REVIEW Libri Oncol., Vol. 39 (2011), No 1-3, 65 – 69

NUTRITIONAL SUPPORT IN CANCER PATIENTS

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Summary

The incidence of malnutrition in cancer patients treated in the intensive care unit (ICU) is significantly higher than in other patient groups.

Hypermetabolism and increased energy requirements resulting from surgery further aggravate nutritional status in malnourished patients and increase the incidence of adverse events including infections, sepsis, wound dehiscence, tissue edema, decubitus and death. The estimation of nutritional status and nutritional needs, compensation for all energy requirements, including vitamin and mineral supplementation using parenteral, enteral or combination of both feeding techniques should become everyday practice in the ICU. Monitoring the success of treatment through laboratory test results and clinical status as well as early recognition of adverse effects of nutritional support minimize the frequency of complications resulting from nutritional therapy.

KEYWORDS: *malnutrition, malignancy, nutritional status, nutritional support*

NUTRITIVNA POTPORA ONKOLOŠKIH BOLESNIKA

Sažetak

Pojavnost pothranjenosti u bolesnika oboljelih od malignih bolesti koji se liječe u jedinicama intenzivnog liječenja (JIL) je znatno veća nego u drugim skupinama bolesnika.

Hipermetabolizam i povećane energetske potrebe koji su posljedica operacijskog zahvata dodatno pogoršavaju nutritivni status u pothranjenih bolesnika i povećavaju učestalost neželjenih posljedica u vidu infekcija, sepse, dehiscijencije rana, edema tkiva, dekubitusa kao i smrtnost. Procjena nutritivnog statusa i nutritivnih potreba, nadoknada svih energetskih potreba, uz suplementaciju vitamina i minerala primjenom parenteralne, enteralne ili kombinacijom obaju tehnika prehrane nužno treba postati svakodnevna praksa u JIL-u. Praćenje uspješnosti liječenja kontrolom laboratorijskih nalaza i kliničkog statusa kao i rano prepoznavanje neželjenih učinaka nutritivne potpore minimaliziraju učestalost komplikacija koje su posljedica nutritivnog liječenja.

KLJUČNE RIJEČI: *pothranjenost, maligna bolest, nutritivni status, nutritivna potpora*

INTRODUCTION

In intensive care units (ICUs) malnutrition is present in 30% of all ICU patients on the average. The incidence of malnutrition in cancer patients treated in the intensive care unit (ICU) is about 80%, which is significantly associated with an increased risk of developing complications, prolonged recovery, prolonged length of hospital stay, and increased patient mortality (1).

The loss of weight is a bad prognostic sign as regards the treatment outcome of patients with cancer. Studies have shown that 80% of patients with cancer of the upper gastrointestinal tract and

60% of lung cancer patients already experience a significant weight loss at the time of diagnosis (2).

Malnutrition in cancer patients is partly due to symptoms caused by the development of tumor (loss of appetite, nausea, vomiting, difficulty swallowing, diarrhea, constipation, pain), metabolic changes associated with the disease and required medical procedures (diagnostics, surgery, chemotherapy and irradiation) (1-3).

Malnutrition eventually results in the increased incidence of infections, poor wound healing and dehiscence, reduced immune response and respiratory function, and electrolyte imbalance (2). Nutrition and nutritional supports are an essential factor in the treatment of cancer patients, to be administered for the purpose of preserving the body's immune function.

METABOLIC AND ENDOCRINE RESPONSE TO TUMOR DISEASE

Many mediators including tumor necrosis factor – α (cachectin), interleukin-1, interleukin-6, interferon and leukemia inhibitory factor, as well as tumor products (proteolysis induction factor or lipid-mobilizing factor) have a direct catabolic effect on host metabolism leading to the development of cachexia – a syndrome characterized by the development of advanced malnutrition with significant weight loss and muscle wasting (3).

Altered metabolism of fats, proteins and carbohydrates, including enhanced lipolysis, gluconeogenesis from amino acids and fatty acids, is a result of the action of numerous neurotransmitters and neuropeptides released into the host tissue in response to the disease.

Weight loss then occurs as a result of a imbalance between decreased energy intake and increased energy expenditure, or increased basal metabolic rate in cancer patients.

Some studies suggest monitoring of the basal metabolic rate (BMR) as a prognostic method for the development of the disease, with the drop of its levels predicting short-term survival.

Surgery or the stress response to surgery is responsible for additional adverse metabolic and endocrine changes in the body, which in the immediate postoperative period, are further aggravated by the existence of mechanical barriers (gastrointestinal anastomosis, postoperative ileus) to feeding resulting in further impairment of the patient's nutritional status.

The assessment of nutritional status and setting up the criteria and indications for nutritional support including individual planning tailored to each patient's needs are therefore indispensable.

