

## PERIOPERATIVE NUTRITIONAL STATUS

Vlad Andrei Nechifor , Denis Iulian Trufă, Cătălin Marian Ciută,  
Lidia Iuliana Graur, Iulia Potorac, Mariana Graur

University of Medicine and Pharmacy “Gr. T. Popa” Iași

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### Abstract

*Malnutrition is defined as the pathological state in which the nutritional intake is insufficient, excessive or ill-balanced and represents a frequent problem among hospitalized patients. The risk factors involved in the development of malnutrition are related to the patient, the amplitude of the surgical gesture and the non-surgical treatment. The evaluation of the nutritional status in the perioperative period using clinical and paraclinical parameters is essential. Based on the parameters, bio-clinical scores such as the Nutritional Risk Index or the Subjective Global Assessment, which establish the risk for perioperative complications, were composed. The medico-surgical collaboration which includes ICU-specialists, nutritionists and surgeons is essential for the investigation of the nutritional status, determining the time of the intervention and the necessity for nutritional support.*

**key words:** *malnutrition, nutritional status, nutritional support, perioperative complications.*

### Introduction

Patients that require surgical interventions are subject to metabolic and physiological challenges that can affect the nutritional status. Nausea, vomiting, pain, postoperative anorexia, accelerated catabolism, infections and slow wound healing can accompany major surgical interventions. All these complications have an even greater impact on patients with a poor nutritional status.

Patients with a certain degree of preoperative malnutrition have a significantly higher risk of developing postoperative complications, including death, in comparison

to those with an uncompromised nutritional status. A modified nutritional status can affect the function of various systems: cardiovascular, respiratory, renal and gastrointestinal [1]. The immune function and muscular strength are also affected, leaving these patients more vulnerable to infectious complications and imposing postoperative intubation [2]. All these factors contribute to a longer hospitalization period, more readmissions into the hospital and much higher care costs for these patients [3].

The existence of an appropriate nutritional status does not guarantee a favorable postoperative evolution, especially if enteral

 16 University Street, Iasi, Romania, *corresponding author e-mail: graur.mariana@gmail.com*

nutrition is delayed. The absence of postoperative nutrition for 10-14 days, period during which the metabolism is accelerated, can lead to the development of several complications and a higher postoperative death rate compared to the situation in which adequate nutritional support would be offered [4]. This information correlates with the recommendations of the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) [5].

### Evaluation of the perioperative nutritional status

The nutritional status is defined as the state of the organism in relationship with the demand and use of nutrients. It can be assessed according to clinical (weight correlated to ideal weight, body mass index, subcutaneous adipose fold, arm circumference) and biological (total proteins, albumin, pre-albumin, transferin, retinol-binding protein) criteria (Table 1).

There is a weak correlation between the anthropometric measurements and biochemical composition of the organism [6]. These are useful in establishing the nutritional status in relation to the patients' history and clinical examination [7].

**Table 1.** Normal values of biological parameters [8]

Biological parameters	Normal values
Total proteins	5.6-8.4 g/dl
Albumin	42± 2g/l
Transferine	2,8 ± 0,3 g/l
Retinol-binding protein (RBP)	62 ± 7 mg/l
Pre-albumine	310±35 mg/l

Weight loss is associated with the worsening of the postoperative prognostic.

Antoun et al. have demonstrated that a weight loss higher than 15% is associated in oncological surgery with a significant growth of postoperative complications [9]. The body mass index (BMI) is calculated according to the formula  $BMI = \text{weight (kg)} / \text{square height (m}^2\text{)}$ . In general surgery (except for bariatric surgery) and after a cardiac transplant, a BMI smaller or equal to 18,5kg/m<sup>2</sup> is associated to growth in postoperative morbidity and mortality [10,11]. Also, in cardiac surgery a preoperative BMI smaller or equal to 21 kg/m<sup>2</sup> is associated to more postoperative complications (especially infectious ones) [12] and a BMI smaller or equal to 24kg/m<sup>2</sup> is associated to an increase in postoperative mortality [13].

Transthyretine (TTR) is a major amyloid fibrillary protein identified in certain forms of amyloidosis. It is a plasmatic protein synthesized mainly by the liver, but identified in other locations as well, including endocrine cells of Langerhans islets [14, 15].

