CLINICAL NUTRITION

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PERIOPERATIVE NUTRITIONAL CARE IN THE PATIENT ACCORDING TO THE ENHANCE RECOVERY AFTER SURGERY PROTOCOL: A LITERATURE REVIEW

Michał Krasowski[1] ✉, ***Alicja Kalinowska[2]***, ***Wiktoria Pietras[2]***, ***Adrian Kozieł[2]***, ***Zofia Kurek[2]***, ***Aleksander Jentkiewicz[2]***, ***Esmail Haj Obeid[2]***, ***Jakub Ulrych[2]***, ***Jan Krupa[2]***, ***Maciej Malinowski[2]***

[1]*Poznan University of Medical Sciences, Poznan, Poland*
[2] *Medical University of Warsaw, Warsaw, Poland*

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✉ ***mich.krasowski@wp.pl***

ABSTRACT

Background: Since the beginning of surgery, reducing postoperative complications and early recovery have been two fundamental principles that have guided the improvement of surgical techniques and perioperative management.

Unfortunately, preoperative malnutrition is probably the least frequently identified risk factor in surgery, but one of the most treatable to improve outcomes. Perioperative malnutrition is an independent predictor of worse surgical outcomes. It is known that malnutrition in surgical patients means higher postoperative mortality, morbidity, length of stay (LOS) in hospital, frequency of re-hospitalizations and hospital costs [9,12,15]. Between 20% and 50% of patients undergoing elective surgical procedures meet the criteria for some degree of malnutrition [8,6,10].

Purpose: to evaluate the impact of the Enhanced Recovery After Surgery (ERAS) protocol through the Global Leadership Initiative on Malnutrition (GLIM) on patients undergoing elective surgery.

Methods: A systematic review of scientific articles published between 1994 and 2024 was conducted using PubMed and Google Scholar. The keywords included "malnutrition in surgical patients," "malnutrition diagnosis," and "ERAS protocol." Articles written in English and freely available in full text were included in the analysis.

Conclusion: The research highlights that early nutritional interventions, particularly those following the ERAS protocol, significantly reduce postoperative complications, mortality, and hospital stays. Tools such as the GLIM scale, which effectively diagnose malnutrition, and evidence-based nutritional strategies like carbohydrate loading and immunomodulating diets, were shown to optimize surgical outcomes.

Perioperative nutritional care is essential for minimizing complications, improving recovery times, and enhancing patient outcomes. The ERAS protocol provides a comprehensive framework for integrating nutritional management into surgical care, emphasizing the need for early diagnosis of malnutrition and individualized patient preparation. Implementing these guidelines in clinical practice should be a standard approach in modern perioperative care.

Keywords: Malnutrition, Perioperative patient care, perioperative nutritional support, Malnutrition diagnosis, ERAS protocol, GLIM criteria

INTRODUCTION

Modern surgery aims to minimize postoperative complications and shorten hospital stays. Achieving these goals requires a multifaceted approach to perioperative patient care.

The implementation of new surgical techniques combined with special protocols for perioperative treatment based on personalized evidence, the risk of complications in patients today has decreased by half. This has reduced the complication rate and length of hospital stay by 30-50% for many types of surgery (52).

This improvement is achieved through the use of nutritional elements that reduce the stress of the surgical patient, which reduce metabolic stress and allow recovery of bowel function. Malnutrition before oncologic and non-oncologic major surgery is common and can be attributed to a variety of causes (43).

Gastrointestinal abnormalities (e.g. malabsorption of nutrients and mechanical obstruction) and treatment-related side effects (e.g. neoadjuvant therapy and steroids). In addition, there are always individual patient-related factors (e.g., comorbidities, socioeconomic status, and anorexia) that contribute to worsening the preoperative nutritional status of surgical patients (44).

Moreover, preoperative malnutrition is often accompanied by other morbid conditions such as impaired functional capacity, frailty and sarcopenia (45, 46), and is associated with worsened mental status (47).

A meta-analysis by Canadian scientists (2018) including 18,039 medical and surgical patients showed that among those malnutrished, 49.7% were also sarcopenic and 41.6% were prefrail (48). It is remarkable that the risk of becoming sarcopenic or prefrail among malnutritioned surgical patients was 16 and 4 times higher than the average among surgical patients, respectively.

METHODOLOGY

We conducted an exhaustive search for scientific articles using PubMed and Google Scholar. The search covered articles published between 1994 and 2024. Keywords used in the search included "Malnutrition in surgical patients," "Malnutrition," "Impact of malnutrition on the immune system," "GLIM criteria," "NRS scale," "Malnutrition diagnosis," and "ERAS protocol." The search was limited to articles written in English with full-text versions freely accessible.

