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The role of nutritional treatment in postsurgical convalescence process

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Abstract

The article discusses the importance of adequate nutrition for patients suffering from serious illnesses, such as those requiring surgery. Despite medical advances, malnutrition remains a challenge for practitioners. The authors described the importance of nutritional support for patients in critical care, short bowel syndrome and after bariatric surgery. The text highlights the difficulties and challenges of nutritional treatment, such as malnutrition, overweight, and the need to adapt nutritional practices to the latest guidelines and research. The article also emphasizes the importance of educating patients about the benefits of nutritional treatment and the need for access to dietary counseling at every stage of the disease. The role of artificial intelligence in nutritional treatment and the need for further research and innovation in this area are also addressed. The paper describes the different methods of nutrition - enteral and parenteral, their advantages and risks, and notes the need for an individualized approach to each patient, taking into account their condition, age, gender, height and weight. Ultimately, the article emphasizes the importance of access to health care and education to increase the effectiveness of nutrition treatment.

Keywords: nutritional treatment; enteral nutrition; parenteral nutrition; cachexia; surgery

Introduction

Patients affected by serious diseases – such as major illnesses requiring surgery – need proper nutrition to recover. Despite the fact of significant medicine progress and enhanced ways of treating critical illnesses, malnutrition remains a challenge for practitioners [1,2]. Malnutrition is a state of imbalance between requirement and intake of nutrients. It leads to weight loss, muscle weakness, immune impairment, decrease in protein concentration and aggravated oxygen use. As an outcome we can observe deterioration of wound healing and more often complication occurrence. Higher comorbidity in older patients does not make the whole process easier. Data shows that a combination of standard care and nutritional treatment gives better results than standard care alone [3]. Unfortunately, malnutrition still remains underdiagnosed and undertreated in hospitals [4]. Every patient, especially older and after surgery, submitted to the hospital ward, should be assessed with nutritional status. Nutritional Risk Screening 2002 (NRS) and Subjective Global Assessment (SGA) are commonly used scales which help to evaluate nutritional status [5,6]. It is crucial to start enteral nutrition as soon as possible – it reduces morbidity, shortens length of hospital stay and reduces costs. If it is contraindicated, parenteral nutrition has to be considered. Proper nutrition at home after hospital discharge is also important [1].

Nutritional management

According to the patient's state, age, sex, height and weight proper nutritional plan should be implied. The European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines recommend the use of the Nutrition Risk Screening 2002 (NRS) tool, along with subjective global assessment, and serum albumin <30 g/L in their evaluation of undernutrition [7,8]

Impaired Nutritional Status		Severity of Disease (Stress Metabolism)	
Absent score 0	Normal nutritional status	Absent score 0	Normal nutritional requirements
Mild score 1	Weight loss 45% in 3 months or Food intake below 50–75% of normal requirement in preceding week	Mild score 1	Hip fracture; chronic patients, in particular with acute complications: cirrhosis; COPD; chronic hemodialysis, diabetes, oncology
Moderate score 2	Weight loss 45% in 2 months or BMI 18.5–20.5 + impaired general condition or Food intake 25–50% of normal requirement in preceding week	Moderate score 2	Major abdominal surgery; stroke; severe pneumonia, hematologic malignancy
Severe score 3	Weight loss >5% in 1 month >15% in 3 months or Body Mass Index of 18.5 + impaired general condition or Food intake 0–25% of normal requirement in preceding week	Severe score 3	Head injury; bone marrow transplantation; intensive care patients (APACHE 10)

Table 1. Nutritional Risk Screening 2002 [8].

After evaluation of a patient's condition, practitioners should choose a way of nutrition – parenteral or enteral. Both have benefits and risks.

Parenteral nutrition is a liquid nutrition which is delivered to the patient's bloodstream, it avoids the gastrointestinal system. Food complements may be administered by central catheter inserted into a big vein (used for long-term nutrition; provides all essential nutrients) or by peripheral catheter inserted into small vein on arm (for temporary nutrition; does not provide all needed carbohydrates). This way of nutrition is dedicated to patients with extreme malnutrition or having contraindications to be fed orally. Because of the administration directly to the veins, parenteral nutrition rapidly supplements nutrients to all the cells and improves nitrogen balance and functioning immune system which contributes to better wounds healing. Side effects of parenteral nutrition include phlebitis or in case of overfeeding – hyperglycemia, hypercapnia, hypertriglyceridemia or hepatic steatosis [7,9].

