

The rationale of early enteral nutrition

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Abstract. Malnutrition is a well-known risk factor significantly influencing the occurrence of postoperative infectious complications. There is consensus that nutritional support is an essential component of the multidisciplinary treatment of surgical and critically ill patients. Nutritional support of surgical patients can be carried out with different modalities, depending on the underlying disease and on the patient's general condition. Several studies have shown that the early administration of enteral nutrition promotes the restoration of gastrointestinal mucosa integrity; with total parenteral nutrition such beneficial effect is not observed. The timing of feeding also influences the clinical outcome. During the last few years, standard enteral preparations have been modified by the addition of immunonutrients, such as arginine, glutamine, omega-3 fatty acids, nucleotides and others. These substrates have been shown to up-regulate host immune responses, to control inflammatory responses and to improve nitrogen balance and protein synthesis after injury. A recent study reported that in patients with cancer of the gastro-intestinal tract the nutritional supplementation given only preoperatively was as effective as the combined pre- and postoperative (perioperative) approach, and it could reduce gastro-intestinal side effects. This is probably due to the effect of the immune-enhancing diet on the immune and inflammatory responses.

Key words: Artificial nutrition, enteral nutrition, malnutrition, immunonutrients

Postoperative infections continue to cause morbidity and mortality, prolonging hospital stay and increasing health care costs. Malnutrition is a well-known risk factor for the occurrence of postoperative infectious complications. The mortality rate of patients who involuntarily lost more than 10% of their body weight prior to surgery is higher than that of patients that did not lose weight.

Furthermore, surgical and accidental trauma is well known to cause a transient suppression of the immune system, that increases the infection risk. There is consensus that nutritional support is an essential component of the multidisciplinary treatment of surgical and critically ill patients, especially when the illness is associated with prolonged catabolism and with the inability to use the GI tract. Such circumstances occur frequently in severely septic surgical patients; ar-

tificial nutrition can optimise their recovery by supplying vital energy and nitrogen substrates, along with vitamins and oligoelements (1).

In the second half of the last century several studies underscored the importance of feeding surgical patients adequately, to reduce the severity and duration of the catabolic phase, thus decreasing the postoperative infection risk (2, 3). Postoperative nutritional support benefits the high risk surgical patients, by decreasing surgical morbidity, maintaining immunocompetence and improving wound healing (4). Scrimshaw et al in 1959 (5) demonstrated the interaction of nutrition, immune response and infection. The deficiencies of almost all nutrients may influence negatively host defences (3); conversely, many nutrients have the ability to enhance the immune defence.

Nutritional support of the surgical patients can be carried out with different modalities, depending on the underlying disease and on the patient's general condition. There are four main modalities of artificial nutrition: oral supplementation of nutrients; enteral nutrition (EN); total parenteral nutrition (TPN); mixed parenteral and enteral nutrition. Compared to parenteral nutrition, the EN provides nutrients in a more physiologic manner.

Additionally, EN when compared with current TPN solutions prevents gastro-intestinal mucosa atrophy, attenuates the injury stress response and preserves normal gut flora (6). Several studies have shown that the early administration of EN promotes the restoration of GI mucosa integrity in nutritionally depleted patients; such benefit is not observed with TPN, because with TPN the mucosa continues to present increased permeability, in spite of improved general nutritional status (7). The EN has a specific trophic effect on the GI tract; such effect is potentially valuable in preventing microbial translocation from the gut to the blood stream and subsequent gut-derived infection (8). Early enteral feeding is well tolerated and it reduces significantly the rate of postoperative complications (6). As a consequence, there is now consensus that critically ill patients are candidates to enteral feeding if they have a functioning GI tract.

The timing of feeding, as related to surgery, also influences the clinical outcome. The earlier the patient is fed enterally, the better is the clinical outcome.

The EN usually can begin postoperatively as soon as the patient is haemodynamically stable. Preferably it should start within 24 hours after surgery, and no later than 48 hours (9, 10). As long as there is no significant abdominal distension, enteral feeding is not contraindicated, even with markedly diminished bowel sounds. Most patients can be fed enterally without waiting for flatus.

Immediate or early postoperative EN stimulates the splanchnic and hepatic circulation; it improves intestinal mucosa blood flow, it prevents intramucosal acidosis and permeability disturbances and it eliminates the need for stress ulcer prophylaxis (11).

The potential complications of enteral and parenteral nutrition are described in table 1 and 2.

