



**Chapter 41** 1

Nutrition 2

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**BACKGROUND** 4

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. 5  
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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. 16  
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**PREOPERATIVE EVALUATION** 23

**EVALUATION OF NUTRITION STATUS** 24

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 25  
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29 serum hepatic proteins such as the negative acute phase proteins  
30 albumin and prealbumin are NOT valid indicators of nutritional status,  
31 rather they more accurately reflect severity of disease/inflammation  
32 [5]. Furthermore, low levels of these serum proteins are not  
33 responsive to nutrition intake during an active inflammatory state [4].  
34 A routine preoperative evaluation for nutritional status should include  
35 the following:

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

### 50 **RISK STRATIFICATION**

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

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## 59 **PREOPERATIVE MANAGEMENT**

### 60 **OPTIMIZING NUTRITION STATUS IN THE DAYS/WEEKS PRIOR 61 TO SURGERY**

#### 62 **Preoperative Enteral and Parenteral Nutrition**

63 Patients with severe malnutrition (defined as nutritional risk screen  
64 [NRS] greater than three OR weight loss of 10–15 % of total body  
65 mass in the past six months or BMI <18.5) undergoing major elective  
66 surgery (i.e., gastrointestinal surgery, cardiothoracic surgery, complex

t1.1 **TABLE 41.1** NUTRITIONAL RISK SCREENING (NRS 2002): INITIAL SCREEN-  
 t1.2 ING [5]

t1.3	Is BMI <20.5?	Yes	No
t1.4	Has the patient lost weight within the last 3 months?		
t1.5	Has the patient had a reduced dietary intake in the last		
t1.6	week?		
t1.7	Is the patient severely ill? (e.g., in intensive therapy)		
t1.8	<b>Yes:</b> If the answer is “Yes” to any question, the screening in Table 41.2 is		
t1.9	performed		
t1.10	<b>No:</b> If the answer is “No” to all questions, the patient is rescreened at		
t1.11	weekly intervals. If the patient is scheduled for a major operation, a		
t1.12	preventative nutritional care plan is considered to avoid the associated		
t1.13	risk status		

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

t2.1 **TABLE 41.2** NRS 2002: FINAL SCREENING [5]

Impaired nutritional status		Severity of disease (≈increase in requirements)	
t2.4	Absent	Normal nutrition status	Absent
t2.5	<b>Score 0</b>		<b>Score 0</b>
t2.6	Mild	Wt loss > 5 % in 3 months or food intake below 50–70 % of normal requirement in preceding week	Mild
t2.7	<b>Score 1</b>		<b>Score 1</b>
t2.8			Hip fracture; chronic patients with acute complications; cirrhosis; COPD; chronic hemodialysis; diabetes, oncology
t2.9			
t2.10	Moderate	Wt loss > 5 % in 2 months or BMI 18.5–20.5 + impaired general condition or food intake 25–60 % of normal requirement in preceding week	Moderate
t2.11	<b>Score 2</b>		<b>Score 2</b>
t2.12			Major abdominal surgery; stroke; severe pneumonia; hematologic malignancy
t2.13			
t2.14	Severe	Wt loss > 5 % in 1 month or BMI < 18.5 + impaired general condition or food intake below 50–70 % of normal requirement in preceding week	Severe
t2.15	<b>Score 3</b>		<b>Score 3</b>
t2.16			Head injury; bone marrow transplantation; intensive care patients (APACHE > 10)
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t2.18			
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t2.26 **Score:** [Nutritional status score] + [Disease severity score] = **Total score**

t2.27 **Age** If ≥ 70 years: add 1 to total score above = **Age-adjusted total score**

t2.28 **Score ≥ 3:** the patient is nutritionally at risk and a nutritional care plan is initiated

t2.30 **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

92 diets is somewhat controversial, the following considerations are generally accepted:

- 94 ■ Formulas containing arginine, omega-3 fatty acids, and nucleotides can reduce length of stay, rates of infection, and wound complications such as dehiscence [9].
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- 97 ■ Consider starting immunonutrition 5 to 7 days prior to major elective surgery and continue for 5 to 7 days postoperatively.
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- 99 ■ These formulas should not be used in patients with severe sepsis, pregnant patients, or transplant patients on immunosuppressants [9].
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<b>MANAGEMENT OF NUTRITION IMMEDIATELY PREOPERATIVELY</b>	102
<b>NPO Status Prior to Surgery</b>	103
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.	104 105 106 107 108 109 110 111 112 113 114 115 116 117 118

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## POSTOPERATIVE MANAGEMENT

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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].

141 While enteral nutrition is preferred, parenteral nutrition (PN) may  
142 be required in patients with postoperative ileus. Aggressive parenteral  
143 nutrition support is only validated for malnourished patients. Since  
144 there is no outcome effect of short-term provision of PN, PN should  
145 be delayed until 5 to 7 days postoperatively (after a diet has been  
146 attempted and not tolerated or the diagnosis of an ileus has been con-  
147 firmed) for patients who are well nourished at baseline. Additionally,  
148 PN should only be started if the anticipated duration of use is at least  
149 7 days. Short-term provision of PN for less than 5 days does not  
150 improve patient outcomes and may increase risk for infectious com-  
151 plications [15].

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