Another way of nutrition is enteral nutrition which is preferable if possible. It reduces the incidence of postoperative infections and complications. Enteral feeding is performed as tube feeding (tube inserted into the stomach or small intestine). It contributes to preventing surgical complications such as anastomotic stenosis or leak, delayed gastric emptying or recurrent nerve palsy. It also reduces the length of hospital stay and it is much cheaper than parenteral nutrition.

Contraindications include intestinal obstructions or ischaemia, malabsorption or fulminant sepsis. Most important complications are aspiration, tube malposition, tube obstruction, tube clogging, hypo- or hyperglycemia, electrolyte imbalance or malabsorption [7].

Difficulties and Challenges in Nutritional Treatment of Patients

Both malnutrition and excessive body weight can have serious consequences for patients' health. Nutritional treatment is key to improving their health status, but it is not without difficulties.

Addressing malnutrition and improving nutritional outcomes in hospital settings requires tailored nutritional care plans. A systematic review focusing on individualized nutritional care plans for elderly patients showed that such interventions can significantly improve nutritional status. The review included nine randomized controlled trials, most of which were conducted in Scandinavian countries, and highlighted that individualized care plans, combined with home follow-up visits, are effective strategies for improving patient outcomes.

However, the results also showed inconsistency across different studies, suggesting that while individualized plans are beneficial, their effectiveness may vary depending on many factors, including patients' demographic data, specifics of the intervention, and conditions under which care is provided. This variability underscores the need for ongoing research and adaptation of nutritional care strategies to effectively meet the diverse needs of patients [10].

The process of implementing dietary modifications poses several challenges, especially when considering the patient's response to these changes. A comprehensive review highlighted that patients often encounter significant difficulties when trying to adapt to new dietary guidelines, especially those that require significant changes from previous dietary habits. These challenges are compounded by factors such as personal preferences, cultural dietary norms, and the presence of chronic diseases, which may limit certain types of food [11].

Challenges related to dietary modification also need to consider differences in relation to behavioral change. Younger patients, those under 70 years of age, show greater readiness to plan changes in their dietary behavior compared to older patients. This suggests the need for an age-adjusted approach in dietary counseling [12].

In many facilities, effective nutritional treatment is hindered by the lack of basic tools, such as functional anthropometric equipment, crucial for monitoring growth and nutritional status. Moreover, heavy workloads in healthcare facilities lead to inadequate implementation of growth monitoring, further impairing the delivery of nutritional care [13].

The complexity of implementing effective nutritional treatment is further deepened by structural and educational barriers. There is a critical need to increase nutritional education in the healthcare system to better equip professionals to address these issues. There are opportunities for improvement through more focused nutrition training for healthcare providers and more comprehensive integration of nutrition into medical education. In addition, structural interventions aimed at increasing access to healthcare can significantly enhance the effectiveness of nutritional treatment, helping to overcome problems related to food insecurity and broader social determinants of health [14].

The effectiveness of nutritional education also depends on the specifics and motivation of the target population. For example, interventions tailored to the needs of specific groups, such as Health Action Process Approach (HAPA) based interventions for malnourished pregnant mothers, showed improvement in nutritional knowledge and attitudes. However, they did not significantly change critical pregnancy outcomes, suggesting that while education can improve knowledge, its impact on more complex health outcomes may be limited. This highlights the importance of designing educational programs that are not only informative but also contextually relevant to the specific health and nutritional needs of the target recipients [15].

Critically ill patients, who are in intensive care units (ICUs), are the group most at risk of the consequences of malnutrition and improper nutrition. Critical illness, regardless of the initial disease, is characterized by severe, cytokine-mediated inflammation and catabolism.

In patients, hypermetabolism is observed (with a particular intensification of catabolic changes) associated with an increase in resting energy expenditure and nitrogen losses. Severe protein-calorie malnutrition often occurs in ICUs and is associated with an increased frequency of infections, wound healing disorders, prolonged length of stay in the unit, and increased mortality.

Nutritional support in the form of introducing enteral or parenteral nutrition to patients who do not tolerate adequate oral nutrition seems to be an appropriate measure to improve organ function, maintain lean body mass, and mitigate oxidative tissue damage.

However, the concepts of nutritional treatment (clinical nutrition) have undergone significant changes over the years. The recommended supply of nutrients, the preferred route of nutrition, or the way of monitoring nutritional therapy have often changed.

All of this poses a challenge for medical staff who must adapt to these changes and provide patients with appropriate nutritional support. This requires ongoing training and education, as well as adapting nutritional practices to the latest guidelines and research in this field [16].