Some authors believe that prealbumine (transthyretine) is the most specific protein for the evaluation of the nutritional status, with a half-life of 1,9 days, more important than the absolute values being the variations in time [8, 15]. Determining the level of transthyretine is a sensitive, cost-efficient method in the assessment of the severity of diseases associated with malnutrition and of patients in critical state or suffering from chronic diseases. In patients with high risk, the levels of prealbumin determined twice weekly during hospitalization can alert the physician regarding the nutritional status and therefore, immediate measures can be implemented to improve the nutritional state of the patient [16].

In the evaluation of the nutritional status one must pay attention to the fact that clinical and paraclinical parameters can be influenced by non-nutritional factors such as hepatic malfunction, oedema or ascitis [7].

Also, several indexes or bio-clinical scores have been established in order to correlate the parameters of the nutritional status and postoperative morbidity, respectively mortality. From these we underline the importance of the Nutritional Risk Index (NRI) meant to identify the risk for postoperative complications based on objective parameters such as serum albumin and weight/ideal weight. This score is also used for the dynamic evaluation during the entire hospitalization of the patient undergoing surgery [17]. Another score is the Subjective Global Assessment which is a validated clinical technique that separates patients with a good nutritional status (SGA A) from those malnourished (SGA B) and severely malnourished (SGA C), the most important parameters being loss of muscular mass, loss of subcutaneous adipose tissue and weight loss [18, 19], using for this evaluation the data obtained anamnesticly (nutritional intake, gastro-intestinal symptoms, functional capacity) and through the clinical examination [20]. The group of patients to which this score applies are those undergoing surgical interventions, geriatric patients, oncologic and renal patients [20]. More specific than this score is the Patient Generated Subjective Global Assessment (PG-SGA) for patients with neoplastic pathology, which includes additional questions regarding the symptoms related to the nutritional status and short-term weight loss. This score derives from the SGA and unlike its predecessor which is qualitative, the new score obtains a quantitative,

continuous measurement, that can be rendered numerically (each component of the score receives a grade from 0 to 4 according to the impact of the symptom on the nutritional status), therefore representing an indicator to the necessity of a nutritional intervention [21].

### Malnutrition

Denutrition is the pathological state that follows an insufficient nutritional intake compared to the energetic expenditure of the organism. If the intake is not only insufficient, but also inadequate to the demands, the term used is malnutrition. Therefore, malnutrition is defined as the pathological state in which the nutritional intake is insufficient, excessive or unbalanced (table 2, table 3).

**Table 2.** Degrees of malnutrition [22]

Degree of malnutrition	% of ideal body weight	% of real body weight
Light	80-90%	90-95%
Moderate	70-79%	80-89%
Severe	<70%	<80%

The ideal body weight can be determined through a variety of formulas. Hamwi's method is the most frequently employed [23].

Malnutrition is a frequent problem in hospitalized patients. Almost 40% of adult patients have an important degree of malnutrition upon admission in the hospital and 2/3 of all patients experience a degradation of the nutritional status during hospitalization [24].

The perioperative nutritional status influences the results of the surgical treatment. For a better prognostic, surgeons should always evaluate the preoperative nutritional status. According to this evaluation, they need

to maintain or improve the nutritional intake [25].

The risk factors involved in the development of malnutrition are related to the patient, the type of surgical intervention (the amplitude of the surgical gesture) and the non-surgical treatment. The risk factors related to the patient refer to the age, malignant pathologies, chronic illnesses, chronic alcoholism, persistent symptoms (digestive tract symptoms, shortness of breath, pain) and duration of hospitalization; those related to the type of surgical intervention make the difference between open surgery (especially that for malignant pathologies) and coelioscopic surgery, while the risk factors related to the non-surgical treatment are chemotherapy and radiotherapy, oral corticotherapy, polimedication (more than 5 medicines daily) [26].

**Table 3.** Determining the degree of malnutrition by using serum proteins [27]

	<b>Albumin (g/dl)</b>	<b>Transferine (mg/dl)</b>
Normal	3.5-5.0	200-400
Light malnutrition	2.8-3.4	150-199
Moderate malnutrition	2.1-2.7	100-149
Severe malnutrition	< 2.1	<100

Taking into consideration the fact that malnutrition represents an often undetected problem that raises the risk for postoperative morbidity and mortality, some authors believe that the assessment of the nutritional status is necessary for all hospitalized patients (Table 4) [26].

