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RECOMMENDATIONS FOR SPECIALIZED NUTRITIONAL-METABOLIC TREATMENT OF THE CRITICAL PATIENT

Recommendations for specialized nutritional-metabolic treatment of the critical patient: Acute lung disease. Metabolism and Nutrition Working Group of the Spanish Society of Intensive and Critical Care Medicine and Coronary Units (SEMICYUC)☆,☆☆

Recomendaciones para el tratamiento nutrometabólico especializado del paciente crítico: enfermedad pulmonar aguda. Grupo de Trabajo de Metabolismo y Nutrición de la Sociedad Española de Medicina Intensiva, Crítica y Unidades Coronarias (SEMICYUC)

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Introduction

Critical patients with acute respiratory failure (ARF) are at a high risk of malnutrition due to their background disease condition, catabolism secondary to the acute illness, and the need in many cases for mechanical ventilation (MV). As a result, these patients must be assessed from the nutritional perspective, with consideration of the use of specialized nutritional support.

Questions

What is the best formula for the critically ill with acute lung disease? Are high calorie density diets indicated for restricting volume supply?

Hypercaloric and hyperproteic complete nutrition formulas are widely used in patients with ARF, particularly in the presence of volume overload. Water overload, lung

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edema and renal failure are frequent in patients with ARF, and are associated to a poorer prognosis. Therefore, in patients with ARF that require water restriction measures, high calorie content nutrition formulas are recommended (1.5–2 kcal/ml), with a protein supply of 1.2–2.0 g/kg/day.[1] In recent years a number of studies have supported the use of trophic and non-complete enteral nutrition in patients with acute respiratory distress syndrome (ARDS) and in those in which prolonged MV is expected. No significant differences in terms of mortality, the duration of MV or infectious complications have been documented.[2–4] Nevertheless, methodological limitations mean that these findings must be interpreted with caution.

Patients requiring MV during at least 96 h are at nutritional risk. In individuals subjected to prolonged MV (over 8 days), it is advisable to secure at least 80% of the calorie target in a gradual manner in the first 8 days of MV, whether using enteral nutrition (EN) or total parenteral nutrition (TPN) or complementary feeding. This strategy has been associated to increased survival after 6 months and to improved physical recovery three months after discharge from the Intensive Care Unit (ICU).[5] At present, it seems adequate for critical patients in the first week of admission to receive a calorie supply of 20–25 kcal/kg/day, with a high protein supply (>1.5 g/kg/day).[6]

Indirect calorimetry is the method of choice for calculating the calorie requirements, though its use is limited, particularly when high oxygen concentrations are used[7].

Do low carbohydrate and high fat content diets play a role?

Different studies have shown the benefit of starting early nutritional support in critical patients, though it must be remembered that an excessive energy supply causes lipogenesis, with an increased production of CO_2, and this may contribute to weaning failure. The composition in terms of macronutrients possibly plays no relevant role in the production of CO_2 in patients, provided the nutritional requirements are adjusted and overfeeding is avoided.[8] On the other hand, diets rich in fats and poor in carbohydrates have not shown significant efficacy in critical patients with ARF.[9]

A mixture of long-chain fatty acids and medium-chain fatty acids in 1/1 or 1/2 proportion is able to reduce the amount of linoleic acid and reduce the effects upon pulmonary vasoconstriction. Linoleic acid can contribute to increase lung shunting and to unfavorable immune changes.[9] However, no improved clinical outcomes have been demonstrated with such mixtures.

Are diets enriched with ω-3 fatty acids, γ-linolenic acid and antioxidants indicated?

To date, the published data on the clinical efficacy of diets with combinations of fats rich in eicosapentanoic acid, docosahexaenoic acid, γ-linolenic acid and antioxidants in the nutrition of patients with ARDS have been contradictory. The heterogeneity of the studies, the lack of information referred to clinical management, the use of formulas with mixtures of pharmaconutrients, and the disparity of results imply that the routine use of such enteral formulas cannot be recommended.[10] Lipid emulsions enriched with ω-3 fatty acids have not demonstrated a decrease in mortality, and the data referred to other outcomes such as nosocomial infection and mean duration of stay are contradictory.[11,12]

Is it necessary to monitor the levels of phosphorus and other micronutrients?