Parenteral nutritional treatment is a key element of care for patients who cannot be adequately nourished enterally. An important element in planning therapy using parenteral nutrition is the place and route of administration of nutrients into the bloodstream. Choosing the right place and route of administration can be a challenge, especially for patients with specific health conditions.

The places of administration can be vascular accesses, such as: peripheral veins, central veins or middle veins, while the routes of administration include: continuous infusion, intermittent infusion, cyclic infusion or bolus infusion.

Choosing the place and route of administration of nutrients into the bloodstream is associated with the risk of complications, such as infections, thrombosis, vascular damage, allergic reactions, as well as metabolic complications related to rapid changes in the concentration of nutrients in the blood. This choice must also take into account the individual needs of the patient, such as health status, type of disease, age, nutritional status, tolerance to different methods of delivering nutrients, as well as patient preferences and comfort, and requires appropriate resources and skills of medical staff. The ability to properly place a catheter, monitor the patient's condition, manage potential complications, and adjust the nutritional plan to the changing needs of the patient is necessary.

All these challenges require further research and innovation to improve the effectiveness of parenteral nutritional treatment and outcomes for patients [17].

Nutritional therapy in examples

Nutritional therapy is a therapeutic approach that utilizes diet and nutrients to improve health and treat various conditions. Nutritional therapy can be used as a standalone therapy or as a

complement to other treatment methods such as pharmacotherapy or physical therapy. Individual nutritional needs are taken into account to provide optimal support for the patient's health. Particularly important is the appropriately tailored nutritional therapy for cancer patients after surgical procedures, patients with impaired absorption from the gastrointestinal tract, gastrointestinal diseases, obesity, and many others.

Bariatric surgery

Nutritional treatment for patients after bariatric surgery aims to provide the necessary nutrients while limiting food intake, and also to support weight loss and maintain a healthy lifestyle. Here are the general principles of nutritional treatment after different types of bariatric procedures:

Gastric Bypass (Roux-en-Y):

- Phase 1 (first few days): After surgery, the patient goes through a transitional period consuming only fluids to prevent dehydration and irritation of the intestines.
- Phase 2 (1-2 weeks post-surgery): Gradual introduction of soft and semi-liquid foods, such as plain yogurt, pureed soups, and low-fat porridge.
- Phase 3 (2-4 weeks post-surgery): Gradual introduction of solid foods with low fat content and easily digestible proteins, such as cooked vegetables, soft fruits, lean meats, fish, and tofu.
- Phase 4 (4-6 weeks post-surgery): Gradual introduction of a variety of foods, increasing the number of meals consumed, but in small portions.

Sleeve Gastrectomy:

After this surgery, patients also go through a transitional period consuming only fluids, and then gradually introducing soft and easily digestible foods.

A key element of the diet is avoiding high-calorie and high-fat foods to support weight loss.

Prioritizing protein intake is recommended to ensure an adequate amount of this nutrient and prevent muscle loss.

Adjustable Gastric Banding (Lap-Band):

After this surgery, the diet is gradually expanded, starting from fluids and progressing to soft foods, and then solid foods.

A key element of nutritional treatment is consuming small portions and avoiding processed foods and high-calorie products.

Regular consumption of protein, fruits, vegetables, and healthy fats is crucial to ensure an adequate intake of nutrients.

All of these principles are individualized for each patient, taking into account their health status, dietary preferences, and response to postoperative management. All patients undergoing bariatric surgery should regularly meet with a clinical dietitian to receive support, monitoring, and adjustments to their diet based on their individual needs and progress in treatment [18, 19, 20].

Short Bowel Syndrome

Short Bowel Syndrome (SBS) is a condition in which a patient has a reduced amount of functional small intestine, leading to impaired absorption of nutrients and fluids from food. This condition can result from various factors, such as surgical removal of part of the small intestine due to injuries, diseases, or the necessity of treating intestinal diseases like Crohn's disease or tumors. The essence of the problem is that the small intestine is the primary site of absorption of nutrients such as vitamins, minerals, carbohydrates, fats, proteins, and water. When its surface area is significantly reduced or damaged, the body struggles to absorb an adequate amount of nutrients, leading to malnutrition, weight loss, vitamin and mineral deficiencies, as well as electrolyte disturbances [21].

Nutritional treatment in short bowel syndrome focuses on providing the patient with the right amount of nutrients, hydrating the body and improving quality of life.