Our primary goal was to raise awareness among medical personnel involved in perioperative care regarding the potential complications of malnutrition during this period, the importance of early malnutrition diagnosis, and the nutritional preparation of patients according to the ERAS protocol.

BODY OF THE REVIEW

PHYSIOPATHOLOGIC MECHANISMS ASSOCIATED WITH THE TYPE OF SURGICAL INTERVENTION

Surgical intervention is itself a traumatic procedure that triggers inflammatory mechanisms, with the secretion of the same proinflammatory cytokines and activation of neurohumoral mechanisms similar to those that occur in disease-related malnutrition, and more intensely [53]. On the other hand, interventions involving the digestive tract (resections, anastomoses, etc.) usually initially impose significant dietary restrictions on patients, which, along with prolonged bed rest, exacerbate sarcopenia and malnutrition [54,55,56,57,58,59,60,61,62].

The Enhanced Recovery after Surgery (ERAS) protocol includes 22 recommendations for comprehensive perioperative care. Among these, patient nutritional preparation has strong support in the scientific literature.

The World Health Organization defines malnutrition as a cellular-level imbalance between the demand for nutrients and energy and their supply, which is essential for growth, maintenance of vital functions, and the performance of specific roles. Numerous studies have shown that malnutrition negatively affects quality of life, morbidity, mortality, length of hospital stay, patient response to treatment, and increases the rate of readmissions [9,12,15].

Between 20% and 50% of patients undergoing elective surgical procedures meet the criteria for some degree of malnutrition [8,6,10]. In a multicenter study conducted across Spain, one in four patients met the criteria for malnutrition [3].

In this article, we will focus on the identification of malnutrition in surgical patients, the consequences of malnutrition, and discuss the current ERAS protocol recommendations regarding perioperative nutrition.

Consequences of Malnutrition (Table 1)

Consequences of Malnutrition			
Impairment of the Immune System Function	Prolonged Wound Healing	Decreased Physical Activity	Prolonged Hospital Stay

DIAGNOSIS OF MALNUTRITION

There are numerous scales available for diagnosing malnutrition, including the Nutritional Risk Screening (NRS), Mini Nutritional Assessment Short Form (MNA-SF), Malnutrition Universal Screening Test (MUST), Nutritional Risk Screening (NRS), and the Global Leadership Initiative on Malnutrition (GLIM). In 2016, major global organizations dedicated to malnutrition diagnostics—The European Society for Clinical Nutrition and Metabolism (ESPEN), Federación Latinoamericana de Terapia Nutricional Clínica y Metabolismo (FELANPE), and the Parenteral and Enteral Nutrition Society of Asia (PENSA)—based on common features of the above-mentioned scales and discussions, created the GLIM scale as the primary and recommended tool for diagnosing malnutrition [17]. According to studies, the GLIM scale has a sensitivity of 61.3% and a specificity of 89.8% [2,5].

The GLIM scale should be used as the primary tool for diagnosing and assessing malnutrition, particularly in situations where nutritional specialists are unavailable. It allows for the diagnosis of malnutrition, unlike another commonly used scale, the NRS, which only suggests that a patient may meet the criteria for malnutrition. The GLIM scale categorizes criteria into phenotypic and etiologic groups (Table 2). To diagnose malnutrition using this scale, one phenotypic criterion and one etiologic criterion must be met [19,11].

Table 2: Phenotypic and Etiologic Criteria of the GLIM Scale

Phenotypic	Etiologic
Weight loss (%) >5 within 6 months or >10 beyond 6 months	Reduced Food Intake or Assimilation <50% of ER> 1 week or any reduction for > 2 weeks, or any chronic GI condition that adversely impacts food assimilation or absorption
Body Mass Index (BMI) <20 if <70 years old <22 if > 70 years old	
Reduced Muscle Mass Reduced by validated body composition measuring techniques	Inflammation Acute, Chronic or Injury related

Phenotypic Criteria of the GLIM Scale Allow Classification of Malnutrition into Moderate and Severe Categories (Table 3)

Table 3: Classification of Malnutrition into Moderate and Severe Categories

Phenotypic Factor	Moderate Malnutrition	Severe Malnutrition
Weight Loss	5-10% within 6 months	>10% within 6 months
Body Mass Index (BMI)	<20 if <70 years, <22 if >70 years	<18.5 if <70 years, <20 if >70 years
Reduced Muscle Mass	Mild to moderate depletion	Severe depletion

As recommended by the American College of Gastroenterology (ACG), the nutrition risk screening (NRS) scale is suggested as a tool for early malnutrition screening.

This scale consists of two parts: an initial screening section (Table 4) and a more detailed diagnostic section

(Table 5). Patients proceed to the second part of the NRS scale if they meet the criteria to score at least one point in the initial screening section.

