NUTRITION OF THE CRITICALLY ILL PATIENT IN FIELD HOSPITALS ON OPERATIONS

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Introduction

Critically ill patients can rarely feed themselves and are therefore at risk of becoming malnourished. This is reflected in decreasing body weight and muscle mass. They are also at risk of developing secondary complications such as nosocomial pneumonia and critical illness polyneuromyopathy Provision of an adequate supply of nutrients has been shown to lower the incidence of metabolic abnormalities, reduce septic morbidity, improve survival rates and can decrease length of hospital stay [1]. Early nutrition support has also been associated with a reduction in the body's catabolic response to injury. Improved clinical outcomes have been seen in decreasing complication rates, improved wound healing and promotion of graft and donor sites [2].

There is good evidence that nutritional support for critically ill patients will prevent malnourishment, but it does not need to be started for several days. Its use to prevent secondary complications has less robust evidence, (level 2 at best or trends to better outcomes rather than statistical significance), but there is a general consensus that it will modulate the underlying disease, and should be started as early as possible. It is a standard of care in most UK Critical Care Units to provide early nutritional support.

Starting enteral nutritional early for major burns has however been proven to be beneficial [3]. Prolonged ileus and stress ulcers in burns patients have been largely eliminated by early enteral feeding. Some evidence suggests that in burn patients early enteral feeding may decrease hypermetabolism, decrease catabolic hormones and improve nitrogen balance, as well as maintaining gut mucosa, reducing incidence of diarrhoea and length of hospital stay [4-6]. Improvement in immune function and the reduction in mortality and morbidity has been shown with enteral feeding of traumatic brain injury patients [1,7]. A reduction in infection rate, shorter hospital stay and an improved outcome has also been shown in trauma patients [8].

This paper presents some of the evidence for the early enteral nutrition of the critically ill patient, and also discusses the route of administration and what should be given. A possible flow chart for the use of enteral nutrition in the Field Hospital is also presented.

Metabolism in Critical Illness

During a "stress" injury the metabolic changes that occur are different than that during starvation. The aim is to mobilise energy reserves for repair and defence, which will occur even if there is no provision of nutrition. The phases of the metabolic response are classically

1. The Ebb Phase
2. The Catabolic Phase
3. The Anabolic Phase

The Ebb Phase starts immediately, mobilising liver glycogen and free fatty acids from adipose tissue, but the body's ability to use them is limited. The Catabolic phase commences approximately 24hours post injury and will last differing amounts of time depending on the nature of the injury. This phase is indicated by a rise in metabolic rate. Hormonal changes (a rise in catecholamines, cortisol, and glucagons levels), together with a rise in cytokines (interleukin(IL)-1 & 6 and tumour necrosis factor alpha(TNF)) will result in the breakdown of lean muscle, releasing amino acids which are used for gluconeogenesis. The degree of this breakdown will depend on the severity and duration of injury, but may prolong weaning off ventilator and delay rehabilitation. Nutritional support during this time will minimise these effects, however even in patients who achieve energy balance the process still occurs [9]. During the final anabolic (recovery) phase, nutritional support should restore the losses in muscle mass by increasing protein synthesis. It will ensure a quicker resolution of the protein deficit, and hence enable quicker rehabilitation.

Indications

Both NICE [10] and the Veterans Affairs agency in the USA [11] have given advice on the screening, assessment and recognition of patients already (or at risk of becoming) malnourished. However nutritional assessment of critical ill patients poses problems [12], and as has been discussed above, nutrition is started to prevent complication rather than address ongoing nutritional deficits. It would therefore seem reasonable to start supplemental nutrition on any critically ill patient who is unlikely to have adequate oral intake for greater than 24 hours.

Starting Artificial nutritional support

The timing as to when artificial nutritional support should be started is unclear, and has been subjected several trials. A meta analysis of these showed that if it was started within 24 hours of admission, mortality and infectious complications are decreased, compared to starting it later – but this was not statistically significant [13]. Another study found a statistically significant reduced incidence of septic complications and progression to multiple organ failure in trauma patients commenced on enteral feeding within 24 hours [14]. However as no study has shown harm from early enteral nutrition, it would seem reasonable to start it as soon as possible.

