Nutritional support in gastrointestinal surgery: an overview

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Received: 1 November 2008 / Accepted: 6 November 2008

Abstract Nutritional status is important in determining the outcome of surgical patients. This is particularly so in patients undergoing gastrointestinal (GI) surgical procedures. It is important for the GI surgeon to be always aware that he has to assess the nutritional status of his patient, provide supplementation when required and have the means to get enteral and/or parenteral access when required. He must have the knowledge to choose the right route and formula for nutritional support. This evidence-based review gives an overview of the subject with the purpose of increasing awareness about the science of surgical nutrition.

Keywords Nutritional support · Enteral nutrition · Parenteral nutrition

Introduction

Surgeons have been technical masters for centuries. Well before the advent of anaesthesia and other supportive systems, surgeons have performed major surgical procedures with some success. But, the real success of surgery came about after the support systems like anaesthesia, antibiotics, intensive care and importantly, nutritional support came of age. Nutritional support becomes particularly important in gastrointestinal (GI) surgery because this subset of patients are likely to be malnourished in the preoperative phase and their nutritional state is likely to suffer further as the gut may not be functional in the postoperative period.

This short review addresses, in an evidence-based fashion, the following questions regarding nutritional support in GI surgery.

1. Does nutritional support alter surgical outcomes?
2. Which subset of our patients needs nutritional support?
3. How is nutritional support given?
4. What are the principles governing enteral nutrition?
5. What is intestinal failure? What are the principles of parenteral nutrition?
6. What are the common clinical conditions needing nutritional support in GI surgery?

Does nutritional support alter surgical outcomes?

It seems logical to believe that good nutritional status and support leads to a better reparative process in the body which in turn leads to better surgical outcomes. To prove this scientifically has not been easy. With many confounding variables playing their part in mortality and morbidity following surgery, to prove that nutrition alone was responsible for outcome, is difficult. However, various markers – both laboratory markers and clinical markers – have been employed to measure the outcomes with and without nutritional support (Table 1).

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Table 1 Some of the parameters used to assess the effect of nutritional support on surgical outcome

Laboratory	Clinical
Lymphocyte function	ICU stay
Endotoxin suppression	Hospital stay
Visceral protein	Septic complications
	Mortality

In one of the earlier studies addressing this question [1], 145 patients undergoing major abdominal and thoracic surgical procedures were studied. Fifty patients had preoperative parenteral nutritional support for a week before surgery and the rest had no nutritional support. Complications like septic complications, wound dehiscence, fistulation etc. were measured. The group with nutritional support had significantly fewer complications.

In a review of 13 randomised controlled trials (RCTs) of patients mostly with GI cancers, pooled data suggested that preoperative nutritional support of adequate calories and proteins given for at least 5 days, resulted in a 10% reduction in postoperative complications [2].

Demonstration of decreased mortality has not been uniform in studies addressing the role of nutritional support. However, in one study 468 patients undergoing surgery for stomach and colon cancers, patients were randomised to have nutritional support in the study group with no nutritional intervention in the control group [3]. This study showed not only a significant reduction in morbidity (18.3% Vs 33.5% in controls) but also a reduction in mortality (2.1% Vs 6%).

It is prudent to conclude that providing preoperative nutritional support in the moderately and severely malnourished patients for about a week in the preoperative phase and supporting them nutritionally for a week postoperatively, will result in a reduction in morbidity and may reduce mortality as well.

Who needs nutritional support?

The need for nutritional support for improving operative outcomes is well understood. But, to define the characteristics of patients who need such support and to prove that such policies are effective in controlled trials, has not been easy. Reviews of several such trials have provided mixed results. This can be understood, because, the task of controlling confounding variables, other than nutrition, in surgical outcomes, is demanding.

What is clear is that the concept of 'hyperalimentation', where large amounts of calories were administered in the hope and belief that it would be helpful, has been proved to be harmful [4]. It is wise to be selective in choosing the patients who need nutritional support. Several parameters like anthropometric measurements (weight, weight loss

etc.), laboratory data (albumin, transferrin, prealbumin) and immunological parameters (skin reaction) have been studied to decide the subsets of patients who need nutritional support.