Table 4: Initial NRS Screening

Question	Criteria	Score
Body Mass Index (BMI)	<20.5	1
Weight Loss	Unintentional weight loss in the last 3 months	1
Reduced Dietary Intake	Reduced food intake over the last week	1
Severe Illness	Severe acute or chronic condition	1

If the patient scores 1 or more points, the screening in Table 2 is performed.

If the patient does not score any points, the patient is re-screened at weekly intervals. If the patient, for example, is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.

Table 5: Final NRS Screening

Criteria	Severity	Score
Impaired Nutritional Status	Weight loss >5% in 3 months or Food intake below 50–75% of normal requirement in preceding week	1
	Weight 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	2
	Weight loss >5% in 1 montth (>15% in 3 mths) or BMI <18.5 + impaired general condition or Food intake 0-25% of normal requirement in preceding week in preceding week.	3
Disease Severity	Hip fracture, Chronic patients, in particular with acute complications: cirrhosis, COPD. *Chronic hemodialysis, diabetes, oncology*	1
	Major abdominal surgery, Stroke. *Severe pneumonia, hematologic malignancy*	2
	Head injury, Bone marrow transplantation. *Intensive care patients (APACHE>10).*	3

If the patient >70 years old add 1 point
≥3: Nutritional intervention recommended.
0–2: No risk of malnutrition.

PERIOPERATIVE NUTRITIONAL RECOMMENDATIONS ACCORDING TO THE ERAS PROTOCOL

The Enhanced Recovery After Surgery (ERAS) protocol was first introduced in 1997 by Professor Henrik Kehlet, a Danish surgeon who developed perioperative management principles aimed at improving treatment outcomes and reducing complications. Since then, the ERAS protocol has been expanded and adapted to various types of surgeries in many countries worldwide. In 2012, the ERAS protocol was introduced as a recommendation for perioperative preparation for patients undergoing colon resection [22]. This protocol introduces the patient as a co-responsible party in the treatment process, thereby engaging them in perioperative preparations [28]. According to research, involving patients in the treatment process results in a reduced hospital stay and a decrease in postoperative complications [40,29].

ERAS pathways have repeatedly been shown to significantly reduce postoperative morbidity after colorectal surgery (49, 50) and many other types of surgery (51). Thus, it may be that the benefits of immunonutrition (IMN) or pharmaconutrition encompasses are no longer apparent once full ERAS is implemented (52).

A meta-analysis of randomized studies implementing the ERAS protocol in patients undergoing colon surgery demonstrates a 50% reduction in postoperative complications [38]. Hospital stays are also shortened with the implementation of the ERAS protocol [14]. Among the recommendations in the ERAS protocol are nutritional guidelines, which will be the focus of the following sections of this article.

Nutritional care under the ERAS protocol can be divided into preoperative and postoperative phases.

PREOPERATIVE PREPARATION

Preoperative preparation involves correcting micro- and macronutrient deficiencies. If required, patients should undergo nutritional therapy 7–14 days before surgery, with enteral nutrition preferred over parenteral nutrition. Immunomodulating nutrition is also recommended, which involves incorporating preparations containing arginine, omega-3 fatty acids, and nucleotides into the patient's diet. Preoperative nutritional care also includes carbohydrate loading (CL). Research indicates that CL shortens the postoperative recovery period and reduces the time to the first bowel movements following gastrointestinal surgeries [23]. Additionally, CL decreases hunger and thirst in the preoperative period, reduces insulin resistance [32], alleviates anxiety, and promotes anabolism over catabolism.

For carbohydrate loading, patients are advised to consume high-carbohydrate meals primarily consisting of pasta, rice, or grains two days before surgery. Two to three hours before surgery, patients are given 50 g of complex carbohydrates [30] along with 400 ml of water. Contraindications for CL include ascites, advanced heart failure, advanced renal failure, and Addison's disease.

POSTOPERATIVE NUTRITION

In the postoperative period, it is recommended (in the absence of contraindications) to introduce small portions of nutrition approximately four hours after surgery, with enteral nutrition preferred over parenteral nutrition [34]. Studies confirm that early nutritional initiation reduces postoperative complications and accelerates patient recovery [7,13]. Protein intake is recommended at 1.2–2 g/kg of body weight per day, and caloric intake should be 25–30 kcal/kg of body weight per day [26]. Immunomodulating nutrition initiated preoperatively may be continued postoperatively.

The ERAS protocol emphasizes early initiation of nutrition and avoiding unnecessary preoperative fasting. This approach reduces the risk of complications such as infections [21], improves treatment tolerance, and accelerates recovery. Perioperative nutritional recommendations according to the ERAS protocol are summarized in Table 6.

