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The truth about nutrition in the ICU

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Introduction

For the critically ill patient who is expected to remain more than 48 h in the intensive care unit (ICU), the need for nutrition is an accepted standard of care. The traditional screening tools used to identify malnutrition on the hospital ward are not adequate for use in the ICU because critically ill patients cannot communicate verbally to provide diet histories. Due to their high catabolic state, all ICU patients are at risk of developing malnutrition if not fed adequately. Since critically ill patients may be so different in terms of pathologies and severity, "One size does not fit all" may be the message for nutrition in the ICU.

Truth number 1: enteral nutrition, preferably as early as possible

In an initiative to develop evidence-based clinical practice guidelines for the provision of nutrition therapy to critically ill patients, a literature search [1] found strong evidence demonstrating significantly reduced mortality, and led to the guideline's primary recommendation for enteral nutrition compared with any form of standard care, including waiting for return of oral intake or providing intravenous (IV) dextrose (Fig. 1). Other major guidelines also express strong preferences for enteral nutrition in critical illness compared with waiting for return of oral intake, or any type of intravenous calories [2]. Evaluation of clinical trials commencing enteral nutrition within 48 h of intensive care unit admission reveals a significant reduction in infectious complications. A statistically significant mortality reduction is reported in meta-analysis of clinical trials commencing enteral nutrition within 24 h of ICU admission or catastrophic injury [3] without inducing any significant harm; provision of early enteral nutrition also reduces overall hospital costs [4].

Truth number 2: avoid overnutrition

Energy supply in excess of energy needs is associated with an increased rate of complications [5]. Therefore, excessive administration should be avoided. Target calorie intake should be carefully applied, and nonnutritional calories such as propofol should be limited [6]. We recommend not exceeding 35 kcal/kg/day total energy intake,

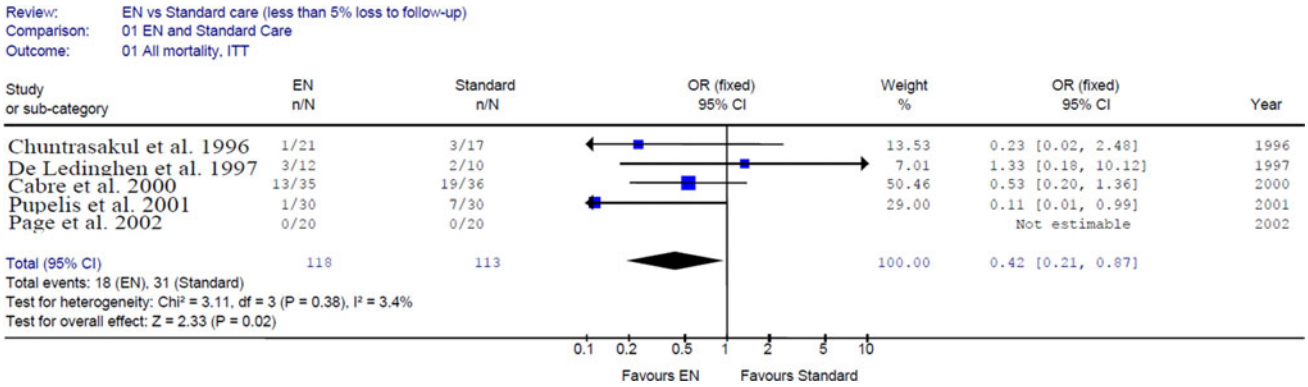

Fig. 1 Enteral nutrition versus standard care [nil per os (NPO) or IV dextrose]; from [1] with permission

with patients whose body mass index (BMI) exceeds 30 kg/m^2 targeted to their ideal BMI of 21–23 kg/m^2.

Large observational studies [7] but no prospective randomized controlled trials (PRCTs) have shown the association between negative energy balance and increased rate of complications. The TICACOS pilot study [8], which tried to target calorie intake according to measured energy expenditure, found an increase in ICU length of stay and length of ventilation but also improved hospital survival.

Truth number 3: predictive equations for energy needs are frequently inaccurate

Prediction of energy needs is reasonably sound except in patients characterized by disequilibrium between body mass and composition (sarcopenic obese), abnormal muscle tone (paralysis, agitation), variable degree of adrenergic stress related with the disease severity (pain, fever), and treatments (intensity, invasiveness) [9]. Indirect calorimetry is the gold standard, but is insufficiently available. European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines recommend 20–25 kcal/kg body weight in the early acute phase, which should be increased to 25–30 kcal/kg in stabilized patients [10]. In unstable patients, this evaluation should be repeated daily, and the Faisy equation may help by taking into account clinical changes such as temperature and minute ventilation.

