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Optimal Nutrition Therapy in the Paediatric Intensive Care Unit

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A significant proportion of infants and children admitted to the paediatric intensive care unit (PICU) are malnourished, and further deterioration of nutrition status has been observed dur- ing the course of critical illness. The prevalence of obesity is also rising in the PICU, and is as- sociated with higher rates of complications, increased length of stay, and loss of muscle tissue in this population (Bailey 2010). Optimal nutrition therapy for critically ill infants and children is essential to meet both macronutrient and micronutrient requirements, and to preserve lean body mass during critical illness.

Goals of Optimal Nutrition Therapy

Nutrition screening is recommended on ad- mission to the PICU to identify patients who are malnourished or at risk for nutritional deterioration or complications (Mehta and Compher 2009). At-risk individuals must be promptly assessed by a dedicated PICU dietitian for assessment of nutrient require- ment, and monitored for nutritional dete- rioration during their hospital stay (Skillman and Wischmeyer 2008).

Prescription of appropriate energy and protein goals is the next step to achieving optimal nutrition therapy for PICU patients. Critical illness and injury significantly alter energy and protein requirements and may limit the potential for growth until after res- olution of the insult. The physiologic stress response is characterised by reprioritisation of hepatic protein synthesis to increase acute phase proteins (C-Reactive Protein) and re- duce transport proteins (prealbumin and al- bumin).

While attempts to attenuate pro- tein breakdown during this phase are largely unsuccessful, adequate protein intake may avoid net negative protein balance. Indirect calorimetry (IC) is the most accurate method to determine energy requirements in the PICU (Mehta and Compher 2009). Energy expenditure measured by IC varied from 60-130% of energy expenditure pre- dicted by standard equations in mechani- cally ventilated children (Coss-Bu et al. 2001). Energy intake goals matching basal metabolic rate (BMR) equations based on healthy children may cause overfeeding in some critically ill children (Mehta, Bechard et al. 2010). On the other hand, those with severe burn injuries or neurologic injury may require up to 175% of predicted BMR and may be underfed (Prelack et al. 2007).

Thus, critically ill children are at risk for both underfeeding and overfeeding. Prolonged inadequate intake can exacerbate malnutri- tion, cause loss of lean body mass, and in- crease infection rates in the PICU, whereas overfeeding can induce hypercarbia, hyper- glycemia, and lipogenesis (Skillman and Wischmeyer 2008). It is essential to frequent- ly monitor the cumulative balance between intake and actual requirement of energy and protein, adjust the nutrition prescription, and implement strategies to prevent complications from underfeeding and overfeeding (Hulst et al. 2006).

After accurate estimation or measurement of energy requirement, enteral nutrition (EN) should be initiated within 24-48 hours from admission in haemodynamically stable pa- tients with a functioning gastrointestinal (GI) tract, and increased to meet estimated or measured energy and protein goals within the next 24 hours. Initiation of early EN can reduce caloric deficits, improve protein retention, and is generally well tolerated. EN should be postponed until after resolution of haemodynamic instability, GI bleeding, is- chaemia, and ileus. Parenteral nutrition (PN) may be initiated if a delay in EN initiation is anticipated (Duggan et al. 2002), or to supplement inadequate enteral feeding.

Thus, overall goals for optimal nutrition therapy in the PICU include:

a) Screening for at- risk and malnourished patients;
b) Accurate assessment of energy and protein requirements during illness course;
c) Prescription of energy and protein based on accurate assessment or measurements;
d) Monitoring cumulative energy and protein balances;
e) Use of EN where feasible with the aim of early initiation; and
f) Prudent use of PN where necessary.

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