Hypophosphoremia is a frequent laboratory test finding in patients with ARF. It is associated to respiratory failure and can at least partially influence weakness of the respiratory muscles.[13] The rapid correction of respiratory acidosis after MV can also contribute to hypophosphoremia by increasing glycolysis and facilitating phosphorus penetration into the intracellular compartment. It is particularly important to determine its levels in malnourished patients or individuals at risk of suffering refeeding syndrome.[11]

How does mechanical ventilation in prone decubitus condition the administration of nutritional support?

Although a common practice in the ICU, few studies have evaluated the safety of enteral nutrition in patients in prone decubitus. In a prospective, controlled before-after study of 38 patients ventilated in prone decubitus and receiving enteral nutrition, the authors recorded no increased incidence of digestive or respiratory complications versus supine decubitus, and recommended raising the patient headrest to 25° during MV in prone decubitus.[14] The authors of another prospective study in patients ventilated in prone decubitus concluded that enteral nutrition is feasible and safe, and is not associated to an increased risk of gastrointestinal complications or bronchoaspiration pneumonia – provided tolerance is closely monitored.[15] Both studies administered enteral nutrition via a nasogastric tube.

How do noninvasive mechanical ventilation and high-flow oxygen therapy condition the administration of nutritional support?

In patients requiring noninvasive MV, oral intake is typically inadequate and difficult to apply. Few studies have evaluated the administration of enteral nutrition in these patients, though some publications have reported an increase in airway complications in patients administered this type of nutrition and subjected to noninvasive MV – though with no impact upon mortality.[16] Another prospective study did not find fasting or underfeeding to worsen the prognosis.[17] Given the risk of bronchoaspiration, it seems reasonable to administer enteral nutrition at low doses, with close monitoring of signs of intolerance, and complementing with parenteral nutrition if the patient does not tolerate complete enteral dosing.

With regard to the use of high-flow oxygen therapy devices, these allow satisfactory reintroduction of oral feeding or the use of oral nutritional supplements, with no contraindications apart from those secondary to the patient disease process.[18]

Recommendations

- In patients with acute lung disease, low carbohydrate and high fat diets have not been found to be effective; their use is therefore not recommended (Level of evidence: moderate. Grade of recommendation: high).
- Based on the existing evidence, the routine use of lipid diets or emulsions enriched with ω-3 fatty acids in patients with ARDS is not recommended (Level of evidence: moderate. Grade of recommendation: moderate).
- In patients with ARDS, it is not advisable to administer ω-3 fatty acids dissociated from enteral nutrition (Level of evidence: moderate. Grade of recommendation: moderate).
- In patients with ARDS, it is advisable to monitor the phosphorus levels, particularly during weaning from ventilation (Level of evidence: low. Grade of recommendation: high).
- Enteral nutrition is recommended during ventilation in prone decubitus (Level of evidence: moderate. Grade of recommendation: high).
- In patients subjected to noninvasive mechanical ventilation, the use of enteral nutrition may be considered, even though at trophic doses, with close monitoring of signs of intolerance (Level of evidence: low. Grade of recommendation: moderate).

Conflicts of interest

Dr. Grau-Carmona has served as consultant to Lyrics Pharmaceutical from October 2017 to February 2019 in the development of a clinical trial, and has received payment for conference lectures in 2018 and 2019 from Orion Pharmaceutical S.A. and B. Braun Medical S.A. None of these activities constitute a conflict of interest in relation to the recommendations of the present study. Dr. Sánchez-Alonso has received funding from Nestlé and Abbott for participation in training courses. Dr. Vila-García declares that she has no conflicts of interest.

Note to supplement

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