Patients receive a diet with increased caloric and nutrient content to compensate for the loss of the ability to absorb food. People with SBS may need vitamin and mineral supplementation to prevent deficiencies, due to their limited ability to absorb nutrients. The use of specialized nutritional supplements containing easily absorbed forms of nutrients such as protein, carbohydrates, fats, vitamins and minerals may be necessary.

If a patient requires long-term administration of nutritional preparations intravenously, he or she is properly trained to do so. Parenteral nutrition at home (HPN) provides an opportunity to reduce hospitalizations [22].

Oncology surgeries

People who have undergone surgery to remove cancers from areas of the gastrointestinal tract, such as the colon, stomach or pancreas, may require a special diet to promote healing, provide adequate nutrients and prevent malnutrition [23].

Cancer cachexia is a complex syndrome characterized by loss of skeletal muscle mass that is difficult to reverse with standard nutritional support, leading to progressive deterioration of body function. Its pathophysiological mechanisms include unfavorable protein and energy balance, resulting from various factors such as reduced food intake and metabolic disorders [24].

Cancer patients should be screened for cachexia. One of the simplest ways is to regularly measure BMI (Body Mass Index), which we calculate from the formula - body weight/length^2 [25].

Nutritional interventions can be effective, at least in part, and can improve treatment outcomes for some forms of cancer, such as head and neck cancer, and for therapies, such as chemoradiotherapy, that often lead to reduced food intake without significant metabolic disturbances [26].

During enteral nutrition, it is important that the diet be rich in energy. This is achieved by increasing the fat content. Many dietary recommendations for patients with cancer-induced malnutrition focus on increasing the energy density of the diet, and most commercially available products are advertised and chosen for their high caloric content [25].

With all forms of malnutrition, there is a risk of micronutrient deficiency, especially water-soluble vitamins [27]. According to recommendations based on a review of the work of Ströhle et al. and the positions of the American Cancer Society, the use of multivitamin and micronutrient supplements in doses close to the recommended daily intake is beneficial and safe for cancer patients, including those undergoing chemotherapy and radiation therapy [25].

Similarly, for parenteral nutrition, vitamins and trace elements should usually be supplemented unless there are any contraindications. After parenteral nutrition lasting longer than 1 week, supplementation of vitamins and trace elements is necessary. In general, supplementation of trace elements in parenteral nutrition can prevent a decrease in their plasma levels [28].

Future directions

Despite the advancement of knowledge and the availability of numerous publications and scientific research, intensive education about the benefits of nutritional treatment in patients remains essential. Dietary counseling should be accessible to every patient at every stage of the disease.

Immuno-nutrition

The concept of immuno-nutrition has emerged in recent years, especially among oncology patients. It utilizes specific nutrients such as glutamine, arginine, omega-3 fatty acids, nucleotides, and antioxidants. Its aim is to improve cellular immunity, limit local and systemic inflammatory reactions, and enhance the immune activity of the mucosal-associated lymphoid tissue (MALT) system.

According to reports, immuno-nutrition in the perioperative period in gastroenterological surgery reduces the risk of infectious complications by 50% [29]. The application of this nutritional approach in the perioperative period leads to a reduction in inflammatory markers and postoperative infectious complications. Additionally, in abdominal surgery, such nutrition allows for a shorter hospital stay [30].

Artificial Intelligence

The use of artificial intelligence in nutritional treatment is currently being proposed in the study of the interaction between nutrients and gut microbiota. This is important for developing more effective probiotics and their new combinations [31]. Furthermore, artificial intelligence can be used to develop individualized dietary plans. This will allow for the creation of more personalized diets that take into account individual differences such as metabolism or genetic factors among patients [32].

Currently, the work on utilizing artificial intelligence in nutritional treatment remains at the research stage. However, there is a necessity to start introducing their availability for both individuals and populations [33].

Summary

Nutrition plays a critical role in the treatment of patients with serious illnesses, particularly those undergoing surgery. Despite medical advancements, malnutrition persists as a challenge in healthcare. It is important to educate patients about the benefits of nutritional treatment and the necessity of access to dietary counseling throughout the disease process.

There are different methods of nutrition, such as enteral and parenteral, which can be individualized based on patient characteristics. Beside the challenges in nutritional treatment include dietary modifications, behavioral changes, and the lack of essential tools in healthcare facilities this part of patient therapy should be given special attention.

It is possible in the future to use artificial intelligence in nutritional treatment and it needs further research and innovation in this field.

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