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Short Communication

Proceedings of Frontiers in Critical Care 2013. Micronutrients - which and when?

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Introduction and background

A key goal for intensivists is prevention and treatment of malnutrition. However, before understanding the impact of the problem and finding ways to solve this, it is important to know more about the basic metabolism in the critically ill.

Methods

Analysis of professor Paul Wischmeyer's presentation on the first Frontiers in Critical Care congress on the 12th of April 2013 in Amsterdam, The Netherlands complemented by a review of relevant papers.

Results and main message

Margaret Herridge recently published data from survivors after the ICU [1]. Following ICU discharge, patients were asked to complete a questionnaire (SF-36) assessing the quality of their physical functioning (a physical role score) at three, six and 12 months following discharge. At 3 and 6 months a median score of zero was reported and a year after discharge a score of 25. Physical role scores of healthy individuals have an average of 80-90. So the question is whether the ICU is producing survivors or if we are producing victims? And what is the reason for this extremely low score?

More than 50% of all patients in the ICU are underfed based on calories and protein. Critically ill patients can lose as much as 1 kg of lean body mass daily, which can be lethal for some patients. Sick patients are not equal and need different goals. For Wischmeyer, the answer is protein delivery: 1.2—2.0 g/kg/day.

Both the EPaNIC trial and the EDEN trial showed no benefit of higher energy delivery [2, 3]. Both trials delivered a relatively low protein amount. In the Swiss PN trial studying early adequate energy with high protein delivery, benefit was shown on less infectious complications from day 9 [4]. In a large Canadian observational study every extra 30 grams/protein a day was associated with reduced mortality [5]. This was also demonstrated in the Omega trial [6].

Totally unexpected, the control group performed better than the group receiving boluses fish oil. This might have been because the control supplement contained 20 g of protein per day and the fish oil supplement 3.8 g. The positive effects of adequate protein provision were also shown in a retrospective study. This study showed that survival was better when the protein and energy targets were achieved, not when only energy targets were achieved. This makes protein one of the most vital pharmaconutrients.

Critical illness and injury is not a homogeneous process. It contains several phases. The acute phase of critical illness lasts for a few days. The chronic phase can last for weeks, and hopefully there is a recovery phase. In the acute phase the body becomes catabolic. The body responds by breaking down muscle to make amino acids and glucose. Eventually amino acids and protein stores are exhausted.

In contradiction to what is usually thought the septic patient is not hypermetabolic during the first seven days and the measured resting energy expenditure is low. It is the recovery phase where patients start to become hypermetabolic, Zauner et al. showed that the resting energy expenditure at day 0, showed no difference between septic and non-septic patients [7]. In fact the sicker the patients were, the lower the REE was. So, to optimize nutrition in the acute phase, Wischmeyer advised to reduce calories and use enteral or oral protein supplements or TPN in the at risk patients.

In the chronic phase, and especially in the recovery phase, more aggressive caloric delivery and perhaps pro-anabolic therapy may be needed. In the recovery phase continued protein and calories are required to continue the recovery of lean body mass and physical function.

What about the other micronutrients? Wischmeyer recently published in the NEJM, early provision of glutamine as a high dose supplement did not improve clinical outcomes and was associated with an increase in mortality among critically ill patients with multi-organ failure [8]. So there is no room for glutamine in the early phase of sepsis and MOF. In this trial, parenteral selenium did not provide benefit, as the dose appeared quite insufficient to increase plasma selenium levels. However, several reviews conclude that higher dose parenteral selenium significantly reduces mortality in the critically ill with SIRS or sepsis [9—11].

Discussion

In modern times, ICU patients are treated for weeks or even months as advances in acute phase resuscitation has allowed us to save patients that would not have survived before. These patients appear to undergo different phases of critical illness, and will have different nutrition needs throughout these phases. Insulin resistance is maximal in the acute phase of illness, so the body might benefit from a more hypocaloric, high-protein nutrition to minimize catabolism. In the chronic phase, and recovery phase, caloric delivery and pro-anabolic therapy may be needed. Delivery of the right amount of protein and the right micronutrients at the right time also appears to be vital. The aforementioned studies are showing that it may be beneficial to optimize nutrition individually instead of providing the same amount and nutrients for all ICU patients and also the role of indirect calorimetry in the ICU should be expected to increase in the near future. However, further research is needed to aim for a customized individual nutrition for the critically ill patient.

Conclusion

Further research is needed to evaluate the effect of nutrition with adequate protein delivery (1.2 to 2.0 g/kg/day) on outcome and better methods are needed to analyze the patient's admission nutrition status and lean body mass throughout ICU care.

Key Message

As Wischmeyer puts it: 'If we work together with continued clinical trials and clinical care targeted to specific patient needs, delivering the right nutrients, at the right time, in the right amounts, perhaps even the least-fit patients can survive'.

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