In a landmark study [5], it was demonstrated that only severely malnourished patients benefit from nutritional support. A group of 395 malnourished patients undergoing abdominal and noncardiac thoracic surgical procedures were randomised to receive 7–14 days of preoperative parenteral nutritional support or no support. In the subgroup of patients with moderate malnutrition, the infectious complications were higher in the nutrition support group. Reduction in infectious and non-infectious complications was seen only in the severely malnourished group.

A recent systematic review [6] of papers on preoperative nutritional support in patients undergoing pancreaticoduodenectomies reiterates this fact that not all patients benefit from nutritional support. Support must be selective and the enteral route may be more beneficial than the parenteral route. This issue will be further addressed in the next section.

The consensus view about choosing the patients needing nutritional support is delineated in the European Society of Parenteral and Enteral Nutrition Society guidelines published in 2006 [7].

Nutritional support is indicated in the following situations:

Presence of at least one of the following criteria:

- weight loss > 10–15% within 6 months,
- BMI < 18.5 kg/m²,
- Subjective Global Assessment [8] Grade C,
- serum albumin < 30 g/l (with no evidence of hepatic or renal dysfunction).

Nutritional support is indicated even in patients without obvious undernutrition, if it is anticipated that the patient will be unable to eat for more than 7 days perioperatively.

It is also indicated in patients who cannot maintain oral intake above 60% of recommended intake for more than 10 days.

How is nutritional support given?

Once the decision is made to provide nutritional support, the clinician has to decide the quantity and type of support to be given and the route of administration. The general requirement of nutritional needs is about 30–35 kcals/kg ideal body weight of nonprotein calories and proteins amounting to about 9–10 gm nitrogen/day or 1–1.5 gm/kg/day (about 60 gm of proteins/day) [9]. Energy can be given in the form of glucose and/or fats. The latter generally accounts for about 30% of total calories administered. Glucose calories are cheap to provide. But, the volume of fluid to be given to reach the required calories may be too high for a patient who is critically ill or has cardiovascular

debility. Also, the carbon dioxide produced by metabolism of glucose can increase the work of breathing and may delay weaning of a ventilated patient [10]. Lipids are calorie rich, but are expensive. Lipid administration may also block reticulo-endothelial system, increasing infections [11], and may sometimes interfere with the functioning of laboratory equipment – particularly electrolyte estimation.

Readymade solutions including caloric/protein formulations for various conditions and electrolytes are now available both for enteral and parenteral administration.

Should the nutrition be given through the enteral or the parenteral route?

The enteral route has several advantages:

- Enteral administration is safe and cheap
- It maintains the integrity of the gut and reduces bacterial translocation and hence, reduces septic events [12]
- It is more physiological – the enterohepatic circulation presents the liver with nutrients in the ‘first pass’ and facilitates metabolism [13].

Thus the adage “If the gut is available, use it!”. However, several concepts associated with enteral nutrition have been questioned. Also, there are several situations where the gut is not available for use. In these circumstances, one should not hesitate to institute parenteral nutritional support.

Principles of enteral nutrition

The first requirement for enteral nutrition is access to the gut. The nutritional support may vary from simple oral supplementation to the food the patient is already taking, to complete tube feeding. The access for tube feeding may vary from nasogastric tube to a gastrostomy tube to a jejunostomy. Several of these tube placements can now be done by percutaneous techniques by endoscopists [14–16]. However surgeons must bear in mind the need for a possible nutritional support and must be liberal in inserting a feeding jejunostomy tube at laparotomy when major resections are undertaken.

The safety of enteral nutrition is ensured by following some basic principles in tube placement and maintenance. Detailed guidelines for this are available [17]. In short, the following principles have to be followed.

- Tube placement has to be ensured by clinical and/or radiological means.
- Repeated assessments confirm that the tube is in place.
- Patency of the tube is ensured by regular flushing with aerated and plain water, before and after each feed.
- Feeding is carried out cyclically – and never at nights.
- Drip feeds work better than bolus feeds.

