

Nestlé Health Science and GE Healthcare Critical Care Nutrition Road Show, November 2017 – a summary

Jan Wernerman, Professor of Intensive Care Medicine at Karolinska Huddinge, spoke on the subject of **“Indirect calorimetry in nutritional therapy - Measuring energy expenditure in the intensive care unit”**. Several observational studies¹ indicate less favourable outcomes when there is a negative cumulated energy balance in ICU (Intensive Care Unit) patients. In other studies², the most favourable outcomes were associated with an energy intake of 50-70% of target. A point prevalence study revealed that, for several reasons, critically ill patients only receive about 50% of the planned intake and that all patients are treated alike, regardless of the situation – a “one-size-fits-all method”. So what to conclude from this? Obviously the patient case-mix in the observational studies sometimes results in contradictory results. The few existing randomised studies of hypocaloric feeding in critically ill patients do not provide convincing results in meta-analysis. Professor Wernerman pointed out that for some patients their critical illness is so severe that nutrition is of little impact on their outcome. This will affect the scientific investigations of the effect of nutritional treatment, if the actually beneficial effect is considered across all critical ill patients. This presents a problem as the patient groups in which nutrition treatment is actually beneficial, tend to be drowned in these observations. Excessive energy intake involves a risk of overfeeding ICU patients. A commonly held belief used to be that a little extra energy to be on the safe side will not cause any harm, but nowadays we know better. Aggressive overfeeding also increases the risk of refeeding syndrome.



Professor Jan Wernerman

“No size fits all in the nutritional treatment of critical ill patients”.

All guidelines recommend using indirect calorimetry, but according to Professor Wernerman it is still greatly underused. There are no excuses for not measuring! Indirect calorimetry may not be exact, but compared to other types of measurement among the critically ill, it is still the “best in show”. Among commercially available measuring equipment in Scandinavia, the GE Healthcare COVX is the least expensive alternative. Although associated with a purchase cost, it is not expensive to operate, especially in relation to the high treatment cost per day in a typical ICU unit.

Methodology to evaluate protein requirements

There is an ongoing scientific debate on the energy and protein needs. WHO recommends 0.83 g protein/kg for healthy subjects, but in several reviews and guidelines a higher amount is recommended for critically ill patients due to desired preservation of lean body mass and muscle function and to avoid hypermetabolism etc. Also, as patients with multiple organ failure have increased protein turnover it is important to individualize the recommendations. Professor Wernerman questions the belief that a higher protein intake makes it possible to achieve nitrogen

¹ Villet et al, 24:502, Nutr 2005 among others.

² Krishnan et al, Chest 124:297 (2003) among others.

balance and highlights that the nitrogen balance technique has considerable limitations in critical illness. A well-conducted study in Linköping (*Larsson et al, Br J Surg, 1990*) regarding nitrogen needs in severely injured patients during the first week after trauma, revealed that nitrogen retention decreased with increase in nitrogen supply and with time after injury. This paper, in conjunction with a retrospective study employing neutron activation to assess total body proteins (*Ishibashi et al, CCM 1998*), has formed the basis for the present ESPEN recommendations. The study of *Allingstrup et al (ICM 2017)* may be considered one of the most important well-conducted studies in the area of nutrition. The results do not favour full caloric and protein nutrition already starting at the time of ICU admission, on the other hand no harm was seen in relation to that protocol.

The lack of concrete guidelines indicates the importance of checking recommendations against the literature. The website www.criticalcarenutrition.com from Canadian Professor Daren Heylands group is a site with great impact and content.

An important recent study is *“Resting energy expenditure, calorie and protein consumption in critically ill patients: a retrospective cohort study”* by Zusman et al (*Crit Care 2016*). This was conducted on 10 000 patients, with indirect calorimetry used on a small group. The findings of this study suggest that both caloric underfeeding and overfeeding appear to be harmful to critically ill patients, and in particular that a higher caloric intake may be associated with harm. The optimal approach to defining caloric goals therefore requires an exact estimate, which is ideally performed using indirect calorimetry – still the best practice! Indirect calorimetry allows for individualised nutrition, prevents overfeeding, is easy to perform and has a clear focus on nutrition.

Finally, Professor Wernerman recommends two well-designed studies: *“Early enteral nutrition in critically ill patients: ESICM 2017 report”* (*Intensive Care Med 2017*) and *“Metabolic and nutritional support of critically ill patients consensus and controversies”* (*Preiser et al, Critical care 2015*). These two publications emphasise that the level of evidence for most recommendations for ICU nutrition rest on a poor basis of evidence, and secondly that there is information on what opinion leaders agree and disagree on.

Jørgen Wiis, Chief Physician at the Department of Intensive Care, Copenhagen University Hospital, spoke on the subject of **“Protein-energy requirements in critical ill patients and their impact on clinical outcomes”** and explained how we can tailor nutritional needs for ICU patients. For several reasons, many ICU patients suffer from energy deficits, although most ICUs are improving. It is also clear that the ESPEN guidelines need to be updated. The *Alberda study*³ showed that increased intakes of energy and protein appear to be positive for critically ill patients, particularly when BMI is <20 or > or = 35.



Chief Physician Jørgen Wiis

³ The relationship between nutritional intake and clinical outcomes in critically ill patients: results of an international multicenter observational study. *Alberda C et al, ICM 2009.*

“Everybody in ICU is at nutritional risk. Indirect calorimetric methods can identify and individualised the nutritional needs.”

