patient outcomes and may increase risk for infectious complications [15].

REFERENCES