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Chapter 9

Guidelines for specialized nutritional and metabolic support in the critically-ill patient. Update. Consensus SEMICYUC-SENPE: Gastrointestinal surgery

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Abstract

Gastrointestinal surgery and critical illness place tremendous stress on the body, resulting in a series of metabolic changes that may lead to severe malnutrition, which in turn can increase postsurgical complications and morbidity and mortality and prolong the hospital length of stay.

In these patients, parenteral nutrition is the most widely used form of nutritional support, but administration of enteral nutrition early in the postoperative period is effective and well tolerated, reducing infectious complications, improving wound healing and reducing length of hospital stay.

Calorie-protein requirements do not differ from those in other critically-ill patients and depend on the patient's underlying process and degree of metabolic stress.

In patients intolerant to enteral nutrition, especially if the intolerance is due to increased gastric residual volume, prokinetic agents can be used to optimize calorie intake. When proximal sutures are used, tubes allowing early jejunal feeding should be used.

Pharmaconutrition is indicated in these patients, who benefit from enteral administration of arginine, omega 3 and RNA, as well as parenteral glutamine supplementation.

Parenteral nutrition should be started in patients with absolute contraindication for use of the gastrointestinal tract or as complementary nutrition if adequate energy intake is not achieved through the enteral route.

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Key words: *Gastrointestinal surgery. Nutritional support. Pharmaconutrients. Complementary parenteral nutrition.*

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SEMICYUC: Spanish Society of Intensive Care Medicine and Coronary Units.
SENPE: Spanish Society of Parenteral and Enteral Nutrition.

RECOMENDACIONES PARA EL SOPORTE NUTRICIONAL Y METABÓLICO ESPECIALIZADO DEL PACIENTE CRÍTICO. ACTUALIZACIÓN. CONSENSO SEMICYUC-SENPE: CIRUGÍA DEL APARATO DIGESTIVO

Resumen

El estrés de la cirugía gastrointestinal y la enfermedad crítica representan una gran agresión sobre el organismo, lo que ocasiona una serie de cambios metabólicos que pueden conducir a una situación de desnutrición grave, con aumento de las complicaciones posquirúrgicas, mayor morbimortalidad y prolongación de la estancia hospitalaria.

En estos enfermos la nutrición parenteral es la más utilizada, pero se ha visto que la nutrición enteral administrada de forma precoz en el postoperatorio es efectiva y bien tolerada, con disminución de las complicaciones infecciosas, mejoría de la cicatrización de las heridas y menor estancia hospitalaria.

Las necesidades caloricoproteicas no difieren de las de otros pacientes críticos, y dependerán de la patología basal del paciente y de su grado de estrés metabólico.

En caso de intolerancia a la nutrición enteral, en especial si se debe al aumento del residuo gástrico, se deben utilizar procinéticos para optimizar el aporte calórico. En caso de suturas proximales se debe recurrir a la colocación de sondas que permitan la nutrición en yeyuno de forma precoz.

La farmaconutrición tiene efectos beneficiosos en este t ipo de enfermos, con indicación de mezclas de arginina, omega 3 y RNA por vía enteral, así como la suplementación con glutamina en nutrición parenteral.

La nutrición parenteral deberá iniciarse en los pacientes con contraindicación absoluta para la utilización del tracto gastrointestinal, o como nutrición complementaria si no se consigue un aporte calórico adecuado por vía enteral.

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Palabras clave: *Cirugía gastrointestinal. Soporte nutricional. Farmaconutrientes. Nutrición parenteral complementaria.*

Introduction

Surgery is the cause of a number of deep inflammatory and metabolic changes with the primary objective of ensuring the adequate defence of the body and prioritize the metabolic pathways to useful products in the acute stage of the disease.