In a kind of “cookbook” for targeted nutrition delivery in critical illness, it is absolutely crucial to consider the nutrition status before admission to the ICU. Several important studies favour adding protein at the beginning of the treatment but being slower with carbohydrates. The prospective study *Allingstrup MJ et al 2012*, for instance, showed a significantly decreased hazard ratio of death with increased protein provision.

How much protein should be administered? According to several papers, for instance the Weijs⁴ study, 1.2 g/kg is sufficient for most patients (BMI 20-30). A simplified calculation method for calculating protein requirements is the Bistrian formula for urine urea excretion.

Dr Wiis stressed the importance of considering the quality of life of the patient: when the survival aspect has been fulfilled, will the nutritional treatment really matter for the patient in the long term? Possible complications of early parental nutrition, as in the well-known Epanic⁵ study, were also discussed along with the request of more evidence regard to early nutrition. Relevant short-term outcomes such as infections and metabolic control should be emphasised in critical care nutrition.

Together with Matilde Jo Allingsstrup, Jørgen Wiis is one of the authors of the “*Early goal-directed nutrition versus standard of care in adult care patients: the single-centre, randomised outcome assessor-blinded EAT-ICU trial*”⁶. The aim of this trial was to test the effect of early goal-directed protein-energy nutrition in the short term and the physical quality of life in ICU patients in the long term. This was a randomised study on 200 subjects who received early goal-directed nutrition in a way that had never been tested previously. Although the thesis could not be confirmed, as the patients were probably fed too early, the trial provides important data on the effects of early goal-directed protein-energy nutrition.

Dr Wiis concluded his lecture by stating that everybody in ICU is at nutritional risk, and that tools and scoring models for identifying critically ill patients who benefit most from nutrition therapy are very important. By using calorimetric methods, it is possible to identify more precisely patients who need extra nutrition and to implement individualised designed nutrition. To sum up: one size does not fit all!

Henrik Højgaard Rasmussen, Professor of Clinical Nutrition at Aalborg University Hospital, spoke on two topics, “**Risk of overfeeding and hyperglycaemia**” and “**How to reach the protein and energy targets**”. The nutritional status before admission to an ICU is of great importance. It has effects,



Professor Henrik Højgaard Rasmussen

⁴ Proteins and amino acids are fundamental to optimal nutrition support in critically ill patients. *Weijs et al. Critical Care 2014, 18-701.*

⁵ Early versus Late Parental Nutrition in Critically Ill Adults, *Cesar et al, AJRCCM 2013.*

⁶ Early goal-directed nutrition versus standard of care in adult care patients: the single-centre, randomised outcome assessor-blinded EAT-ICU trial, *Allingstrup et al, ICM 2017*

especially on muscle mass and function, even five years after hospital discharge. The great challenge is to find the optimal feeding level and to avoid refeeding problems. Unfortunately, there are few studies that show significant clinical outcome of nutritional treatment as well as screening tools in ICU indicating which patients are at risk. Professor Højgaard Rasmussen recommends using good nutritional practice for all patients: assessment of nutritional status followed by plan, monitoring and follow-up. He also recommends two very interesting papers: Dogma of PRCT in ICU (Vincent JL)⁷ and Weijs PJM & McClave⁸. The latter paper stresses the need to differentiate fear of energy overfeeding from future benefits of protein feeding. There is so much to gain from this!

At most ICUs there are more patients with both lower and higher BMI than in the general population. A CT scan can evaluate fat mass and lean body mass of ICU patients. Monitoring of muscle mass is of great importance in the ICU, needing more attention. Screening systems are used to track disease-related malnutrition. There is, however, no clear definition of malnutrition, only a proposal from ESPEN. According to an observational study, REE (resting energy expenditure), which increases after the injury phase, is less marked nowadays – we consequently treat patients better today.

Anabolic resistance involves several factors. Professor Højgaard Rasmussen referred to the Allingstrup study⁹, in which adding more protein seems to lead to better survival. It is of vital importance to counteract anabolic resistance in risk patients. In conclusion, it is difficult to find the right balance between energy and protein recommendations. Too much energy increases fat mass, which may result in muscle atrophy, among other complications (e.g. infections, hyperglycaemia).

“Differentiate fear of energy overfeeding from future benefits of protein feeding. There is so much to gain from this!”

Both insufficient (in the hypermetabolic phase) and excessive energy intake can lead to hyperglycaemia. It is thus important to consider both endogenous and exogenous substrate supply in meeting nutritional targets to avoid overfeeding and underfeeding. Most patients need less energy in the first acute catabolic phase (first week), as the body produces a large amount of energy itself at the start. Very early aggressive feeding therefore implies a risk of overfeeding. This is difficult to measure, so the use of calorimetry is recommended in addition to adding more energy later. Parenteral nutrition might be considered at a later stage. The energy requirements should be re-evaluated continuously. An improved energy balance giving 75% of REE means improved survival. ESPEN and ASPEN can be consulted for disease-specific protein requirements.

Learnings from the roadshow: Professor Wernerman concluded the day by stressing that nutrition treatment is very important on ICUs in order to minimise the loss of lean body mass, which is substantial in ICU patients. As there is no consistency agreement in American and European guidelines, it is important to maintain the discussion on optimal treatment methods. All the speakers stressed that there are many factors to consider when it comes to critical care nutrition. There is also a large time gap between the ICU treatment and the follow-up. A better definition of this gap would probably give us a better understanding of what really benefits the patient.

⁷ *Crit Care Med*, 2010

⁸ *Curr Opin Clin Nutr Metab Care* 2016;19:116-119

⁹ *Allingstrup et al, ICM* 2017