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NUTRITION IN GASTROINTESTINAL SURGICAL PATIENTS

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Abstract

Despite important advances in surgical care and minimized surgical trauma, postoperative complications are still of great concern. Nutritional depletion has been demonstrated to be a major determinant in the development of postoperative complications. Nutritional status of gastrointestinal surgical patients is an important issue, which need to be attended in particularly during the perioperative period.

Fears of postoperative ileus and the integrity of the newly constructed anastomosis have led to the adoption of starvation with administration of intravenous fluids until the return of normal bowel sounds and passage of flatus. However, it has been shown that early postoperative enteral feeding is both beneficial and well-tolerated.

Meta-analysis has shown that enteral feeding compared with parenteral nutrition is associated with fewer complications, reduced costs and a shorter hospital stay. Therefore it should be the preferred option whenever possible.

Evidence to support preoperative nutrition is limited, but malnourished individuals fed for 7-10 days preoperatively may have improved surgical outcome.

Prolong preoperative starvation is not essential, and the administration of preoperative carbohydrates is safe without the fear of increasing the risk of aspiration.

Initially nutritional support was aimed at meeting the energy needs and providing proteins and other essential micronutrients, while now it is more directed at modulation of the immune functions, the so called immunonutrition.

Multimodal strategies including minimal invasive surgery, adequate postoperative analgesia, nutritional care, and enforced mobilization resulted in reduction in postoperative complications and length of hospital stay.

Introduction

Protein-energy malnutrition is a common problem in hospital patients. The majority of patients experienced nutritional depletion during the course of their hospital admission, which was more severe in those patients who were already depleted at the time of their admission[1]. Gastrointestinal patients, especially with underlying malignancy, are at high risk of developing malnutrition, and surgical stress can also accentuate this catabolic problem[2].

Nutritional depletion is associated with changes in body composition, tissue wasting and impaired organ function, which leads to impaired immune and muscle function. Thus these patients are vulnerable to complications.

The absence of a standardized definition of nutritional depletion has led to the utilization of markers of nutritional status. Serum albumin, muscle function tests, immunological status and weight loss are used as indicators because they show a correlation with postoperative morbidity and mortality[1].

In recent years, several traditionally accepted 'rules' and 'truths' regarding perioperative nutritional cares have been challenged. Ensuring adequate nutritional intake has been a major focus of perioperative care and research has

focused on the methods of delivering nutritional support, their comparative clinical benefits and minimizing the metabolic changes associated with surgical trauma.

Metabolic Changes in Surgical Patients

The physiological stress of surgical trauma causes a transient surge of sympathetic activity and an associated rise in catecholamine secretion. This is followed by a more prolonged hypermetabolic state associated with negative nitrogen balance. If nutritional support is inadequate then skeletal muscle proteolysis and wasting occurs. In addition, a range of hormonal responses develops. Cytokines, including Tumour Necrosis Factor (TNF) and interleukins (IL-1 and IL-6) have an important role in determining longer-term metabolic changes[3]. These changes may not be clinically relevant unless complications develop.

Physiological Changes in Surgical Patients

In the immediate postoperative period, there are two to fourfold increase in the small intestinal permeability, which returns to normal within five days[4]. Nutritional depletion is associated with increased small intestinal permeability and a decrease in villous height[5]. This in turn indicates a failure of the gut barrier function to exclude endogenous bacteria and toxins. Although these have been proposed to be a cause in the systemic inflammatory response syndrome, sepsis and multiorgan failure, no proof of a correlation with septic complications after major upper gastrointestinal failure has been proven[6].

Early Postoperative Enteral Nutrition

The traditional postoperative management of patients after gastrointestinal surgery involved a period of 'nil by mouth' and nasogastric decompression in order to prevent postoperative nausea and vomiting and to protect a newly constructed anastomosis. The fasting period continued until resolution of postoperative ileus, indicated by the return of bowel sounds and passage of flatus. However, this type of management is not supported by scientific evidence[7,8]. On the contrary, experimental and clinical studies have demonstrated that early postoperative feeding increases strength and healing of an anastomosis[8]. In addition, meta-analysis of 26 trials, including approximately 4,000 patients didn't support the routine use of nasogastric decompression in the postoperative period[9]. Small intestinal motility recovers 6-8 hours after surgical trauma and moderate absorptive capacity exists even in the absence of normal peristalsis[10]. It has since been shown that postoperative enteral feeding in patients undergoing gastrointestinal resection is safe and well tolerated even when started within 12 hours of surgery[11]. There are reported data indicating that early nutrition after surgery prevents an increase in gut mucosal permeability, produces a positive nitrogen balance, improves total calorie intake, and reduces infectious complications[12].