Malnutrition is associated with changes in body composition, and delayed wound healing, decreased functional capacity, impaired immune function and changes in the different organ systems[1]. Therefore, malnourished patients are at risk of experiencing infectious and cardiorespiratory complications[2,3], increased morbidity and mortality and prolongation of hospital stay. The presence of postoperative ileus and integrity of new anastomosis have led to maintaining fasting with administration of parenteral fluids until the patient starts with bowel sounds or clears gases. However, it has been shown that early postoperative enteral nutrition is effective and well tolerated[4]. Enteral feeding is associated with clinical benefits, such as the reduction in the incidence of postoperative infectious complications and improved healing of tissues[5].

Therefore, the nutritional intervention is essential as part of the treatment of postoperative gastrointestinal patients, including those with good previous nutritional status, since the worsening of nutritional status due to the surgical stress and critical illness will be a determinant factor of poor subsequent outcome.

What should the calorie intake be?

Caloric requirements will be adapted to the stress status of the patient[6-9]. The surgical patient admitted to the intensive care unit (ICU) is usually in a grade 2-3 stress condition, so the calorie supply should be 25-30 kcal/kg/day. In a hyperglycemia state, 20-25 kcal/kg/ day will be required. In the catabolic phase, 20-25 kcal/kg/day will be administered and will be increased to 25-30 kcal/kg/day in the anabolic phase[7] (IV). It is recommended not to exceed 2,000 kcal/day.

What amount and quality of energy and protein substrates is required?

Protein supply will be within 1.2-1.5 g/kg/day of proteins[10] (IV), that could increase in cases of protein loss increase, as in patients with open wounds, burns, or enteropathy with protein loss. Nitrogenated losses in patients with open abdomen are higher than in other surgical patients, with a mean protein loss of 3.5 g of nitrogen in 24 h, so it has been proposed to increase protein supply a mean of 2 g of nitrogen per litre of abdominal fluid lost[11] (III).

Glucose supplied as energy substrate should be adjusted to maintain glycemic values below 150 mg/dL, providing insulin as necessary[12] (Ib) and avoiding protocols for tight glycemic control (80-110 mg/dL).

The minimum amount of lipids required is 1 g/kg/day and its total supply will account for 30% of calorie supply but, sometimes and according to the patient's condition, it may be 40%. Only if there is hypertriglyceridemia (> 400 mg/L) its supply will be withdrawn or stopped[13]. Lipid emulsion including middle-chain triglycerides (MCT) is better metabolized in the mitochondria and has been shown to have advantages over lipid emulsion based on long-chain triglycerides (LCT) alone, with less infectious complications in surgical patients[14] (Ib).

Advances in the understanding of the metabolic, immunomodulating and inflammatory properties of fatty acids have allowed for developing new lipid formulas for modulating the inflammatory response in various situations of aggression. A metaanalysis[15] compares the immune effects of all lipid emulsions, without finding advantages of some over others. The recommendations of the Canadian Critical Care Group on nutritional therapy in critically-ill patients pooled studies based on the nature of the lipid used and found no differences in their clinical outcome[16] (IV). Heller et al., in a randomized prospective study, evidenced that intravenous administration (i.v.) of ω-3 fatty acids at doses of 0.11 g/kg/day for an average of 8.7 days in 661 surgical ICU patients, reduces mortality as compared to mortality predicted by SAPS II[17] (III).

A MCT/LCT emulsion enriched with fish oil, with a high vitamin E content, has been recently launched onto the market. A randomized, double-blind clinical trial performed in postoperative critically-ill patients operated for abdominal aorta aneurysm[18] compared 2 homogeneous groups of patients receiving total parenteral nutrition (TPN) for 5 days. Patients receiving this new fat mixture had a significant increase of eicosapentaenoic acid, leukotriene B5 and vitamin E when compared with the control group, a significant reduction of hospital stay and a non-significant trend towards a lower incidence of pneumonia. Another randomized, double-blind study[19] compared this emulsion enriched with fish oil to LCT in patients undergoing elective thoracoabdominal surgery, finding a trend toward shorter hospital stay. Despite this, for the moment there are not enough data available to recommend the type of lipids that must be used in critically-ill patients with PN and abdominal surgery.