- Minimal residual feed in the stomach is confirmed by aspiration before the next feed is given.

However there are several situations – collectively called ‘Intestinal Failure’ – where enteral nutrition cannot be instituted.

What is intestinal failure?

Intestinal failure [18] refers to a condition where inadequate digestion and/or absorption leads to malnutrition and dehydration. In simple terms, it occurs because of inadequate length or function of the bowel. The common causes are listed in Table 2.

Intestinal failure does not necessarily rule out enteral feeding [14]. But many a time, total parenteral nutrition or parenteral supplementation will be required.

Parenteral nutrition (PN)

When the gut is not available for providing nutrition, the parenteral route is adopted. Thus the main indications for PN are short gut syndrome and failure of enteral nutrition to meet the set goals [19]. PN may be given either through the peripheral veins or through the central veins.

While several formulations are available for peripheral PN, most of them are hypocaloric, because of the need to maintain a reasonable osmolality and limit vein wall irritation [16]. This makes it difficult to meet nutritional goals. Hence, for adequate nutritional support, a central venous catheter is generally needed.

Infraclavicular subclavian vein catheter insertion is the best option for providing PN. In difficult cases, an ultrasound guided cannulation of the subclavian vein has been shown to be useful [20]. Several mechanical, metabolic and infective complications (Table 3) have been reported with PN [21].

However, if care is taken to avoid over feeding and hyperglycaemia and adequate nursing care is provided in maintaining the central venous access, these complications are well within acceptable limits [22].

Table 2 Common causes for intestinal failure

Inadequate function	Inadequate length
Hyperemesis gravidarum	Massive bowel resection
Chronic pseudo-obstruction	Bowel fistulae
HIV infection	Ischaemic bowel
Inflammatory bowel disease	Adhesive obstruction
Radiation enteritis	Congenital defects

Table 3 Complications of parenteral nutrition

Mechanical	Infective	Metabolic
Malposition	Bacteraemia/septicaemia	Hyperglycaemia
Coiling	Endocarditis	Hyperlipidaemia
Catheter embolism	Catheter sepsis	Hypercapnia
Disconnection – air embolism		Electrolyte/acid base disturbance
Venous tear – haemorrhage		Trace element deficiency
Blockage		Hepatic dysfunction

Common clinical GI conditions requiring nutritional support

Severe acute pancreatitis is a disease with a significant metabolic response. Nutritional support is essential in metabolically supporting these patients [23]. While only PN was being carried out in the past, it has now been shown that jejunal enteral feeding not only provides adequate nutrition but also reduces septic complications.

Patients with cancer, particularly GI cancer, suffer from significant malnutrition. One of the concerns in providing nutritional support to these patients is that of faster progression of cancer. This concern has been proven to be unfounded. Quality of life in critically ill cancer patients improves with institution of nutritional support [24]. Factors contributing to this improvement are improved energy and protein intake leading to positive nitrogen balance and immunomodulation.

Patients with ulcerative colitis show remission with both enteral and parenteral nutritional support when used along with standard medical therapy. Nutritional support as an additional tool in obtaining remission in Crohn's disease is controversial. When bowel obstruction is not an issue, enteral nutrition can be used in these patients with some success [25].

A mention must be made about immune-nutrition [26]. Aminoacids, arginine and glutamine, nucleotides and omega-3 fatty acids are nutritional supplements that positively impact on the immune status. Supplementation of enteral and parenteral feeds with these compounds has shown to decrease septic complications in critically ill patients. Detailed discussion on this topic is beyond the scope of this article.

Conclusion

Nutritional status is important in determining the outcome of surgical patients. This is particularly so in patients undergoing GI surgical procedures. It is important for the GI surgeon to be always aware that he has to assess the nutritional status of his patient, provide supplementation when required and have the means to get enteral and/or parenteral access when required. He must have the knowledge to

choose the right route and formula for nutritional support. This paper has made an attempt to give an overview of the subject with the purpose of increasing awareness about the science of surgical nutrition.

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