ASSESSMENT OF NUTRITIONAL STATUS AND INDICATIONS FOR NUTRITIONAL SUPPORT

Malnutrition is an eating disorder characterized by unintentional weight loss. Cancer patients who within one, three or six months lost more than lost more than 5% , 7.5% or 10% of their body weight and those with BMI <22 or 20%-loss of their usual body weight are at risk of developing malnutrition (5).

Depending on BMI levels, malnutrition can be graded as mild (18.6-20), moderate (16.5-18.5) and severe (<16.5).

Subjective Global Assessment (SGA) is a simple and useful nutritional assessment tool that in addition to detailed anamnestic data (current disease, medical history, previous therapeutic procedures, allergies, dietary characteristics) and clinical examination, also combines anthropometric measurements and laboratory and biochemistry tests (8).

If the patient's status cannot be evaluated using the above method, serum markers of nutritional status can be used, of which serum levels of albumin, prealbumin, transferrin and nitrogen balance measurement are the most accessible for analysis to reflect protein synthesis, distribution and breakdown.

Nutritional support is indicated in patients with anorexia and malnutrition, patients with 10% of BMI loss within 1- 3 months, disturbed bowel function, postoperative patients and patients with a mechanical barrier to the passage of food due to obstructive tumors of the gastrointestinal tract.

PLANNING FOR PROTEIN AND ENERGY EXPENDITURE

The specificity of metabolic response to surgical trauma in patients operated for malignancy is recognized in the lack of reserve energy resources (liver glycogen, adipose tissue) that the body would use during starvation following surgery.

Before the surgery, already present metabolic changes caused by cancer lead to increased energy demands in these patients and mobilization of glycogen, fat and protein reserves to meet the requirements. At the same time, reduced protein synthesis and increased protein breakdown result in albumin loss and muscle protein waste. Preoperative preparation and a number of diagnostic procedures prolong the starvation and aggravate energy and protein imbalances.

Daily tissue loss in the ICU non-cancer surgical patients has been estimated at about 0.6 kg/day and the period of 5-7 days has been considered the period of time when nutritional support should be started. Due to metabolic changes in surgical patients with cancer this period should be shortened to the least possible time, especially if the patients are undernourished (12). Planning for nutritional support in the ICU patients includes the estimation of energy requirements and also requirements of proteins, carbohydrates and fats. The presence of chronic diseases (diabetes, renal failure, COPD) and other disorders (fistula, sepsis) lead to additional metabolic changes that should be included in the nutritional support plan (9).

The first step in planning nutritional support is to calculate patient energy requirements. This requires calculation of two main components of the nutritional formula including the total amount of energy required and the required share of fats, proteins and carbohydrates to meet the patient needs.

Energy needs are determined by using either indirect calorimetry or equations (the Harris-Benedict) and by calculating nitrogen requirements that are also considered most appropriate for the ICU patients.

The Harris-Benedict equation (17) for calculating basal energy expenditure corrected for the specific stress factor of individual conditions, including the clinical assessment of energy expenditure, is the most frequently used method of calculating energy needs in the ICU patients:

Males: BEE = 66+13.8 x BM +5 x BH- 6.8 x age

Females: BEE = 655+9.6 x BM+1.8x BH -4.7 x age

BEE – basal energy expenditure; BM – body weight; BH – body height

In the state of stress, measured values should be corrected by the so-called stress factor:

Starvation 0.85-1.0

Low-level stress 1.3

Major surgery, severe stress 1.3 – 1.5

Malignant disease 1.6

Measurements and calculation of nitrogen balance of its intake and excretion are most appropriate for planning energy expenditure in the ICU patients. This is based on a measure of total nitrogen losses including losses determined from a 24-hour urine collection to which losses through stool and sweat accounting for about 1.6 g/day, and losses due to the presence of fistulas of about 2.0 g/day are added up. As each gram of nitrogen is produced from the breakdown of 6.25 g protein their intake can be adequately planned. Energy requirements are further determined taking into account that for the utilization of each gram of nitrogen 80-150 g of glucose are required, depending on the intensity of stress the patient is exposed to, and function of particular organs and organ systems.

Proteins, carbohydrates and fats usually account for 15-25%, 30-50% and 10-25%, respectively, of total daily energy requirements and in case of any specific needs, these ratios should be tailored to meet each patient's individual needs.

Cancer patients show an increased insensitivity to insulin, poorer glucose tolerance of glucose, poorer peripheral glucose utilization as well as the need for intensive insulin therapy to maintain normoglycemia.

During the period of nutritional support, laboratory monitoring of electrolytic and acid-base status, liver enzyme levels, blood sugar, albumin, coagulogram, red cell count, white cell count and CRP, as well as clinical patient monitoring are required.

METHODS OF NUTRITIONAL SUPPORT

Nutritional support can be delivered by the enteral, parenteral or a combination of both feeding routes. The choice of route depends on both the patient capability of oral feeding and the functional status of the gastrointestinal system.