With regard to the carbohydrate/lipid ratio, a study[20] compared PN with carbohydrates/lipid ratio of 80/20 to PN with 50/50 ratio, finding a lower nitrogen loss in the 80/20 group, though with a worst control of blood glucose, concluding that a greatest evidence is required to establish a recommendation.

Do specific nutrients play any role in nutritional-metabolic support in these patients?

Glutamine

The patients where elective abdominal surgery is indicated show some degree of malnutrition and a deficit of circulating glutamine for different reasons, most of them associated with their underlying disease (anorexia, intestinal obstruction, blood loss, etc.). This situation worsens postoperatively, since glutamine demands increases in response to the aggression, having demonstrated that circulating and muscle-released glutamine values are inadequate for surgery stress[21]. Several studies have evaluated the role of glutamine supplements in postoperative patients following abdominal surgery[21-26].

A metaanalysis including 9 randomized, controlled clinical trials, with a total of 373 patients undergoing abdominal surgery, concluded that administration of PN supplemented with glutamine (20-40 g/day) has a beneficial effect on nitrogen balance, reduces hospital length of stay and infectious complications[22] (Ia). Dechelotte conducted a multicenter, randomized, double-blind, controlled study, with administration of PN supplemented with glutamine versus PN without glutamine, concluding that in the glutamine group infectious complications are reduced and a better glycemic control is achieved[23] (Ib). Estívariz performed a similar clinical trial including surgical patients with various etiologies, ranging from pancreatic to colon surgery, and concluded that in the PN group with glutamine infectious complications decrease in the subgroup of colon surgery, but not in that of surgery of pancreatic necrosis[24] (Ib). Oguz conducted a study in postoperative patients with colorectal cancer, where enteral nutrition vs enteral nutrition supplemented with parenteral glutamine was administered, in a total of 109 patients, concluding that glutamine supplements reduce the number of postoperative complications and hospital stay[25] (Ib). Kumar compared in patients with peritonitis and abdominal injuries the administration of enteral glutamine (45 g/day) versus conventional EN without finding benefits in the glutamine group[26] (Ib).

Arginine

Arginine supplements are recommended due to their beneficial effect on T cells and their function as nitric oxide precursor. Several studies in critically-ill patients show that when arginine is administered with other pharmaconutrients, infections and hospital stay decrease. These effects are more apparent in cancer patients to undergo elective abdominal surgery[27,28] (Ia), particularly when they have also received this type of nutrition preoperatively. The beneficial effect of pharmaconutrition in wound healing and a reduction in suture dehiscence also appears to be demonstrated in these patients[29] (Ib). Therefore, it is recommended to use diets enriched with arginine, ω-3 fatty acids, and RNA postoperatively following abdominal surgery.

There are no studies to recommend the single use of arginine systematically in EN or PN in surgical patients[6] (IV).

Micronutrients and antioxidants

Given the essential action of micronutrients (vitamins, trace elements) in maintaining immune and antioxidant system function, their supply is necessary in any patient susceptible to these deficiencies, even if of subclinical type. The critically-ill patient has a negative trace element balance and an increased production of free oxygen radicals[30]. Therefore, it is necessary to supply micronutrients and antioxidants in the nutrition of critically-ill postsurgical patients, though there is no evidenced about the exact amount. The studies performed with micronutrients confirmed that selenium supplementation evidenced a trend towards reducing 28-day mortality, though the differences were not statistically significant[31]. In PN 2-4 mg zinc/day are recommended. When there is an inflammatory bowel disease, pancreatic disorders or intestinal fistulas after surgery, losses can account for several times the normal requirements, so it is recommended to increase zinc supply in PN, though an exact dose cannot be given[32].

