The Role Of Nutritional Support In Critically Ill Patients: New Data And Recommendations (Literature Review).

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ABSTRACT

In recent decades, nutritional support has become key in the complex therapy of critically ill patients, significantly affecting the outcome of the disease, the course of organ dysfunction, and overall survival. Critical conditions are characterized by severe hypermetabolism , catabolic metabolism, immune dysfunction, and the risk of developing nutritional deficiency already on the first day of stay in the intensive care unit (ICU). Current recommendations emphasize the early initiation of enteral nutrition, preferably within 24–48 hours after stabilization of hemodynamic parameters, which helps maintain the intestinal barrier function, reduce bacterial translocation , and reduce the risk of infectious complications and multiple organ failure. In this article, we will consider the role of nutritional support in the ICU in seriously ill patients.

Keywords: *nutritional support, metabolism, barrier functions, energy needs, energy, immunity*

Introduction

Critical conditions are accompanied by severe metabolic disorders, complex inflammatory and catabolic processes, which significantly increases the risk of developing nutritional deficiency. Patients in intensive care units (ICUs) are exposed to hypermetabolic stress, aggravated by multiple organ dysfunction, sepsis, surgical interventions and other factors, which necessitates early and adequate nutritional intervention [17, 13]. Current data indicate a close relationship between adequate nutritional support and a decrease in mortality, incidence of infectious complications, length of stay in the ICU and restoration of the patient's functional status [9,10,16].

The most important aspect in organizing nutritional support is the timely initiation of nutrition, preferably enterally , which provides physiological stimulation of the gastrointestinal tract, maintenance of microbiota and the barrier function of the mucous membrane [5,6]. Along with this, personalization of nutritional therapy requires taking into account energy needs, which depend on the patient's age, severity of the disease, the presence of concomitant diseases and the functional state of organs [19]. The widespread introduction of indirect calorimetry allows us to clarify the energy balance and minimize the risks of hypocaloric or hypercaloric feeding.

The choice of the volume and composition of nutritional support requires a personalized approach taking into account the degree of hypercatabolism , the presence of sepsis, organ dysfunction, the level of inflammatory markers (CRP, procalcitonin), as well as the balance between nutritional needs and tolerance. The use of indirect calorimetry, which determines the exact energy requirement of the patient, is growing. In addition to the caloric component, amino acids (glutamine , arginine), omega-3

fatty acids, antioxidants (selenium, zinc), which provide immunomodulatory and anti-inflammatory effects, play an important role. However, excessive nutritional load, like hypocaloric nutrition, is associated with adverse outcomes, including increased oxidative stress, hyperglycemia, and liver dysfunction. Today, issues of optimizing nutritional support protocols for various categories of critical patients are being actively studied: surgical, septic, patients with multiple organ failure, burns and traumatic brain injuries [11,12].

The role of nutrients with immunomodulatory action is also actively studied: in particular, positive effects are demonstrated by omega-3 polyunsaturated fatty acids, glutamine , arginine, antioxidants (selenium, zinc), vitamins C and D [3,4,17,18]. However, uncontrolled use of some substrates, such as glutamine , requires caution due to potential complications in certain clinical conditions [9,10,14].

Nutritional support is becoming an integral part of complex intensive care. Its organization requires multidisciplinary interaction of resuscitation physicians, nutritionists , dietitians, pharmacologists and physiotherapists. Modern guidelines and results of multicenter randomized studies (NUTRIREA-2, TARGET, EPaNIC , CALORIES) serve as a foundation for optimizing nutritional protocols, providing patients with the best chances for recovery [15-18].

Modern nutritional support for critically ill patients is based on the results of a number of large multicenter randomized controlled trials (RCTs) that have significantly changed approaches to organizing nutrition in intensive care units.

One of the most significant studies in this area was the EPaNIC (Early versus Late Parenteral Nutrition in the ICU), conducted by Casaer et al . (2011) This RCT demonstrated that delayed initiation of parenteral nutrition (not earlier than 7 days) combined with early enteral support was associated with a lower incidence of infectious complications, a shorter duration of mechanical ventilation, and a shorter hospital stay compared with early parenteral nutrition.

NUTRIREA-2 study (2018) conducted by Reignier et al ., compared the effectiveness of total parenteral and total enteral support in patients with septic shock and respiratory failure. The results showed no significant differences in mortality between the groups, but total enteral nutrition was associated with a higher incidence of gastrointestinal complications (ischemia, diarrhea, aspiration).

Another large-scale study, TARGET (2018), was conducted by Chapman et al ., examined the effects of normocaloric (100% of estimated requirements) and hypocaloric (70% of requirements) nutritional support on outcomes in adult ICU patients. The results of the study revealed no significant differences in 90-day mortality rates, emphasizing the importance of nutrient quality and the optimal rate of caloric correction.

In the PermiT (2015) study, Arabi et al . examined the safety of caloric restriction (approximately 50% of requirements) compared with a standard strategy. The results of the study showed no difference in survival, but caloric restriction during the acute phase of illness was associated with better nutritional tolerance without the risk of overfeeding.