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Route of Administration

There are 2 main routes of administration: enteral (gastric or jejunal) or parentral (ie intravenous). There is a significant body of evidence that the enteral route reduces the incidence of nosocomial pneumonias and gastric stress ulcers. Enteral feeding can be achieved in most patients even in the presence of abdominal distension, diarrhoea and large residual gastric volumes or the absence of bowel sounds. The efficacy of parenteral nutrition (PN) is not established and there have been papers that have shown parenteral nutritional support to be an independent factor in the prediction of death in both trauma and sepsis [15]. PN has also been shown to be associated with an increase in infection rates, over feeding and hyperglycaemia Therefore the use of PN can not be supported in this context, and will not be considered further in this paper.

There is little data as to whether the gastric or jejunal route should be used. It has been proposed that if gastric aspirates are high then by bypassing the lower oesophageal sphincter, using a jejunal tube, will allow enteral feeding. Certainly jejunal feeding has been widely accepted in the treatment of pancreatitis. It may also overcome the possible problem of residual gastric volumes, which may predispose to aspiration during flight, and therefore allow feeding to continue during transfer to the UK. One meta analysis has shown that jejunal feeding decreases the incidence of noscomial pneumonia (but not mortality), however these results were heavily influenced by a single trial [16,17].

Rate of Administration

Nitrogen requirements range from 0.2-0.3g/Kg/day depending on the degree of hypermetabolism [18]. It is possible to estimate calorie requirements using indirect calorimetry, but this can be complicated and has not been shown to provide any benefit over assuming daily calorific requirements of a critically ill patient are about 25 kcal/kg ideal body weight [19]. High percentage full thickness burns patients are more catabolic and will therefore require a higher calorie intake [20].

It is unclear as to whether feed should be started at the full estimated rate or started slowly and built upto the target rate. Observational data suggests that starting at a high rate may increase the incidence of complications [21]. However the only randomised controlled trial reported on this showed that starting at the target rate decreased infectious complications [16]. It must be noted this trial only recruited head injured patients and had limited numbers, therefore it is common practice to start at a low rate and build up. This was also the NICE recommendation [10]. It would therefore seem reasonable to start at a low rate and build upto the target rate over 24 hours.

There is very limited data on the effect of flight and enteral feeding. It is possible that movement, acceleration, pressure changes and vibration may all predispose to regurgitation and possible aspiration. It would seem reasonable to limit the volumes given to patients prior to casevac, and possibly give it by the NJ route. This subject is examined further elsewhere in this edition [22].

Choice of feed

There are many feeds on the market, with different ones being aimed at different clinical conditions, however standard 1kcal/ml feeds are often used as the starter feed of choice. Even within the 1 kcal/ml feeds there are several different options, notably fibre rich or not. The fibre rich feeds assist bowel motility, but would be contra indicated in those patients with gastointensinal disease / injury. There are also many low sodium feeds marketed for the treatment of hypernatraemia. The same effect can be achieved by giving enteral water. Enteral feed is given at the standard calculated rate and sterile water administered through a separate giving set into the same enteral feeding tube [23].

Novel Substrates

Most standard feeds are nutritionally complete in terms of vitamins and elements. Therefore for most illnesses no routine supplementation in terms of nutrition will be required. A proposed critical care feeding regimen is given in Box 1. The only routinely encountered condition which would require further supplementation would be burns of greater than 30%, who would need more trace elements such as zinc. However several additional nutrients have been promoted as supplements to feeds to decrease the incidence of complications.