Truth number 4: the timing to prescribe supplemental parenteral nutrition remains uncertain

Progressive increase of energy deficit during ICU stay increases morbidity. In case of failure of enteral nutrition (EN) to match nutritional needs, supplemental parenteral nutrition (SPN) is added to EN, but monitoring of total daily intakes is mandatory to avoid overfeeding. Latest studies about supplemental PN [8, 11, 12] generated discrepant results due to inconstant levels of energy provision, timing of prescription, and patient characteristics. It remains clear that: underfeeding promotes protein catabolism to fuel obligatory glucose needs and reduces immune and healing function; EN covers energy needs in most critically ill patients if properly implemented by a competent team, which limits SPN to patients who fail to tolerate EN; patients with ICU stay <4 days, likely to resume their eating and digestive capacity within 5 days, should not be given PN.

Truth number 5: give enough protein to fight anabolic resistance

Muscle wasting occurs early and rapidly during the first week of critical illness and is more severe in patients with multiorgan failure (MOF). Large muscle and protein losses have been described in the critically ill patient [13]. Protein synthesis remains refractory in the early phase. To overcome anabolic resistance, high protein intake (1.5 g/kg/day) has been recommended [10] during the early phase of ICU, regardless of calorie intake, based on a PRCT. Appropriate feeding products should be chosen: specific amino acids (leucine, arginine) may have higher metabolic value, but large studies are lacking. During the recovery period, they should be combined with a sufficient amount of energy to avoid proteolysis for fuel energy deficit. Electric stimulation, muscle activation, and mobilization may limit anabolic resistance [14].

Truth number 6: glutamine is recommended in parenterally fed patients without MOF

Glutamine supplementation in patients expected to require PN for longer than 10 days is supported by many

studies and recommended (grade A) by ESPEN [10]. However, the recent REDOXS study [15] in 1,223 patients with severe organ failure (i.e., 93 % in shock state, 33 % with renal failure) showed that high-dose glutamine (0.78 g/kg/day = twice or more the recommended dose) starting within the first 24 h of ICU admission, with or without nutrition support, increased the mortality rate. In a subgroup of patients, glutamine plasma levels were measured and found high at admission. Supplementing glutamine in patients with renal failure or more than two organ failures is therefore to be avoided until more data are obtained.

Truth number 7: give selenium in sepsis and consider fish oil in ARDS

IV selenium administration should be considered in septic patients according to a recent meta-analysis, since it was associated with significantly lower mortality [16].

Supplemental n-3 fatty acids (10 g/day of omega-3 fatty acids) administered enterally continuously in acute respiratory distress syndrome (ARDS) or acute lung injury (ALI) have been associated with PaO_2/FiO_2 improvement and decrease in length of ventilation [17]. When administered in larger doses and in bolus, the results were not confirmed. Intravenous administration of omega-3 fatty acids improved the infection rate and length of stay in critically ill patients after surgery according to a recent meta-analysis [18].

Truth number 8: blood glucose should be controlled, conventionally

It is universally accepted that hyperglycemia and hypoglycemia are associated with worsening outcomes from critical illness. Three large-scale clinical trials have investigated different blood glucose target ranges for insulin treatment. One major trial conducted in a single surgical ICU demonstrated that mortality was significantly reduced if insulin treatment targeted a tight blood glucose range (6.0–4.5 mmol/L) compared with a conventional range [19]. Two subsequent confirmatory trials failed to demonstrate any benefits from this tight glucose target range, with the largest trial, conducted across 42 hospitals from 4 countries, demonstrating significant excess mortality using the tight glucose range compared with the conventional range (10–8.0 mmol/L) [20].

Truth number 9: monitoring: do not measure gastric residual volume

Gastric residue measurement has been rechallenged recently [21], and this procedure does not seem to improve outcome (no decrease in ventilator-associated pneumonia or length of stay). Early enteral feeding gradually reaching targets over the first 72 h is recommended. If measured, gastric residue should be readministered to the patient after evaluation to prevent energy deficit. If a threshold volume is used, we recommend 500 mL for the average-sized person.

Conclusions

In the last decade, critically ill patients have become more polymorbid, aged, and complex. There are no studies demonstrating that fasting or starvation benefits the critically ill. Practice has been improved by numerous studies in the field of early enteral feeding, glucose control, and preventing nutrition complications. However, more studies are required to define the best timing for supplemental parenteral nutrition, as well as the quantity and quality of protein, lipids, and micronutrients.

Conflicts of interest The authors declare that they have no conflict of interest.

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