Avoiding underfeeding in severely ill patients

Jean-Louis Vincent and Jean-Charles Preiser discuss (Feb 2, p 354)[1] two important studies by Claudia Heidegger and colleagues[2] and Michael Casaer and colleagues,[3] and suggest an evidence-based algorithm, which essentially does not foresee supplemental parenteral nutrition (SPN) before days 5–7 after intensive care unit (ICU) admission, even in patients with contra-indication for enteral nutrition.[1] Furthermore, they state that SPN probably should be restricted to the most severely ill patients (possible long stayers), and in patients with malnutrition SPN should be started earlier.

We agree that available data from well-designed prospective randomised studies do not adequately cover malnourished patients and potential ICU long stayers. However, for critically ill patients there is clear evidence that energy and protein intake are significantly associated with outcome.[4] For patients at risk, 5–7 days of underfeeding might be detrimental. The European Society for Clinical Nutrition and Metabolism guidelines recommend that: "All patients receiving less than their targeted enteral feeding after 2 days should be considered for supplementary parenteral nutrition".[5] It is essential to anticipate the course and stay of patients at the time of ICU admission, and to assess caloric and protein intake every day. Guidance by measurement of resting energy expenditure with indirect calorimetry might be very helpful in patients at risk. The benefits of a feeding protocol are also unequivocal. Therefore, the framework proposed by Vincent and Preiser[1] bears a substantial risk of underfeeding in malnourished patients and potential ICU long stayers. If there is consensus that these high-risk patients should be enterally fed, targeting caloric needs and if necessary supplemented by SPN or even total parenteral nutrition at an early stage, then the algorithm could be adapted as shown in the figure.

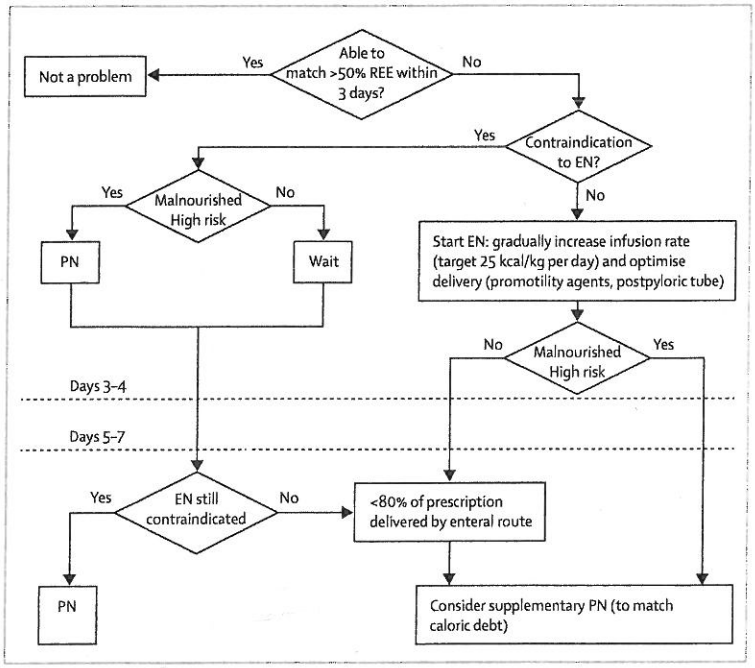

Figure: **Proposed framework for starting parenteral nutrition in severely ill patients**
REE=resting energy expenditure. EN=enteral nutrition. PN=parenteral nutrition.

AW has received speaker's fees from Baxter, B Braun, Fresenius Kabi, and Nestlé. PS has received speaker's fees from Abbott, Baxter, B Braun, Fresenius Kabi, and Nestlé.

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Authors' reply

We thank Arved Weimann and Pierre Singer for their letter which gives us the opportunity to explain further the rationale behind our suggested strategy.[1]

The early parenteral nutrition approach suggested by Weimann and Singer is mainly based on the association between the magnitude of the so-called caloric debt and the complication rate. By contrast, we based our algorithm on recent progress in the understanding of the metabolic response to critical illness, supported by the results of prospective trials. From an evolutionary perspective, the metabolic response to stress is highly preserved among species, and is largely expressed as insulin resistance, which is now understood to be an adaptive mechanism developed to survive injury.[2] Insulin resistance results in an unavoidable increase in endogenous glucose production, up to 1500 kcal per day, at least for the first 3 days after injury.[3] Hence, the caloric debt during the acute phase of critical illness should no longer be calculated as the

When should we add parenteral to enteral nutrition?

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In *The Lancet*, Claudia Heidegger and colleagues[1] present the results of their supplemental parenteral nutrition (SPN) study, providing new fuel for the continuing debate about nutritional support in critically ill patients. Despite considerable controversy in this field, physicians generally agree on two key aspects: firstly, the enteral route is preferable whenever possible,[2-4] and secondly, if possible, enteral nutritional support should be started early (within 24–48 h after admission). Implementation of enteral nutrition in critically ill patients can, however, be challenging, and is complicated by regurgitation and emesis, delayed gastric emptying and increased gastric residual volumes, abdominal distension, and diarrhoea. Additionally, provision of enteral nutrition is often interrupted for tests or procedures. Therefore, even in the most experienced and motivated intensive-care units (ICUs), less than 70% of patients receive adequate enteral caloric intake.[5] The other patients have a so-called caloric debt (ie, the difference between the enteral caloric intake and the resting energy expenditure); a higher cumulative caloric debt has been associated with increased complications, including infections, and prolonged stay in the ICU.[6,7]

