

Malnutrition and Sepsis in the Critical Patient and its Relationship with Mortality

Hilev de las Mercedes Larrondo Muguercia*, David Orlando León Pérez and Ángela Rosa Gutiérrez Rojas

Hospital Clínico Quirúrgico "Hermanos Ameijeiras", La Habana, Cuba

***Corresponding Author:** Hilev de las Mercedes Larrondo Muguercia, Hospital Clínico Quirúrgico "Hermanos Ameijeiras", La Habana, Cuba.

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Abstract

An evaluative review is carried out to the presence of malnutrition in patients under critical conditions and the factors that predispose them to developing sepsis. Its objective is to highlight the relevant or scarcely known aspects of the variables that best predict septic complications and their association with mortality. Malnutrition has unfavorable repercussions on the critical patient's evolution which conditions the development of infectious diseases in advanced stages. The APACHE II score, SOFA score and serum cholesterol, together with other biochemical and metabolic indicators, are useful in characterizing the patients' condition at discharge. There is an association between sepsis and mortality and its prognostic value, but the association between sepsis and malnutrition is less clear.

Keywords: *Malnutrition; Critical Patient; Sepsis, Cholesterol; Albumin; APACHE II*

Introduction

Malnutrition in the hospital environment constitutes an important problem for its morbidity and mortality [1].

In the Intensive Care Units (ICU) the problem of the malnutrition can affect the patient's evolution until 50% or more [2].

The nutritional inadequacy that continues to the states of starvation, hyper catabolism, serious infections and chronic illnesses, can also be the antecedent of these complications, it is presented with significant loss of the corporal mass.

In the case of the critical patient, the death can happen for the concurrence of malnutrition, sepsis and multiple organ failure; all these events are associated with inadequate synthesis of hepatic proteins and fail of the mechanisms of immune defense. Any nutritional imbalance, will affect, in some measure, the competition of the immune system [3].

The sepsis has a high incidence; in spite of the enormous efforts to control it, and maintains a high mortality and a high social and economic cost [4].

Malnutrition presupposes a disadvantage for the patient's evolution in global context and especially if it develops infectious illness in advanced stadiums. The management in the ICU-8B at the Clinical/Surgical "Ameijeiras Hospital" (HHA) is very complex. Annually the ICU-8B at the received much more than 350 patients, from the clinical and surgical services, a great number of that are patients with cancer, old people, and septic surgical patients. Considering many of these patients have a precarious nutritional and immunologic state, it is logical the need of have easy tools to apply and to predict the mortality is comprehensible. The excellent information is revised with the purpose of evaluating the relationships between the malnutrition and the development of septic complications at the admission and which variables are associated with the mortality in a group of critical patients.

Development

The morbidity and mortality rates for sepsis and malnutrition in the clinical/surgical ICU are high. The reasons above mentioned, justifies the necessity to use multiple elements that allow to carry out the initial characterization of the patients for trying to predict their ulterior evolution.

The Acute Physiology and Chronic Health Evaluation (APACHE II) score [5] and the Sequential Organ Failure Assessment (SOFA) score [6] applied the first day of admission an inpatient hospital stay, are useful tools to discriminate between survival and death of patients. Laboratory parameters are used in association with age, sex, albumin levels and plasmatic cholesterol, as well as the glycemia and the

absolute lymphocyte count. The risk of malnutrition is stratified using method as the Nutritional Control (CONUT) [7,8]. The predicting scores and the nutritional parameters have bigger value when they are determined early in the first 24 hours of having entered the patient in the ICU. The diagnosis and the stadiums of the sepsis can be defined using the Third International Consent of Definition for the Sepsis and the Septic Shock [9].

To the above exposed elements, should be added all the diagnostic interventions and therapies, included in the different performance protocols and guides [9-11]. It is frequent the use of predicting scores in the context of critical care services the services where they have demonstrated a satisfactory predictor power of mortality in dissimilar clinical situations, both in patient with surgical complications as of medical origin, some authors have even rehearsed their use in urgencies services like tool of help in the moment to decide if the patient requires or not of intensive surveillance [12,13].

It is such the utility of this scores that well could incorporate in a systematic way in the undernourished patient's characterization from the moment of their admission, of course when combining these with the habitually markers used of malnutrition.

Of the metabolic-nutritional parameters, the serum cholesterol is not habitually used in the evaluation of the risk of complications or deaths, it is explained by the well-known relationship between hypercholesterolemia and atherosclerotic risk, however, the hypocholesterolemia can be related with some specific pathological conditions and in certain cases, it can possess predictive value of complications and risk of dying.

Several studies reflect the association of the low values of cholesterol and the mortality [14,15]. The explanation for such a phenomenon is enough known. The cholesterol composes is an important part of the cellular membranes and it is the responsible for its viscosity, fluency and capacity of exchange of substances and signs through membranes, it also constitutes the nucleus of the steroidal hormones that shows excellent functions in the homeostasis, and it can justify the states of relative functional suprarenal inadequacy at least partially during the states of septic shock with poor hormonal and homeostasis answer during the stress states.