Fiber

Soluble fibre may be beneficial in patients developing diarrhea while receiving EN. Both soluble and insoluble fibres must be avoided in patients at a high risk of intestinal ischemia or intestinal motility disorders. Cases of intestinal obstruction in non-surgical patients who were given an enteric formulation with insoluble fibre have been described[33].

What should be the best nutritional support route?

In critically-ill patients it has been shown that EN should be started early for its benefits on the clinical outcome. A metaanalysis performed on studies in patients undergoing elective gastrointestinal surgery compared the results of early EN versus fasting. A reduction in the risk of infection and hospital stay was confirmed, with a trend to decreased mortality in the treated group[34] (Ia). In surgical patients who can tolerate enteral diet, early EN is recommended, as it reduces the risk of infection, length of stay and suture dehiscence, particularly if there is a gastrointestinal cancer[35] (IIb). In patients whose anastomosis is located in the proximal gastrointestinal tract (gastrectomy,

pancreatoduodenectomy, esophageal resection), jejunal feeding can be given, either through a jejunostomy or a nasojejunal tube, recommending early EN via this route[36,37] (IIb).

In case of impaired intestinal motility, the use of prokinetics such as metoclopramide (10 mg IV 4 times daily) and erythromycin (200 mg twice daily) reduces residual gastric volume and improves the percentage of patients that may be nourished successfully[38] (III).

Is it indicated to administer parenteral nutrition? At what time?

Patients who cannot tolerate EN should receive PN adapted to their calorie-protein needs[9]. TPN will be indicated in case there is an absolute contraindication to EN[39]. In a randomized study, 300 patients undergoing major surgery received continuous PN or glucose alone (300 g/day) for 14 days. The group treated with PN had a lower mortality than the group treated with glucose[40] (Ib). The metaanalysis by Simpson and Doig, who compared PN to EN in critically-ill patients, evaluated 9 studies, finding a lower mortality in the PN group versus the late EN[41] (Ia). There is controversy about the use of early PN. The Canadian Nutrition group[42] (IV) recommends that, if the gastrointestinal tract is affected, early PN may be indicated, since a prolonged fasting period is associated with a poor outcome.

Is it indicated to administer parenteral nutrition as a complement to enteral nutrition?

In critically-ill surgical patients it is often difficult to provide all necessary nutrients by the enteral route. As there are no specific studies in abdominal surgery with complementary PN, following the recommendations of the critically-ill patients in general, the use of PN complementary to EN must be considered if 60% of the energy goal is not met at the third day of admission. If the goal of 20-25 kcal/kg/day is not reached, enteral and parenteral nutrition may be started, as with insulin therapy PN does not involve an additional risk[43,44] (IV).

Recommendations

– In patients undergoing abdominal surgery, the nutritional needs are similar to all other critically-ill patients (C).

– Administration of prokinetics should be considered in patients with intolerance to enteral nutrition (C).

– In surgery of the gastrointestinal tract with proximal anastomosis enteral nutrition using a feeding catheter placed distal to the anastomosis is recommended (B).

– The administration of w-3 fatty acids may be considered to improve outcome in these patients (C).

– The use of diets enriched with pharmaconutrients is recommended in neoplasic patients undergoing abdominal surgery (B).

– Parenteral nutrition in critically-ill surgical patients should be supplemented with glutamine (A).

– In critically-ill surgical patients there are not enough data available to recommend supplementing enteral nutrition with glutamine (C).

– Complementary parenteral nutrition should be started if 60% of nutritional requirements are not achieved on the third day of hospital stay or, during hospital stay, for at least 2 consecutive days (C).

Conflict of interests

The authors declare that they have participated in activities funded by the pharmaceutical industry for marketing of nutritional products (clinical studies, educational programmes and attendance to scientific events). No pharmaceutical industry has participated in the preparation, discussion, writing, and establishing of evidences in any phase of this article.

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