

Editorial

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How to prescribe parenteral nutrition the safest way: case by case or using machine learning?



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In the dilemma of when to initiate feeding in the critically ill, how much to prescribe, and which feeding route to use, 2 reviews in recent issues of Journal of Intensive Medicine have addressed very important points: is it safe to underfeed our patients, and is it safe to use parenteral nutrition (PN)? It is unanimously recognized that early enteral feeding is the preferred route,^[1,2] but the use of this medical nutritional therapy is limited by many obstacles. First, interruptions related to procedures or to transportation to surgery or diagnostic examinations have been reported, and a reduction in the time of administration as well as the amounts of energy and protein administered may result.^[3] Second, symptoms of enteral nutrition intolerance are frequent and include large gastric residual volume, an inability to reach the energy/protein target on day 3, severe diarrhea or constipation, and elevated intra-abdominal pressure. These symptoms not only impair the progression toward optimal nutritional support but are also associated with increased mortality rates.^[4] As a matter of fact, several audits ^[5,6] suggest that most patients in the intensive care unit are underfed. Tatucu-Babet and Ridley ^[7] provided us with an excellent overview of the consequences of underfeeding. Meanwhile, most multicenter randomized controlled trials(RCT) that found no advantage of iso-feeding compared to underfeeding did not conduct a measurement of energy requirements using indirect calorimetry and are therefore of limited usefulness in concluding that underfeeding is preferred.^[8] Most observational studies using indirect calorimetry as a tool for energy target found a clinical advantage in defining an energy goal of 70% at day 3 to avoid overfeeding in the acute phase when excessive substrate endogenous production occurs.^[9] Therefore, a cautious and progressive energy prescription may be recommended to prevent undesirable underfeeding while simultaneously avoiding overfeeding. This phenomenon is optimally obtained by indirect calorimetry but, if indirect calorimetry is not available, the use of predictive

equations should be encouraged on its lower end, preventing overfeeding.^[1]

In the tango of providing enteral feeding while testing gastrointestinal tolerance, the health professional should remember that, if enteral feeding is limited and the energy protein balance is endangered, PN remains a safe and useful tool. Berger and Pichard, in a meticulous review,^[10] first showed that PN has undergone a revolution. Originally a method reserved only for patients unable to be fed through the gastrointestinal tract at all, new indications for PN have since emerged. PN per se was shown to be as safe as enteral nutrition.^[11] The previous elevated rate of infection associated with PN has decreased over the years due to more precautious handling of venous access, reducing the rate of catheter-related sepsis to a minimal value. Liver function test results may be elevated but can be managed, and the rate of hypoglycemia and vomiting is much lower than that seen when using enteral nutrition.^[11] The key to the success realized using PN is now its appropriate prescription, avoiding overfeeding that could be associated with complications. Again, the use of indirect calorimetry guides the prescription of energy to 70% of the energy expenditure at day 3 according to European Society of Parenteral and Enteral Nutrition (ESPEN) guidelines.^[1] The use of supplemental PN in the case of partial intestinal intolerance has grown more and more frequent and is associated with improved outcomes.^[12] The timing of PN may be defined by the patient's condition and the need for it in comparison to their capacity to use their gastrointestinal tract. A "case-by-case" evaluation and personalized nutrition are required and will limit the severity of an energy deficit. New and frequent clinical situations, such as high-flow nasal cannula oxygen therapy, non-invasive ventilation, or severe dysphagia, impair oral nutrition. Enteral feeding may increase the risks of vomiting and/or aspiration. Peripheral PN is increasingly more prescribed in these contexts in view of the fact that it is considered a safe approach to feeding.

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Nevertheless, the "case-by-case" approach recommended by guidelines^[1] is a consequence of the failure of RCTs to deliver clear messages. The decision when to start PN remains uncertain. As such, this may be the setting to involve machinelearning processes to support the decision-making of health professionals. Deep learning of the database and use of algorithms developed in the current health care setting will suggest when enteral feeding may fail, when PN may be started, and what amount of energy/protein should be provided.^[13] In practice, when enteral nutrition is failing, physicians are reluctant to start PN, which may be initiated between days 3-10 according to different international recommendations. During this time, partial enteral nutrition is often prescribed, leading to energy deficits and a risk of aspiration. With the support of machine learning, decision-making in favor of PN can occur earlier with an improved safety outcome, reducing the underfeeding risk. Evolving from a "case-by-case" approach based on physician experience, decision-making will be supported by the mathematic probabilities of nutritional success and the determination of clusters of patients prone to tolerating or not tolerating enteral nutrition. In this way, genuine personalized nutrition will be possible and will facilitate the delivery of optimal medical nutritional therapy with the support of machine learning.

Conflicts of Interest

The author declares no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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