Gastrointestinal adverse effects related to early feeding are abdominal cramps, bloating, diarrhoea, vomiting, delayed gastric emptying and aspiration[11]. An appropriate delivery method should be selected, depending on the anticipated duration of enteral feeding, aspiration risk and gastrointestinal anatomy.

In general, bowel sounds are either present or absent. When we hear bowel sounds we must differentiate between normal or abnormal sounds. The latter could be sluggish, very frequent, or have fine or coarse pitch. They are sluggish when they are just recovering after a period of ileus. Very frequent bowel sounds develop in patients with hyperactive bowel such as in diarrhoea, while fine or coarse pitch develop in bowel obstruction due to passive movements of the distended bowel loops

with air and fluid. The character of the normal bowel sounds must be learned by listening first to the abdomen of normal people. The most common cause of absent bowel sounds is paralytic ileus.

Parenteral Nutrition

A large multi-centre clinical trial has shown no significant reduction in morbidity or mortality when Total Parenteral Nutrition (TPN) was administered perioperatively to a heterogeneous group of surgical patients[13].

Evidence to support preoperative parenteral nutrition is limited. But subsequent studies on severely malnourished patients with gastrointestinal malignancy, who received nutrition parenterally for at least 7-10 days preoperatively has shown clinically significant reduction in both infectious and non-infectious complications, and surgical outcome can be improved[13,14]. However, unless the parenteral nutrition can be delivered at home through a well-organized protocol, the extended in-hospital period is obviously impractical due to the longer hospital stay and costs, and the possibility of inviting several complications as a result of that.

Enteral versus Parenteral Nutrition

Each route of delivery of nutritional support is associated with different complications. Generally, parenteral nutrition carry greater morbidity than those associated with enteral nutrition due to the invasive nature of administration. In addition, enteral feeding may prevent gastrointestinal mucosal atrophy, attenuate the trauma stress response, maintain immunocompetence and preserve normal gut flora[15]. It is therefore concluded that the enteral route should be used whenever possible, but if this route will not be available for more than one week then early administration of TPN should be considered.

Dietary Supplements Oral dietary supplements such as (Fortisip®), providing 1.5 kcal, 0.05 g protein and 0.18 g carbohydrate per milliliter, have been studied in patients subjected to gastrointestinal surgery[16]. These authors studied 152 patients undergoing lower gastrointestinal tract surgery, and randomized them into four groups; those patients with no nutritional supplements, or received perioperative supplements, only postoperative supplements, and only preoperative supplements. They concluded that perioperative oral nutritional supplementation significantly decreased weight loss and postoperative morbidity regardless of body mass index[16]. The beneficial effects were not restricted to malnourished patients alone[16]. However, the routine use of perioperative oral dietary supplementation in well-nourished patients was not found to be of any additional value[17].

Preoperative Oral Carbohydrate Loading

The traditional routine long preoperative fasting prior to surgery has been challenged. The general rationale of preoperative fasting has been to prevent the risk of aspiration of gastric contents during the induction of general anaesthesia. However, convincing evidence has emerged that the administration of peroral fluids has not increased the risk of aspiration[18].

The significance of insulin resistance mechanism occurring during the postoperative period has been described and should be considered[19]. Carbohydrate-rich beverages have been found to be as safe as clear fluids even when administered shortly before elective surgery, and also found to reduce the postoperative insulin resistance[20]. In addition it have a beneficial effects by reducing preoperative patient discomfort, presservation of skeletal muscle mass and strength, and possibly minimizing postoperative nausea and vomiting[21].

Immunonutrition The field of nutrition

support therapy has undergone a transformation since its conception. Originally, artificial feeding was recommended as a means of providing energy, protein, and essential micronutrients to offset muscle wasting and prevent starvation-induced immune depletion. Subsequently, various dietary components have been used in an attempt to modulate the immune function. The concept of immunonutrition is based on the ability of nutrients to influence the activities of cells of the immune system. The notion is that nutrients can improve cell-mediated immune responses in a way that it is clinically meaningful, but in the context of patients requiring artificial nutrition this concept is extended to include modification of hyper-inflammatory processes (including oxidative stress) and improvement in gut barrier function, and therefore preventing bacterial translocation.

Among the nutrients with a suggested positive effect on immune functions, glutamine, arginine, fatty acids, and nucleotides have been studied extensively[22]. The two nutrients supplement products that have been used and studied most are IMPACT, which contains arginine, fatty acids, and nucleotides, and IMMUNE-AID, which contains glutamine in addition[23].