Table 1. Complications of enteral nutrition

Gastro-intestinal complications

- Diarrhoea
- Gastric bloating and abdominal distension
- Abdominal pain
- Nausea and vomiting
- Regurgitation – inhalation pneumonia

Mechanical complications

- Misplacement of feeding tube
- Occlusion of feeding tube
- Inflammation, bleeding, perforation of nose, pharynx, oesophagus, stomach

Metabolic complications

- Hyperglycaemia
 - Electrolyte alterations
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Table 2. Complications of parenteral nutrition

Complications related to the venous catheter placement technique

- Pneumothorax
- Misplaced catheter
- Subclavian artery injection / trauma
- Haemothorax
- Venous embolism
- Venous thrombosis

Complications related to catheter maintenance

- Occlusion
- Sepsis
- Intravascular knotting

Metabolic complications

- Hyperglycaemia
 - Hypoglycaemia
 - Electrolyte alterations
 - Adverse reactions hypersensitivity (amino acids, fats, etc.)
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Studies of postoperative feeding with a high-nitrogen diet formula were prompted by Alexander's demonstration that high amounts of nitrogen in enteral feeding formulas of children with severe burn injuries improve survival (12). Those studies, underscoring the important role of nutrition in post-injury patients, demonstrated that enteral diet formulas can be customized to improve outcome.

Two influential trials were conducted at Denver General Hospital during the 1980s in severely injured patients. Moore EE et al. (13) demonstrated the advantage of early enteral feeding in post-trauma pa-

tients. They showed that after major abdominal trauma early EN performed through a needle catheter jejunostomy significantly decreased the rate of septic complication (9% vs 29%), compared with the conventional practice of withholding nutritional support for several days after trauma. In the early feeding group the length of hospital stay and the costs of treatment were also lower as compared to the delayed feeding group.

Another study of Moore FA et al in severely injured trauma patients demonstrated that EN is well tolerated and that early EN reduces septic complications as compared to TPN (14).

DeLegge indicated that the rationale for early postoperative enteral feeding stems from the observation of earlier tolerance of the oral diet, of fewer major infections, of fewer metabolic complications vs TPN, and of shorter hospital stay and lower cost (10). The GI tract can be used in most patients, including those with recent GI anastomoses. The only absolute contraindication to enteral feeding is mechanical obstruction.

Given the commonly observed phenomenon of infection as a precipitating factor of multiple organ failure (MOF), early enteral feeding may also lower the risk of MOF. The theory that appropriate nutritional support might be able to prevent the process of MOF is biologically plausible, since response to injury is hallmarked by hyperdynamic metabolic processes involving the reordering of substrate priorities, by increased energy demands and by clinical malnutrition. The benefits of early enteral feeding are contributed by the trophic support of gut mucosa as well as by the improved maintenance of gut metabolic and immunologic function during the hypercatabolic phase.

Early enteral immunonutrition

During the last few years, standard enteral preparations have been modified by the addition of immunonutrients, such as arginine, glutamine, omega-3 fatty acids, nucleotides and others (15). These substrates, defined as immunonutrients, have been shown to up-regulate host immune response, to control the inflammatory response and to improve nitrogen balance

and protein synthesis after injury (16-18). The rationale for using these immunonutrients in surgical patients is based on the well-known post injury alterations of host responses influencing morbidity and mortality. Several clinical studies on the effect of immunonutrition in surgical patients have been carried out; the majority of these trials focus on the clinical outcome of GI cancer patients undergoing elective surgery (17, 19, 20).

Gianotti et al (21) reported a significantly improved outcome in patients with GI cancer treated with the administration of a diet supplemented with immunonutrients, as compared to controls who received conventional nutrition. The immunonutrition supplementation given only preoperatively was as effective as the full peri-operative approach, and it reduced GI side effects. Furthermore, in well-nourished patients, the preoperative oral supplementation with a diet enriched with arginine, omega-3 fatty acids and RNA showed similar results as compared to the full course of pre- and postoperative (perioperative) immunonutrition; it also was superior to the control regimen of fluids and electrolytes only (i.e. no nutritional support).

The nutritional compounds defined as immunonutrients have peculiar properties. Arginine improves macrophage and natural killer cell tumour cytotoxicity; it increases leukocyte bactericidal activity and the production of nitric oxide, a relaxing factor that acts as a potent vasodilator promoting wound healing (15). Furthermore, arginine stimulates T-cell proliferation and activation; it modulates nitrogen balance, protein synthesis and cytokine production (22). The omega-3 polyunsaturated fatty acids are potent anti-inflammatory agents, regulating the fluidity of cell membranes, acting in the pathway of coagulation and up-regulating the immune response (23).

Glutamine reduces the skeletal and intestinal protein waste during stress condition; it enhances macrophage and neutrophil phagocytosis and lymphocyte function and it preserves the intestinal permeability and function (24).

Dietary nucleotide restriction has been shown to cause immunodepressive effects, documented by decreased lymphocyte mitogenesis and response to allogeneic antigens; by delay of the hypersensitivity response, and by prolonged allograft survival (22).

Finally, a comprehensive review published by Heyland et al. in 2001 (25) confirmed that immunonutrition may decrease the rate of postoperative infectious complications, by it did not demonstrate a mortality advantage.

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