REDOXS Study (2013) Heyland et al . demonstrated the importance of caution in the use of immunomodulatory nutrients (glutamine and antioxidants) in multiple organ failure. In this RCT, high-dose glutamine supplementation was associated with increased mortality in patients with multiple organ dysfunction.

In addition, important contributions to the field have been made by meta-analyses in recent years [7], which highlight the role of personalized assessment of energy needs using indirect calorimetry to clarify the actual metabolism of a particular patient.

Despite the absence of a single "gold standard" of nutritional support in the ICU, current data indicate the need for dynamic personalization of nutrition taking into account the patient's clinical profile, stage of the disease, presence of organ dysfunction and degree of nutritional deficiency.

Purpose of the study: is a comprehensive analysis of modern data on the role of

nutritional support in the treatment of patients in critical condition, with an emphasis on current recommendations from international professional communities, the results of multicenter randomized studies in recent years, and key areas of personalization of nutritional therapy in intensive care settings.

Materials and methods: This article is a systematic review of modern literature sources devoted to nutritional support of critically ill patients in intensive care units. The literature search was carried out in the following international scientific databases: PubMed , Scopus , Web of Science , Cochrane Library and Google Scholar .

IN quality key words were used next Terms : "critical care nutrition", "enteral nutrition", "parenteral nutrition", " immunonutrition ", "nutrition support in ICU", "indirect calorimetry ", "sepsis nutrition", "nutritional protocols in critically ill patients", "metabolic response in critical illness". The review included original studies, systematic reviews, meta-analyses and current international clinical guidelines published primarily between 2010 and 2025.

The inclusion criteria were:

- studies focusing on critically ill adult patients (ICU, sepsis, multiple organ failure, ARDS, trauma);
- publications in peer-reviewed journals in English and Russian;
- studies describing nutritional support protocols and assessing clinical outcomes.

This paper summarizes current global data on nutritional support in intensive care and allows us to assess the evolution of modern clinical approaches in this area.

Results and discussion

An analysis of modern clinical studies and current guidelines allows us to identify several key provisions that determine the strategy of nutritional support in critically ill patients (Table 1).

Table 1. Current recommendations for nutritional support of critically ill patients

Component	Recommendation
Time to start enteral feeding	24–48 hours after stabilization
Target caloric intake	20–25 kcal/kg in the first 3–7 days
Target caloric intake after stabilization	up to 30 kcal/kg
Protein	1.2–2.0 g/kg/ day
Indirect calorimetry	If possible for individualization
Immunomodulatory supplements	Omega-3 PUFA, antioxidants - selectively
Glutamine	Caution, contraindicated in multiple organ failure

Firstly, the principle of early initiation of nutritional therapy remains a consensus . According to the ESPEN recommendations (2019), nutritional support should be initiated within the first 24–48 hours after hemodynamic stabilization. This is due to the proven positive effect of early nutrition on the intestinal barrier function, reduction of bacterial translocation , prevention of infectious complications and limitation of the severity of the systemic inflammatory response [17,18].

Secondly, optimal energy goals in the acute period of the disease are limited to 20–25 kcal/kg/ day , with a gradual increase to 30 kcal/kg/ day as the patient's metabolic status stabilizes [13,19]. However, the TARGET (2018) and PermiT (2015) studies showed no significant differences in survival between standard and restricted calorie intake , which confirms the importance of individualization and flexibility of approaches [20,21].

The third important aspect remains adequate protein support: most recommendations (ASPEN, ESPEN) indicate a target protein intake of at least 1.2–2.0 g/kg/ day . Sufficient protein intake is associated with a decrease in the severity of sarcopenia , better tissue regeneration and immune function [22,23]

Great importance is attached to the qualitative composition of nutrients. A number of studies [3,4,21] confirm the benefits of using specialized mixtures enriched with omega-3 PUFAs, antioxidants (selenium, zinc, vitamins A, C, D), which help reduce inflammation, modulate the immune response and reduce the risk of sepsis complications.

Particular attention is paid to the problem of glutamine . Despite its positive effect on immunity and antioxidant protection, the data of the REDOXS study (2013) indicate an increase in mortality when it is used in patients with multiple organ failure, which requires careful and individual administration of this nutrient.

An important innovation has been the widespread introduction of indirect calorimetry for accurate assessment of the energy expenditure of a specific patient [7]. This method allows minimizing the risk of both hypocaloric nutrition and overfeeding, which is critical in unstable patients with severe metabolic instability.

The results of most studies emphasize the need for dynamic personalization of nutritional therapy, taking into account the phases of critical illness (acute, stabilization, recovery), clinical picture, level of inflammation, presence of multiple organ failure, functional status and individual metabolic needs of the patient.

In addition, in recent years, the role of nutritional support in the post-intensive rehabilitation phase (PICS) has significantly increased, where timely nutritional correction promotes the restoration of muscle mass, cognitive functions and reduces the risk of long-term disability [2].