Parenteral nutrition is a method of feeding providing nutrients, fluids and electrolytes through either a peripheral or central venous catheter for patients incapable of receiving long-term enteral nutrition. For this purpose solutions of glucose, fats, amino acids, vitamins, minerals and oligoelements are used either separately or as finished-form preparations. The daily glucose, protein and fat needs are about 4-5 g/kg BW, 1.5 g/kg BW, and up to 1 g/kg BW, respectively (14).

For intravenous administration 5-50% glucose solutions are used. The choice of solution depends on the needs for glucose, volume compensation and also the venous route type.

In addition to eight essential amino acids, amino acid solutions for parenteral administration also contain arginine and histidine for which the body's needs are increased in the state of stress, which cannot be synthesized in sufficient quantities during the stressed state, have an immunostimulative effect and are mediators of protein synthesis in the liver (11). Glutamine is an amino acid increasingly used in the ICU as a supplement to other amino acids or is contained in some combined finished forms for parenteral administration. It is a primary nutrient for enterocytes, colonocytes, lymphocytes and macrophages. Glutamine minimizes the atrophy of the intestinal mucosa during total parenteral nutrition and after chemotherapy and radiation therapy.

Fats are emulsions a small volume of which can ensure a high energy intake.

Enteral nutrition is an optimal method of nutritional support; food can be taken by mouth or through a feeding tube placed either into the stomach or into the small intestine. Using pumps that are specially designed for this purpose, nutrients can be delivered either continuously or as boluses starting with small amounts that are gradually increased to meet all the nutritional requirements calculated when developing the nutritional plan. The administration of enteral nutrition protects the integrity of the intestinal mucosa, inhibits bacterial translocation and achieves better utilization of nutritional components (13).

Nowadays, there are a number of enteral feeding preparations that meet the basic nutritional needs, and also preparations adjusted to meet specific patient needs associated with functional disorders of particular body systems.

According to their composition, preparations for enteral feeding can be divided into the polymeric - composed of whole protein molecules, peptides, long- and short-chain fatty acids, without lactose and with an energy value of about 1 kcal/ml, and the monomeric - composed of simple sugars, amino acids and partially broken down proteins which are appropriate for early enteral feeding.

The combined administration of enteral and parenteral nutrition is a common form of supportive therapy for cancer patients aimed at meeting both the energy and nutritional needs of the patient (15).

Combined nutrition is usually administered in cases of insufficient enteral nutrition.

The ICU mainly provides care to patients in their immediate postoperative course or to the severely undernourished receiving nutritional support in preparation for surgery. Both groups of patients first require correction of their electrolyte status, compensation for volume and energy deficit by parenteral nutrition i.e. delivered via a peripheral or central venous catheter.

Immediately after surgery, patients are not able to take a sufficient amount of fluid as required, with their digestive tract not recovered to receive food due to the development of postoperative ileus and the nature of the surgical procedure itself, which makes parenteral nutrition their sole available source of nutrient and fluid intake.

Modern techniques for multimodal treatment of surgical patients significantly reduce surgical stress and tissue damage, and new approaches to acute postoperative pain management reducing opioid use accelerate the restoration of bowel function and improve the quality of patient recovery with a reduced frequency of postoperative complications.

ADVERSE EVENTS

As with any therapy procedures, enteral or parenteral support may also result in the development of some adverse effects, i.e. complications (16).

Complications of parenteral feeding can be either mechanical as associated with venous catheter placement (hematoma, arterial puncture, pneumothorax, air emobolism, cardiac tamponade) or metabolic (hyperglycemia, increased levels of triglycerides, liver enzymes and bilirubin, fatty inflitration of the liver and bone demineralization). Infections such as phlebitis or sepsis are due to the insertion of a catheter into a peripheral and central vein.

Complications of enteral feeding due to retention of food and gastric contents include aspiration, damage to the nasal mucosa, pharynx and esophagus by the feeding tube (mechanical), vomiting, diarrhea (gastrointestinal) and metabolic imbalance (hyperglycemia etc.).

CONCLUSION

About 60% of cancer patients undergo surgery and owing to advances in diagnosis, chemotherapy, surgical and anesthesia techniques, this percentage is constantly increasing.

Taking into consideration specificities of the metabolic response to both malignant disease and surgical trauma, and the level of stress to which the body has been exposed, methods of energy and nutritional support have been recognized as necessary and indispensable in the treatment of cancer patients.

Due to a better understanding of the metabolic and endocrine responses to the disease itself, and improved nutrition preparations including the proper administration route, this method of patient support is becoming even safer.

Early detection of compromised nutritional status can avoid or alleviate the effects of undernourishment, ensure a faster and quality postoperative recovery ensured, reduce the duration of hospital stay and improve the patient's quality of life.

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