An important question is, therefore, whether we should add parenteral nutrition to enteral nutrition to minimise this caloric debt. During the acute phase of critical illness, the body mobilises substrates from insulin-dependent organs (mainly muscle and fat) to match the increased resting energy expenditure. Furthermore, under these conditions, exogenous calories no longer inhibit the production of glucose by gluconeogenic organs, by contrast with the physiological situation.[8] Hence, excessive nutrition during the acute phase of illness could induce occult overfeeding. International guidelines diverge on the practical applications of these approaches. The American Society for Parenteral and Enteral Nutrition (ASPEN) and Society of Critical Care Medicine (SCCM) guidelines[3] recommend that parenteral nutrition be initiated after 1 week, unless the patient is severely malnourished. By contrast, the European Society of Enteral and Parenteral (ESPEN) guidelines[2] recommend consideration of a combination of enteral and parenteral nutrition after only 2–3 days in the ICU if enteral nutrition alone is insufficient at that time.[2]

In Heidegger and colleagues'[1] two-centre Swiss trial of 305 patients (12% of ICU admissions), patients who were randomly assigned to receive SPN starting from day 4 after ICU admission, calculated to match the caloric needs determined by indirect calorimetry (in two-thirds of the patients), had fewer infections (hazard ratio [HR] 0·65, 95% CI 0·43–0·97) and a shorter time on mechanical ventilation than patients who did not receive SPN. These results contrast with those from the large, prospective controlled Impact of Early Parenteral Nutrition Completing Enteral Nutrition in Adult Critically Ill Patients (EPaNIC) study,[9] in which 4640 patients (53% of ICU admissions) from Leuven, Belgium, were randomly assigned to start parenteral nutrition early (on day 2), according to the ESPEN guidelines, or late (day 8), as recommended by the ASPEN/SCCM guidelines. Overall, there were fewer complications and earlier discharge from the ICU in the late than in the early parenteral nutrition group.

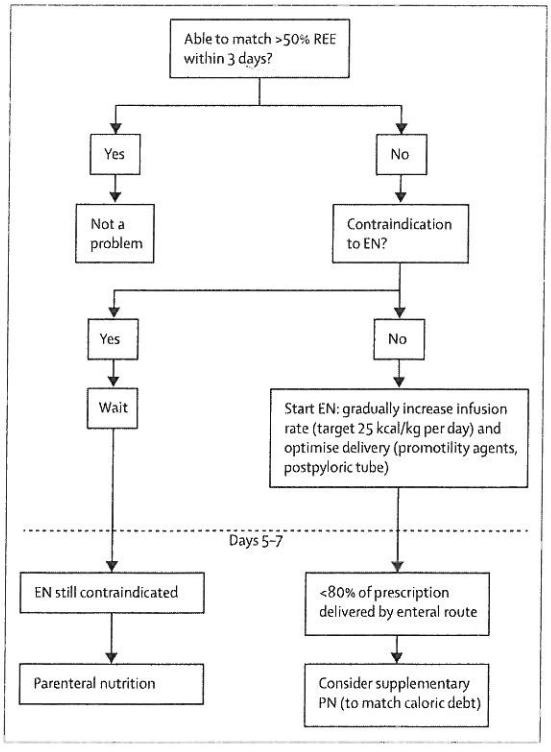

Figure: **Proposed framework for starting parenteral nutrition in acutely ill patients**
REE=resting energy expenditure. EN=enteral nutrition. PN=parenteral nutrition.

How can we reconcile the findings of these two well-conducted trials? The caloric intake was similar in the patients receiving early parenteral nutrition in the two studies, such that these differences are unlikely to account for the different results. The differences are more likely to be related to the types of patients studied. In the SPN study,[1] inclusion criteria were more restrictive than in the EPaNIC study[9]—only patients with an expected stay of at least 5 days and a functional gastrointestinal tract were eligible. In the EPaNIC study,[9] patients were mostly surgical admissions, received higher (possibly excessive) glucose loads than did patients in the SPN study, and severely malnourished patients (body-mass index <17 kg/m^2) were excluded. Although the Acute Physiology and Chronic Health Evaluation (APACHE) II scores were similar (at around 23) in the two studies, the patients in the SPN study stayed longer in the ICU and had a higher hospital mortality rate than did those in the EPaNIC study (around 15% *vs* 11%). The SPN study also used indirect calorimetry to avoid overfeeding, but the clinical value of this approach is debated.

Taken together, the data from these two studies suggest that there is no urgency to start parenteral nutrition. We suggest a framework for an algorithm for parenteral nutrition in the ICU on the basis of the available evidence (figure). Essentially, SPN should not be considered before days 4–7 after ICU admission, and should probably be restricted to the most severely ill patients (or possibly long-stayers) who have a substantial caloric deficit despite apparently adequate enteral nutrition. In patients with malnutrition, SPN could be started earlier.

The results of these and other studies will continue to stir controversy. Perhaps the most important consideration is that every acutely ill patient is different, and nutritional strategies and goals need to be personalised to the individual. Early SPN is probably more appropriate for patients who are malnourished and in those who are likely to have a protracted ICU course. The next important question relates to optimum protein intake, which has been below recommended concentrations in most studies available so far[10] and might play a more important role in outcomes than will the amount of calories.[10–12] This important question was not specifically studied in the EPaNIC or SPN trials, but will certainly be the focus of future studies.

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