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Update on nutritional support in ICU

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Introduction

Nutritional support is a standard aspect of modern intensive care, and all patients who stay in an ICU for 48 h or more should be provided with nutrition. There remain, though, several areas of contention about the best way to provide nutrition, and indeed, the purpose for which nutritional therapy is being used.

In the 1990s there was a major shift in the manner in which nutritional therapy was provided to critically ill patients. Until that time, although it was generally accepted that enteral nutrition (EN) was the preferred method for feeding ICU patients, in fact parenteral nutrition (PN) was frequently used when prolonged nutritional support was required. Partly, this was because of the reassurance that substrate delivery by the intravenous route provided, and partly it was because of difficulties around the process of enteral feeding, which resulted in a high degree of underfeeding and failure with this approach. Dogma around feeding after surgery, the presence or absence of bowel sounds, diarrhoea and aspirate volumes all prevented EN being used effectively in many centres. With the focus on splanchnic perfusion and the gut as one possible driver of multiple organ failure that started to emerge around that time, the potential value of EN as a tool for improving gut and immune health became the subject of much research, and this led to a strong and widespread move towards enteral feeding wherever possible. Building upon this, the potential value of specific nutrients, frequently with immuno-modulating properties, was crystallised into the formation of specific 'immune-enhancing' feeds, and the concept of 'immuno-nutrition' was born. As experience grew, different products, substrates and mechanisms were all introduced, but the area has remained controversial. Generally, studies focussed on commercially-available products which were based upon combinations of ingredients in fixed doses, limiting the ability of investigators to identify the contribution of individual substrates, and were frequently too small or in populations insufficiently defined to allow clear answers as to the merits or harm of this approach.

In spite of such limitations, these developments resulted in continuing interest in specific groups of substrates, especially glutamine and arginine, anti-oxidants, selenium and omega-3 fatty acids, to name just some. Although widespread use of the more innovative enteral feeds remains patchy, there has been a general acceptance that the enteral route is best, and EN has become routine in modern ICUs. Apart from the putative benefits of EN, and its lower cost than PN, PN usage itself has been associated with poorer outcomes, especially in terms of infection rates. The field of critical care nutrition has benefited from the ready availability of regularly updated meta-analyses covering the current evidence base regarding those interventions that have been studied in any detail [1], and this resource is invaluable in guiding clinical practice. Informed by this and other published literature, there are a still number of specific questions and issues associated with nutritional support that deserve specific consideration.

Enteral vs parenteral nutrition

The currently accepted position is that EN is preferable to PN because of a decreased incidence of infections and decreased costs for critically ill patients, although there is no difference in mortality. In the Canadian Practice Guidelines [1], it is noteworthy that the most recent study considered suitable for inclusion in the analysis was from 2001 [2] - before the introduction of tight blood sugar control. Typically, patients who received PN before 2001 received more calories than those who received EN, and had a greater tendency to hyperglycaemia. Interestingly, a dissenting voice in terms of this conventional view of the merits of EN vs PN comes in a different meta-analysis from Simpson and Doig [3], who used an intention-to-treat analytical criterion, and found a mortality benefit in favour of PN, driven by trials which compared PN with delayed EN. There was still an increased infection rate associated with PN usage.

Proponents of PN today argue that the conventional wisdom that PN is harmful is not relevant to modern PN regimens, where over-feeding is avoided, the blood sugar concentration is well controlled, glutamine is routinely included and modern lipid preparations are used. Although few would advocate preferential PN, the concept of combined PN/EN to ensure that metabolic needs are met is gaining increasing credence amongst some experts [4]. Additionally, EN regimens are associated with increased nosocomial pneumonia rates [5] and frequent underfeeding, potentially leading to malnutrition. Doubts about what the current status of 'best practice EN' vs 'best practice PN' have, therefore, led to a large early EN vs early PN trial being commissioned in the UK, due to start later in 2009. For the present protocolised, early EN remains the standard of care.

Maximising EN success

It has been demonstrated in a number of studies that the success of enteral feeding can be substantially improved if the approach is protocolised, with rates for adequate early feeding being higher as a result [6]. It is less clear whether this results in improved outcomes, but it may be important in addressing another recurring problem associated with EN, which is that a significant proportion of patients remain underfed. In the past, underfeeding has not been regarded as harmful, but there is increasing evidence that significant calorie and nitrogen deficits are associated with poorer outcomes in critically ill patients [7].

Nutrition and tight blood sugar control

Tight blood sugar control became part of standard ICU practice in many centres after the publication of the Van den Berghe paper in 2001 [8]. Although the question of whether this approach is correct remains open at the time of writing, after subsequent negative studies and with another large clinical trial from Australia and New Zealand due to report shortly, the fact that blood sugar levels should be controlled (as opposed to a debate about the precise target range) has become an accepted part of standard care. Successful tight blood sugar control requires a reliable calorie source to prevent inadvertent hypoglycaemia, and, therefore, the use of this modality of treatment is usually considered alongside broader feeding protocols, without which the approach becomes difficult.

Specific ingredients

In spite of the controversy over so-called 'immune-enhancing' feeds, there continues to be considerable interest in both specific ingredients (anti-oxidants, selenium, glutamine, omega-3 fatty acids) and feeding products designed for specific purposes. One example of the latter is an enteral feed enriched with specific omega-3 and omega-6 fatty acids and anti-oxidants, aimed at patients with acute lung injury and sepsis, which has clinical trial data to support its value, although only in small scale studies so far [9].

Another development has been to take this approach one step further - a concept often referred to as pharmaconutrition, in which the separation between specific ingredients and general nutrition is formalised by using purpose-developed supplements that contain high concentrations of the particular ingredients (glutamine, anti-oxidants) but do not provide general nutrition. Such supplements are given alongside standard EN or PN, with the aim of ensuring early high-dose delivery of these active ingredients. This approach has also shown initial promise [10].

Two amino acids deserve specific mention. The first is glutamine, which becomes conditionally essential in critical illness, and has important roles in metabolism, inflammation and immunity. The available data strongly support the routine use of glutamine in PN preparations, and data is gradually emerging that suggest it may be of value in EN as well, at least in trauma and burns patients. The other important amino acid in this context is arginine, which was a key ingredient of many of the immuno-nutrition preparations, but which has become controversial in the context of sepsis. Work from Ochoa and colleagues [11] has clarified two different pathways for arginine metabolism associated with different immune states. In the relatively pro-inflammatory (Th1) state associated with infection, high levels of arginine are metabolised towards nitric oxide production, with the associated possibility that this may be detrimental. After trauma and major surgery, however, there is relative immuno-suppression (Th2 state) and increased levels of arginase reduce the levels of arginine available for immune cell activity. Under these circumstances, arginine administration is associated with improvements in immune function, and arginine-enriched feeds have been shown to reduce infectious complications and shorten length of stay in this population.

This convenient story supporting arginine use in major surgery but rejecting it in sepsis is slightly complicated by the lack of clear evidence that arginine-enriched feeds are actually associated with harm in a general ICU population, and the fact that the administration of glutamine itself generally causes an increase in arginine levels. Nevertheless, current recommendations are that arginine-enriched feeds should only be used in the surgery and trauma patient population, and not in patients with sepsis [1].

Key Learning Points

- Nutritional support remains a fundamental component of critical care.
- In spite of the general move towards protocolised enteral feeding, problems of poor nutritional delivery remain.
- New developments in the understanding of the role of key ingredients associated with better quality research are opening exciting prospects around developing these substances as therapeutic options in specific situations rather than considering them just as nutrients.
- Greater emphasis on nutritional monitoring will help ensure that patients benefit as a result.

References

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