Table 6: Nutritional Recommendations in the Perioperative Period According to ERAS Protocol

Phase	Recommendation	Details
Preoperative	Avoid prolonged fasting	- Last solid meal: up to 6 hours before surgery. - Clear fluids: up to 2 hours before surgery.
	Intake of carbohydrate-rich drinks	- Consume 50 g carbohydrates in a drink 2–3 hours before surgery. - Benefits: reduces insulin resistance, muscle protein breakdown, hunger, and thirst.
	Assessment and treatment of malnutrition	- Provide 7–14 days of nutritional intervention for malnourished patients when possible. - Use enteral nutrition (preferred) or parenteral nutrition.
	Immunonutrition supplementation	- Use formulas enriched with: - Arginine - Omega-3 fatty acids - Nucleotides - Especially for oncologic or critical care surgeries.

Postoperative	Early initiation of nutrition	- Start oral or enteral feeding within 24 hours post-surgery if no contraindications.
	Minimize parenteral nutrition	- Reserve for cases where enteral feeding is impossible for more than 7 days.
	Protein and calorie intake	- Protein: 1.2–2.0 g/kg body weight/day. - Calories: 25–30 kcal/kg body weight/day.
	Continued immunonutrition	- Continue supplementation, particularly after major surgeries.

RESULTS AND DISCUSSION

Malnutrition itself can lead to death; however, epidemiological data show that malnutrition significantly increases susceptibility to infections, exacerbates their course, and is a major contributor to diseases and deaths associated with numerous other conditions [31].

Nutritional deficiencies impair both innate and adaptive immune responses. In malnourished patients, the production of complement components, particularly C3—one of the key proteins responsible for activating the immune pathway—is suppressed. Reduced levels of this protein directly impair the immune response to pathogens [33]. Studies consistently show that malnutrition diminishes the biological function of immune cells, such as B lymphocytes, Kupffer cells, and macrophages [35,27]. Dendritic cells, which are among the primary antigen-presenting cells, produce fewer cytokines essential for initiating the immune response cascade when affected by malnutrition [1].

In a study conducted on 709 patients by Correia et al., postoperative infections occurred significantly more frequently in malnourished patients compared to those who were adequately nourished (19.4% vs. 10.1%).

An optimal wound healing process requires an adequate supply of nutrients. Malnutrition prolongs the inflammatory phase of healing by inhibiting fibroblast proliferation and collagen production. As a result, healed wounds exhibit poorer elasticity and reduced vascularization [36,5]. The prolonged wound-healing process, coupled with weakened immune system activity, significantly contributes to the development of chronic wounds at primary surgical sites, which increases morbidity and mortality rates [24,20,38].

Malnutrition disrupts the metabolic processes in patients. The release of anabolic factors decreases, while the production of catabolic hormones increases. In the absence of energy substrates, postoperative patients exhibit reduced physical activity. This results from decreased muscle mass and low levels of energy substrates such as glucose, proteins, and fatty acids [25,16].

All these consequences of poor nutritional preparation prolong hospital stays, increase the number of necessary procedures, including reoperations [25], elevate costs, and, due to extended hospital stays, raise the likelihood of hospital-acquired infections [18]. According to a study conducted by the University of Glasgow, the average hospital stay for a patient who developed a hospital-acquired infection was 30 days, compared to 3 days for a patient without such an infection [25].

Thus, proper malnutrition diagnostics, preoperative preparation, and postoperative care are essential. These aspects will be the focus of the following sections of this article.

CONCLUSIONS

Early diagnosis of malnutrition, effective nutritional preparation, and adherence to ERAS protocol recommendations significantly reduce postoperative complications, reduce hospitalization time, and improve patient quality of life.

These advances have reduced the complication rate and length of hospital stay by 30-50% for many types of surgery.

Some of the elements of evidence-based care in ERAS protocols have a direct impact on metabolic responses to surgery, reducing stress reactions in the postoperative period. They also allow for a much faster recovery of function, including gastrointestinal function.

These advances have opened the door to changes in nutrition. Instead of low-caloric glucose IV fluids, patients can and should eat and drink almost immediately after surgery, which is an integral part of their recovery.

Prehabilitation programs have also been shown to be effective: patients preparing for major surgery receive specific protein-rich nutrition, perform specific exercise programs, and receive mental preparation to increase their resilience to the stress of surgery.

Pre- and probiotics affecting the gut microbiota also show promising effects on outcomes, while the simple use of carbohydrates preoperatively is an effective way of controlling postoperative glucose.

Identifying malnourished patients using tools such as the GLIM scale remains particularly important, as it allows precise detection of malnutrition and, consequently, the implementation of appropriate nutritional interventions to ensure an optimal surgical treatment process.

Introducing an individualized approach to nutritional care and educating patients about their role in the treatment process is a critical step toward minimizing postoperative complications and optimizing surgical treatment outcomes. Implementing ERAS guidelines in clinical practice should be the standard in perioperative care.

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