Modern nutritional support for critically ill patients is a complex and multi-component therapeutic module, closely integrated into the overall intensive care system. With the accumulation of clinical data, approaches to organizing nutrition in the ICU have undergone significant changes, moving away from aggressive strategies of early parenteral nutrition in favor of more balanced and individualized nutritional support schemes.

A key achievement in recent years is the recognition of the need for early initiation of enteral nutrition, which is due to its physiological benefits: stimulation of intestinal peristalsis, maintenance of the integrity of the mucous membrane, prevention of translocation of bacteria and their metabolic products, and a decrease in the incidence of infectious complications [16]. However, unresolved issues remain related to determining the optimal start time and acceptable volume of nutrition in unstable patients with a high risk of intestinal ischemia, which was partially demonstrated in the NUTRIREA-2 study (2018).

A separate difficulty is the choice of energy target in the acute period of the disease. Data from a number of RCTs (TARGET, PermiT , CALORIES) show that both hypercaloric and severe hypocaloric nutrition do not demonstrate reliable differences in mortality outcomes during short-term observation. This confirms the need for dynamic adaptation of energy needs depending on the phase of the critical condition and assessment of actual metabolism [7].

Much attention is paid to protein support, since protein deficiency in the catabolic stress phase leads to rapid loss of muscle mass, decreased immune resistance, and deterioration of rehabilitation potential. Most modern recommendations agree on the need to ensure protein intake of at least 1.2–2.0 g/kg/ day [19,22,23]. However, for certain categories of patients (e.g., with renal failure, burns, sepsis), exact dosages require further clarification and additional RCTs.

immunomodulatory nutrients is particularly challenging . While the positive effects of omega-3 PUFAs and antioxidants have been consistently confirmed in most studies, the widespread use of high-dose glutamine remains a subject of debate due to the potential increase in mortality in patients with multiple organ failure, as clearly demonstrated in the REDOXS study [9,10].

A number of contradictions remain in relation to patients with extremely severe sepsis, shock, multiple organ failure, and burn injuries. In this population of patients, even minimal errors in nutritional therapy can aggravate oxidative stress, contribute to the development of hyperglycemia, increase hypercatabolism, and worsen the prognosis. Here, the use of indirect calorimetry as the most accurate method for assessing energy expenditure, which allows minimizing the risk of both undernutrition and overfeeding, is of particular importance [8].

Nutritional support in the post-intensive care phase (PICS) remains an equally relevant area . Evidence is accumulating that continued

protein and vitamin support after discharge from the ICU improves functional status recovery and prevents the development of sarcopenia and cognitive dysfunction [1,2]. However, long-term randomized studies on nutritional rehabilitation are still limited.

It should be noted that nutritional support for critically ill patients requires a multidisciplinary approach involving not only resuscitators, but also nutritionists , dietitians, pharmacologists, endocrinologists and rehabilitation specialists. Only the integration of efforts by all specialists allows us to minimize complications of nutritional therapy and ensure maximum efficiency of recovery processes in severe patients.

Thus, despite significant advances in the study of the role of nutrition in intensive care, this area of medicine continues to develop rapidly. Further large-scale studies are expected to deepen the understanding of the pathogenetic mechanisms of nutritional support and determine optimal nutrition strategies in various clinical scenarios.

Conclusion. Modern nutritional support in intensive care units occupies a key place in the complex treatment of critically ill patients. Generalized data from numerous clinical studies demonstrate that timely, properly organized and personalized nutrition can significantly affect the course of the disease, the frequency of complications, the duration of rehabilitation and the overall prognosis for survival.

Universal principles of nutritional support for critically ill patients include:

- Early initiation of enteral nutrition – within the first 24–48 hours after stabilization of hemodynamic parameters, in the absence of contraindications.
- Personalization of energy load - taking into account the phases of critical illness, using an energy balance of 20-25 kcal/kg in the acute period with a gradual increase when the condition stabilizes.
- Optimization of protein load - ensuring the intake of 1.2-2.0 g of protein per 1 kg of body weight per day to prevent sarcopenia and support immune function.
- Selecting a high-quality nutrient composition – using mixtures enriched with omega-3 PUFAs, vitamins and microelements (selenium, zinc, vitamins C and D), taking into account the clinical picture and concomitant pathologies.
- Limited use of immunomodulatory substrates - careful use of glutamine , strict adherence to recommendations in the presence of organ failure.
- Widespread introduction of instrumental methods for assessing needs - primarily indirect calorimetry for the precise calculation of energy metabolism.
- Active nutritional support of post-intensive care (PICS) – support of protein, energy and vitamin status after the patient leaves the ICU.

It is necessary to recognize that nutritional support remains a dynamic, continuously developing discipline. At the present stage, a personalized approach is of particular importance, allowing to adapt nutrition to a specific metabolic profile of the patient, minimizing the risks of both deficiency and excess nutrient exposure. The areas of study of nutrigenomics , intestinal microbiota , the role of neuroendocrine regulation of metabolism and immunometabolism remain extremely promising .

Further basic and clinical research will further our understanding of the complex interactions between metabolism, nutrition and inflammation in critical illness, providing the basis for even more effective and safe nutritional strategies in intensive care.

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