Glutamine plays a vital role in cell division, and in critical illness there is a functional deficiency of it in the rapidly dividing villus cells of the gastrointestinal epithelia. Its use has been promoted as helping maintain the GI wall integrity and therefore prevent infections and stress ulceration. A meta analysis of seven trials comparing enteral feed with and without glutamine showed no difference in infections or mortality [24]. There is however evidence of benefit in patients with severe trauma or burns [25], and therefore consensus is for use of it with these patients, but not the general surgical / heterogenous critically ill patient [26]. It is also important to note that glutamine also has a role in secondary brain injury after head trauma, so is contra indicated in these patients. Therefore it is recommended for use for use with the trauma patients in field intensive care unit (unless there is a brain injury).

During injury, the normally non-essential amino acid, Arginine has an increase in its requirements. Arginine has an important role in the generation of nitric oxide, promotes the secretion of hormones such as insulin and growth hormone and has been added to feeds in the hope of improving outcomes. However a meta analysis of 20 trials failed to show benefit in the critically ill patient [27]. It can not be recommended for routine use.

More recently the addition of omega 3 fatty acids has been studied as they are important for cell membrane function, and there are 2 trials of note. One, using patients with acute respiratory distress syndrome showed a benefit in terms of less ICU bed days and less multi organ failure (although not for mortality) [28], the other, using acute lung injury patients showed no difference [29]. This is clearly an emerging field, but there is insufficient evidence as yet to suggest their routine use.

Other Issues / measures.

If patients fail to absorb feed, many units start prokinetic agents, usually erythromycin or metoclopramide. Given the potential side effects (including ototoxicity, pseudomembranous colitis, induction of resistant bacterial strains and sudden cardiac death) erythromycin is often not used. A trial using metoclopramide did not show any benefit in terms of pneumonia, but the dose used was small [30]. Cisapride has been used in the past with good effect, but has been withdrawn from the market due to CVS side effects. Many studies on the use of prokinetics however are often small and have methodological weaknesses [31].

It is equally important to ensure large bowel motility, patient bowels should be open at least once a day. To promote this any patient receiving opioid infusions should be put on sodium docusate and senna tablets. If colonic stasis is suspected, neostigmine 2mg IV should be considered (glycopyrrolate may be required to manage bradycardia and increased bronchial secretions). There is also an increasing body of evidence that the addition of probiotics may help with bowel care management [32].

It has been shown that putting the patient in a head up position also decreases the incidence of pneumonia. Ideally during the administration of enteral feeds the patients should have their head and shoulders supported at a 30-45° angle to help reduce the risk of aspiration of feed, although injury patterns may preclude this.

A large randomized trial, in postoperative patients in intensive care demonstrated that maintainence of normoglycaemia with insulin reduced morbidity and mortality by almost half [33]. The use of insulin becomes increasingly important as feeding commences.

Summary

Although much of the evidence is inconclusive, most of it is based on small patient groups it is generally supportive of early, enteral feeding of critically ill patients. It has become a standard of care in the UK and as such should be encouraged in deployed operational ITUs.

1) Agree with the admitting team enteral feeding is possible

2 Place a gastric tube (if possible NG, if not orogastric).Preferably under direct vision at laparotomy, if not pass blindly and check position with chest X Ray.

3) Start fibre rich feed at 30 ml hr unless contra indicated

4) Calculate calorie requirement
   a) 25 kcal/kg/day basal req (note Ideal body weight)
   b) add 1 % for each % full thickness burn
   c) add 1 % if on a ventilator

5) Divide this by 24 to give the hourly feed rate

6) After 4 hours, aspirate the feeding tube.

7) If residual feed less than 200ml, increase hourly rate by 30 ml/hr and repeat step 6 until target rate reached.

8) If residual feed greater than 200ml, keep rate at 30ml/hr and repeat step 6.

9) If after 24 hours target rate not reached, add prokinetic agents

10) Ensure bowels open daily, all patients opioids should have Sodium Docusate and Senna.

11) If greater then 30% burns add multi vit tab every other day

12) If likely to be feed for greater than 24 hours add probiotic.

Note: If patient is likely to be Casevac'd within 48 hours a jejunal tube should be placed, preferably under direct vision in theatre, otherwise a weighted tube can be placed on the ward; feeding jejunostomy is a last resort.

Box 1 Possible feeding regimen for critically ill deployed patients

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