Glutamine is essential for protein and nucleotide synthesis. Increased metabolic demands of inflammation or injury lead to glutamine consumption, which is associated with progressive changes in intestinal morphology[2]. Glutamine supplementation administered enterally can reverse the intestinal atrophy and prevent bacterial translocation[24]. Furthermore, glutamine seems to have effects on immune function and may decrease the inflammatory response and infectious complications[25].

Arginine is considered as a semi-essential amino acid, acting as an immunomodulator with favourable effects in catabolic conditions such as severe sepsis and postoperative stress[26]. The role of postoperative arginine supplementation on immune, metabolic and endocrine parameters was studied in a randomized clinical trial in patients undergoing gastrointestinal cancer surgery. Faster recovery of immunologic parameters was seen during the postoperative period in the arginine group as compared to glycine-treated patients[27]. Arginine supplementation has also been reported to improve wound healing and improve phagocytic ability and respiratory burst of polymorphonuclear monocytes, most likely due to increased levels of nitric oxide[28].

ω-3 Fatty Acids, replace arachidonic acid in cell membranes and modulate immune function[29]. They alter the formation of prostaglandin E2 to prostaglandin E3, which has less immunosuppressive effect[30]. The use of these fatty acids has been reported to decrease the total number of gastrointestinal and infectious complications and improve postoperative liver and kidney function through modulation of tissue prostaglandin levels[31].

Nucleotides are the precursors of RNA and DNA and are believed to enhance protein synthesis and T-cell functions[32]. The value of supplemental nucleotides has been less studied but seems to be essential for cell-mediated immunity and helper / inducer T-lymphocyte function[24].

Although the composition of nutrition therapy can influence host defense, the published literature is divided on the effectiveness of manipulating nutrition support formulas to achieve hard clinical endpoints[23]. McCowen et al conducted an extensive review about immunonutrition[23]. They stated that unfortunately, the published literature examining the effectiveness of immunonutrition is beset with controversy and conflicting results. One of these problems is the use of various

nutritional formulas by various research groups, making comparison difficult. Another matter, which was noted from publications coming from the same research group that these reports seems to be composed of subpopulation of either their total original patients' population or a reanalysis process with additional patients. This unfortunately could affect careful evaluation of outcome. Attempts to resolve the matter through meta-analysis have not been definite due to somewhat different conclusions[33-35]. However despite that impression, these meta-analysis studies showed that there were universal finding among all reviewed studies, of a shorter hospital stay, and an overall reduction in numbers of infectious complications, and mortality in patients received immunonutrition.

In addition, the importance of the duration, quantity, and timing of immunonutrition is also emphasized in several studies, and there was a trend that the total number of complications was shown to be reduced by immunonutrition, when they were used properly.

McCowen et al[23], summarized their conclusions as follows: The available data suggest that immunonutrition should be considered in the following patients: (1) patients undergoing abdominal surgery for cancer, especially malnourished patients (both preoperatively and postoperatively); (2) ICU patients with APACHE scores of 10-20 but not higher; and (3) patients with multiple trauma. Practical strategies to maximize the success of these nutritional formulas are as follows: (1) arginine should be >12 g/L; (2) duration should be > 3 days, preferably 5-10 days; (3) nasogastric feeding should be used aggressively, with nursing protocols to advance feeding every 4-6 hours, and gastric residuals of around 200 mL should be accepted; and (4) feeding goals should approach 25 kcal/kg, and ≥800 mL/day should be given for optimum outcome.

Multimodal Perioperative Management

Fast-track surgery has been developed and gained increasing popularity and used with benefits for both patients and healthcare providers[38].

Multimodal strategies of perioperative management and rehabilitation, also called enhanced recovery protocols or accelerated recovery programs, have resulted in reduction of morbidity and length of hospital stay as a result of reducing the postoperative stress and enhance recovery[39,40]. These programs include besides other elements of fast track surgery, proper general anaesthesia, effective control of postoperative pain, thereby allowing early mobilization, and enforcement of an early oral feeding. In addition, preoperative patient's education about perioperative care has been shown to be an important determinant of various aspects of patient's outcome and satisfaction[41]. In order to achieve a successful programs, there should a well-planned protocol, which is acceptable by all involved parties, enough personnel to conduct this protocol, patient education during both the preoperative and postoperative periods, and implementation of all other elements of the fast track surgery. Successful programs were found to improve pain relief, reduced hormonal and metabolic stress, enhanced normalization of the gastrointestinal function, and improved postoperative vigilance and mobilization[42]. Therefore, nutritional management plays a great role in the fast track surgery and these programs.

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