

Optimal nutritional support

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There is ongoing debate about the respective roles of enteral and parenteral nutrition. The present short review suggests that these two feeding modalities are not mutually exclusive and that optimal nutritional support may necessitate the concomitant administration of enteral together with parenteral nutrition.

Enteral nutrition: Parenteral nutrition: Nutritional support: Malnutrition

There is prevailing debate as to what constitutes the optimal route of nutritional support. Advocates of enteral nutrition (EN) argue that it is cheaper, safer, more physiological and more protective of gut-barrier function than parenteral nutrition (TPN). There is no doubt that EN should be the modality of choice in patients with a functioning gastrointestinal tract. The problem is, though, that many patients do not have adequate gastrointestinal function. Such a situation is frequently encountered in critically-ill patients in the intensive care unit in whom it is now recognised that intolerance to EN is common. Inadequate nutrient intakes have previously been shown to be associated with prolongation of the acute-phase response and an increased incidence of septic morbidity (Taylor *et al.* 1999). In these patients, therefore, it would seem logical to administer nutrients parenterally. However, recently-published meta-analyses have questioned the role of TPN in the critically ill. Heyland *et al.* (1998) have looked at twenty-six prospective studies comparing the use of TPN with standard care in surgical and critically-ill patients, and have reported a marked reduction in morbidity in malnourished patients, but no effect on mortality. However, for studies of 'higher methodological quality' since 1989 the authors have concluded that 'TPN may do more harm than good in seriously ill patients'. A review by Braunschweig *et al.* (2001) of twenty-seven prospective randomised controlled studies of TPN *v.* either EN or standard care has identified a markedly increased relative risk of infection in the patients who received TPN. Analysis of only the malnourished patients has shown that TPN is associated with reduced infection rates and a decrease in mortality compared with standard care, but not when compared with EN. In contrast to these studies, a review of the published literature on the relative effects of EN and TPN on gut-barrier function and clinical outcome by Lipman (1998) has found that, with the possible exception of a reduction in septic morbidity in patients

with abdominal trauma, there is no demonstrable advantage of EN over TPN. These conflicting findings present rather a confused picture and serve to perpetuate continued debate over the relative roles of EN and TPN in critically-ill patients.

A major problem with analysis of trial data comparing EN with TPN is the fact that it is impossible to set up a prospective randomised trial studying homogeneous patient groups. If a patient has a functioning gut they should receive EN and it is inappropriate to randomise these patients to TPN. Conversely, if patients have inadequate gut function they should receive TPN and persistent attempts to achieve adequate intakes with EN are not in the patients' best interests. Not surprisingly, previous attempts to establish prospective and randomised trials comparing EN and TPN have resulted in many patients being fed by an inappropriate route, which must impact on results. To avoid this pitfall a pragmatic approach has been taken to the decision-making process (Woodcock *et al.* 2001). In this study patients requiring adjuvant nutritional support were fed according to a clinical assessment of the adequacy of gastrointestinal function. Those patients considered to have inadequate gastrointestinal function were given TPN, whilst patients with a functioning gastrointestinal tract received EN. Patients in whom there was reasonable doubt as to the adequacy of gut function were randomised to receive either TPN or EN, providing two truly comparable groups. A total of 562 patients were included in the study, making it the largest prospective study of its kind to date. In keeping with the principle of pragmatism all results were analysed on an intention-to-treat basis. EN was found to be associated with inadequate nutrient intakes, usually as a consequence of poor tolerance of the feed, manifest as high nasogastric aspirates, diarrhoea and abdominal bloating, and particularly common in the randomised patients with doubtful gastrointestinal function. The patients receiving

Abbreviations: EN, enteral nutrition; TPN, parenteral nutrition.

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EN were also found to have a markedly higher incidence of feed-related complications, including complications related to the invasive techniques employed for enteral access. Perhaps, most importantly, no significant difference was observed between the two modalities in terms of septic morbidity, in contrast to previous studies.

There are a number of reasons why these findings are not surprising, even though they are at variance with much of the published literature. First, there is no evidence (in man) that TPN adversely affects gut-barrier function or that it is enhanced by EN (MacFie, 2000). Second, many of the studies that have reported increases in septic complications in patients receiving TPN have involved patients with abdominal trauma, who as a group are markedly different in terms of age and physiological and nutritional status from the majority of patients receiving nutritional support (Kudsk *et al.* 1992; Moore *et al.* 1992). Third, in previous studies nutrient intakes have often been very different in the TPN and EN groups, with overfeeding and consequent hyperglycaemia a common occurrence in the patients receiving TPN. This factor in itself may predispose to sepsis. To avoid this problem in the Woodcock *et al.* (2001) study similar energy intake targets of 125 kJ (30 kcal)/kg per d were set in both groups, with the aim of matching but not exceeding total energy expenditure. Fourth, the study population included a much higher proportion of malnourished patients, with almost one-third having lost $\geq 10\%$ of their usual body weight and approximately half being severely malnourished according to the nutritional risk index (Baker *et al.* 1982). These patients have the most to gain from effective nutrient delivery, which the study has shown to be provided more readily by TPN than by EN. Previous studies have included too many well-nourished patients, who arguably have little to gain from nutritional support, but are nonetheless exposed to the associated risks. It has been demonstrated (Woodcock *et al.* 2001) that these risks also apply to EN, particularly now that more invasive techniques such as percutaneous endoscopic gastrostomies and feeding jejunostomies are being increasingly used. Complications include leakage of feed, obstruction and peritonitis. One patient in the study died as a direct result of percutaneous endoscopic gastrostomy insertion. Such morbidity must be taken into account in any comparative study of the two feeding modalities, although it has unfortunately often gone unreported in the past.

Parenteral and enteral nutrition are not mutually exclusive. Patients requiring adjuvant nutritional support should be fed according to the adequacy of gastrointestinal function. Unlike respiratory or renal function, there is no reliable objective measure available to evaluate this factor and so an assessment of the adequacy of gastrointestinal function is predominantly clinical. In those patients in whom there is doubt as to the adequacy of gastrointestinal function, nutritional support should be given as a combination of EN and TPN in the first instance. Enteral feeding should be commenced at low volumes and increased according to tolerance, which necessitates the close monitoring of intakes by nursing staff. The enteral feeding should be supplemented by TPN to ensure an adequate total

nutritional intake, which is particularly important in malnourished patients. Undernutrition is a debt that must eventually be repaid, and like all debts it is made worse when it is compounded (Griffiths, 2001). As the delivery of EN increases, the TPN is reduced to avoid the potential risks of overfeeding. A slavish commitment to EN in a patient who is clearly unable to tolerate it is inappropriate and is to be discouraged. It has even been suggested that the increase in splanchnic blood flow induced by EN may actually be detrimental to the critically-ill patient (Bistran, 1997). Feeding in this way should also dispense with the need for invasive enteral access in many cases.

In conclusion, the time has come for the enteral *v.* parenteral debate to be finally laid to rest. Patients with questionable gastrointestinal function should be fed using a combination of EN and TPN. The enteral feed is increased or decreased according to tolerance, with the TPN adjusted accordingly. It is important that any additional benefit conferred by specific substrates is investigated against a background of optimal nutritional support.

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