**Table 4.** Consequences of malnutrition [28]

Alteration of the immune function – infections
Delay in surgical wound healing
Higher risk for postoperative complications
Loss of muscular mass that affects -the respiratory function – pulmonary infections -the cardiac function – cardiac insufficiency -the mobility – deep venous thrombosis, pulmonary embolism
Apathy, depression, lack of interest

### **Impact of the surgical stress upon the nutritional status**

After a surgical intervention, complex changes of the homeostasis occur and can be characterized as post-aggression syndrome. The basal energetic needs in the immediate postoperative period are almost 10% higher than those preoperatively [29].

The lesion caused by the operative gesture initiates an inflammatory response that leads to the release of cytokines and acute phase proteins and activates stress hormones. The release of these mediators causes a catabolic status of the metabolism.

Fasting in the preoperative period increases the inflammatory response to stress. Patients with a stress-induced metabolism that is prolonged or severe have a higher risk of complications, which increases even more the inflammatory and endocrine response to stress, leading this way to a vicious circle [30].

Hassen et al. have shown that patients undergoing major vascular surgery associate proteo-caloric malnutrition in the preoperative period to a more severe systemic inflammatory response [31].

One of the main modifications that appear during the postsurgical catabolic response is insulin resistance. This can lead to dehydration, weight loss, fatigue, delay in wound healing, increased risk for infectious

complications. The risk for insulin resistance depends on the amplitude, type and duration of the surgical intervention, as well as on the blood lost in the perioperative period [32].

Establishing the risk for perioperative complications is an important aspect in the management of patients with surgical indications. To this purpose, several score systems have been described. Schiesser et al. have conducted a study referring to the Nutrition Risk Index, Nutrition Risk Score and bioimpedance analysis as score systems meant to identify the patients at risk for postoperative complications, all three correlating to the incidence and severity of the complications that appear after gastrointestinal surgery. It did not manage to establish a significant correlation between the scores, as they identified different patients in the highest risk groups [33]. Thibault et al. have suggested the stratification of the surgical risk according to nutritional criteria. This way, preoperative nutritional status, the existence of risk factors for denutrition and the type of surgical intervention are at the basis of establishing the surgical risk levels [26].

#### **Enteral versus parenteral nutrition in perioperative reequilibration**

There are numerous bibliographical data regarding the type of pre and postoperative nutrition suggesting that preoperative nutritional support 7-10 days before the intervention is useful in patients with a sever degree of malnutrition and for whom the intervention can be delayed. Postoperative nutritional support must be ensured in patients that are incapable of feeding themselves and whenever possible, enteral nutrition is preferred to parenteral nutrition, being more safe and more cost-efficient. Enteral formulas

that stimulate the immune system aim at strengthening the immune functions in malnourished patients undergoing surgical stress [7]. Malnutrition diminishes the immune response in patients suffering from neoplastic pathologies as well as non-neoplastic ones, with a slower healing process and more frequent infectious complications [34].

From a metabolic and nutritional point of view, the key aspects of the perioperative period include: (1) avoiding long periods of preoperative fasting; (2) re-establishing enteral nutrition as soon as possible postoperatively; (3) integrating the assessment of the nutritional status in the general therapeutic conduct of the patient; (4) control of the biological parameters; (5) limiting the factors that exacerbate stress-related catabolism or alter the gastrointestinal function; (6) early mobilization [35].

#### **Conclusions**

The evaluation of the nutritional status perioperatively must be included in the investigation protocol for patients scheduled for ample surgical interventions.

The preoperative discovery of malnutrition is essential in order to establish the surgical risk related to the possibility of postoperative complications. Also, the postoperative nutritional status follow-up and the nutritional intervention (enteral or parenteral) are essential in order to prevent complications and implicitly to shorten periods of hospital stay. The parameters used for the evaluation of the nutritional status are clinical (weight/ideal weight, body mass index, subcutaneous adipose fold, arm circumference) and biological (total proteins, albumin, prealbumin, transferrin, retinol-binding protein) with a variety of scores and

indexes having been created to correlate these data.

The medico-surgical collaboration that includes ICU-specialists, nutritionists and

surgeons is essential for investigating the nutritional status, establishing the operative time and deciding on the necessity of nutritional support.

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