In the paracrine answer, the interleukin 6 (IL-6) is one of the most important pro-inflammatory cytokines during sepsis, causing decrease of the serum cholesterol. This inversely proportional relationship could serve as an indirect parameter of the magnitude of the systemic inflammatory answer under diverse pathological conditions.

López-Martínez, *et al.* analyzed the relationship among cholesterol, plasmatic proteins and C-reactive protein, count of APACHE II score, the presence of multiple organ failure and mortality in 171 septic patient [16]. These authors found a correlation among the levels of cholesterol and the transferrin levels, prealbumin, retinol-binding protein and serum albumin with C-reactive protein and the oxygen consumption. For this reason, the decrease of the levels of cholesterol could be considered indirectly as a marker of the magnitude of the syndrome of systemic inflammatory answer, and it could have predict value.

The serum albumin and the absolute lymphocytes count are two variables that traditionally are abnormal in the undernourished critical patient, they are used to carry out the evaluation of the nutritional state [17]; however, other researchers have not been able to demonstrate the relationship of these variables with the mortality [18].

Although some studies have demonstrated an association between mortality and high values of glycemia, attributed to the insulin resistance presence in an environment characterized by the action of glucocorticoid, catecholamine, glucagon [19].

This topic continues being debated, for example in a cohort of 206 septic patients in which the predicting power of mortality of the glycemia was evaluated, the authors found association between the levels of the glycemia at first day and the initial graveness (evaluated by the Simplified Acute Physiology Score (SAPS 3), but it could not demonstrate its utility as independent marker to predict mortality [20].

The greatest frequency of sepsis is demonstrated among the patients that died in the ICU; a univariate analysis allows to demonstrate the association between the sepsis at admission and the probability of death. The mortality for sepsis is variable, and it depends on many conditions, among them the stadium in that the patient is.

In the last report of the International Guides of Sepsis and Septic Shock [9] are pointed out the severe sepsis and the septic shock being main problems of health that affects to millions of people, and it has a high incidence. The problem is even more serious, because some authors have found in survivors of Sepsis greatest probability of permanent organs dysfunction, cognitive damage and physical disability [4,21].

The CONUT score is proposed and it began to be use in 2002, its creators validated the method obtaining a sensibility of 92,3% and specificity of 85% [7,8].

The application of the CONUT can offer surprising results of increment of the frequency of appearance of malnutrition in a population of patient in the ICU; this result differ from other national and international reports that applied other Screening system and diagnosis [22,23].

This system on one hand is advantageous, because it combines the result of three variables (serum albumin, cholesterol and absolute lymphocytes count) and it gives an unique approach of degree of malnutrition; when these variables are used by separate, the patient can be classified in different degrees of malnutrition; however; we consider that such method could overestimate the frequency of malnutrition, and therefore in a bias, because the cut point of the normality for absolute lymphocytes count is of 1600 cell/mm³ and most of the literature is establishing in 2000 cell/mm³ [4,20].

It would be interesting to make a reappraisal of these conditions using other screening methods, because although there are some comparative studies, they have been applied in non-hospitalized critical patients [24].

The malnutrition is the primary cause of the immune deficit associated to metabolic imbalances that affects the integrity of the mucous ones, the nonspecific resistance (alterations of the activity the system of the complement, the opsonisation, the phagocytosis, the activity of the macrophages), the immunity mediated by cells, the humoral immunity and the integrity of the intestinal and microbial barrier.

The needs nutrients with specific actions on the immune system are guided to maintain all their components. The function, synthesis and liberation of immune cells and molecules immunocompetent, depend on many of complex metabolic processes that require of nutrients specific as cofactors [3].

This complex defense system with all its implications, carries for the organism a high cost and to face to aggression. For it, the organism must respond quickly, but rather it should be able to regulate and obtain nutrients in function of the physiologic conditions of the organism. On the other hand, during the process of the sepsis the metabolism of protein deviate to prioritize the production of acute phase reactants, but to the detriment of the synthesis of proteins like the albumin, the prealbumin, transferrin, retinol-binding protein, collagen, among other. The IL-6 participate in this process (also related with the first levels of cholesterol), circumstance that worsens the malnutrition; with that result, it can consider that both processes are strongly associated.

Conclusions

The current revision allows to summarize that the patients admitted in the ICU present complications of sharp and chronic illnesses that affect their nutritional and metabolic state so much and the adaptive and regenerative capacity. They becomes subjects with high susceptibility of developing energy nutritional malnutrition, organic dysfunctions and the severe sepsis with all their variants.

To know the elements and variables that more contributes to an early diagnosis and that they to be able to of predicting the probability of developing complications and death is a challenge for the assistance teams. The biochemical, metabolic and immunologic variables, together to approaches of international consents on nutritional diagnoses, sepsis, organs dysfunction, the value the APACHE score II and SOFA (calculated the first day of admission), are associated with the mortality. Greater number of investigations is needed on these topics in the critical patient's context.

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