

# Enteral Nutrition in Traumatic Patients: Essential for Achieving Optimal Recovery Outcomes

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## ABSTRACT

Post-traumatic physiological changes result in distinct energy metabolism patterns during each phase of recovery. More injury necessitates increased nutritional support, specifically earliest possible nutrition support in addition to elevated caloric and protein intake. The specific nutrition supplementation for each phase for individual patients may be a crucial aspect of post-traumatic care. Enteral nutrition (EN) is preferred over parenteral nutrition (PN), if no contraindication exists; as it stimulates immunity and avoids the need for invasive procedures. Monitoring clinical signs and gastric residual volume (GRV) together for feeding intolerance is essential to prevent complications. However, although open abdomen after damage control surgery can be encountered in traumatic patients, EN remains an option provided it is carefully managed to replace protein lost from exudative content; thereby, facilitating recovery.

**Keywords:** critical illness; enteral nutrition; feeding intolerance; nutrition assessment; traumatic patient

## INTRODUCTION

Trauma remains a significant cause of mortality worldwide, particularly among the young and economically active population. The World Health Organization has reported that injuries account for about 4.4 million deaths annually, which is nearly 8% of all global deaths<sup>1</sup>. For patients that survive initial insult, in addition to anatomical

injuries, physiological changes; such as a profound systemic inflammatory response, can lead to further complications<sup>2</sup>.

Energy metabolism in post traumatic patient is categorized as: "the ebb phase and flow phase." The ebb phase refers to the hypometabolic phase; wherein, poor tissue perfusion and poor oxygenation following shock is affected. This hypometabolic phase, which occurs within

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the first 3 days after injury<sup>3</sup>, serves as a protective function by conserving energy; thereby, potentially increasing the chances of survival<sup>4</sup>. If the patient survives, they will enter the: “flow phase.” This is characterized by a period of hypercatabolism as the body attempts to repair itself<sup>3</sup>. Increased body temperature may be a sign of this phase. As resting energy expenditure increases during this phase, it is important to increase energy and protein intake: the “flow” phase may last for days or even weeks<sup>4</sup>.

Given the physiological changes that occur post-injury, individualized nutritional support in each phase of injury has emerged as a cornerstone of modern trauma care. According to THAI-SICU data, those in the nutrition-at-risk group had a higher mortality rate after ICU admission<sup>5</sup>. Higher nutritional support for individuals at high risk of malnutrition may yield significant benefits compared to those at low risk. Specifically it reduces mortality rates<sup>6</sup>, length of hospital stays and the incidence of infections<sup>7</sup>. Key topics for consideration in the provision of nutritional therapy in this review include: nutrition assessment, the timing of initiation, the optimal caloric and protein allocation, enteral nutrition administration and monitoring and nutrition in open abdomen.

### Nutrition assessment

Each patient within each post-traumatic period has varying nutritional needs, making a one-size-fits-all approach ineffective. Targeted nutritional interventions are especially beneficial for undernourished patients after major trauma or surgery, are specific in each post-traumatic period, and lead to improved clinical outcomes. Over time numerous tools have been developed to assess nutritional status and guide nutritional support.

In 2002, the Danish Society for Parenteral and Enteral Nutrition created a nutrition risk screening tool, based on an analysis of 128 randomized controlled (RCTs) comparing nutrition support to spontaneous intake. The tool assesses nutritional status through percentage of weight

loss, amount of food intake, and body mass index (BMI), while considering disease severity. A total score of 3 or more indicates that nutrition is at risk, linked to better clinical outcomes like faster mobilization, lower infection rates, fewer complications, and shorter hospital stays for patients receiving optimal enteral nutrition<sup>7</sup>. However, Nutrition Risk Screening 2002 (NRS 2002) is based on data that is not specific to critical patients.

In 2011, a study by Heyland DK et al. developed the Nutrition Risk in the Critically ill (NUTRIC) score to quantify nutrition risk in critical patients in intensive care unit (ICU). The score uses factors like: age, the Acute Physiology and Chronic Health Evaluation (APACHE) score, the Sequential Organ Failure Assessment (SOFA) score, number of co-morbidities, duration of hospitalization prior to ICU admission and interleukin-6 (IL-6) levels, all of which correlate with 28-day mortality outcomes. A total score of 6 or higher indicates a high-risk nutrition status, which may mitigate mortality if optimal nutritional support is provided. However, a limitation for general use is that IL-6 is not routinely measured in practice<sup>8</sup>, leading to the development of a modified NUTRIC score.

In 2015, Rahman A et al. conducted a post hoc analysis of a database from a randomized controlled trial involving patients with multi-organ failure across Europe and North America, so as to further validate the NUTRIC score. The score was recalibrated without the IL-6 component, yielding a modified NUTRIC score ranging from 0 to 9. Additionally, a high-risk cutoff, set at 5 or more, was associated with mortality rate. For high-risk patients, every additionally 25% increase in caloric prescriptions received corresponded to a hazard ratio of 0.82 for mortality. The area under the curve (AUC) for the modified score was 0.648, compared to 0.783 in the original<sup>6</sup>.

Patients being at nutrition risk, identified by BNT/NT<sup>9</sup>; previous NT 2013 version, or the NRS 2002<sup>5</sup>, had higher ICU mortality, according to the THAI-SICU data. Currently, practice guidelines from international

organizations; including the European Society for Clinical Nutrition and Metabolism (ESPEN)<sup>10</sup>, the Society of Critical Care Medicine, the American Society for Parenteral and Enteral Nutrition (SCCM and ASPEN)<sup>11</sup> and the Western Trauma Association (WTA)<sup>12</sup>, advocate for the utilization of NRS 2002, the original NUTRIC score as well as the modified NUTRIC score to assess nutritional risk in patients effectively. The Society of Parenteral and Enteral Nutrition of Thailand (SPENT) recommends utilizing the SPENT nutrition screening tool for adult patients upon admission. If two or more risk factors are identified (unintentional weight loss within the past 6 months, decreased oral intake more than 7 days, body mass index less than 18.5 or more than 25 kg/m<sup>2</sup> or more and critical illness), further evaluation should be performed, using the Nutrition Triage 2013 (NT 2013) or the Nutrition Alert Form (NAF). These tools do not require specialized personnel nor complex physical exams, are accurate<sup>13</sup> and can assess complications associated with malnutrition<sup>9</sup>. Patients having moderate to high malnutrition risk (NT 3 to 4 or NAF B to C), who are hemodynamically stable, are not in the end-of-life stage, and are unable to meet 60% of their resting energy expenditure (REE) for more than seven days, should receive nutritional therapy<sup>14</sup>.

#### The optimal timing for initiating nutritional therapy

Current evidence indicates that initiating early enteral nutrition (early EN) within 24 to 48 hours of admission or resuscitation significantly reduces mortality rates compared to no EN or intravenous fluid administration alone<sup>15</sup>. However, when comparing early EN with delayed EN, initiated after 48 hours of admission or resuscitation, there was no mortality benefit observed in subgroups with traumatic brain injury and abdominal injury<sup>16</sup>. Despite this, the early EN group has a lower infection rate<sup>15</sup>. When comparing early EN with early PN, initiated after 48 hours of admission or resuscitation, there was no observed mortality benefit in critical traumatic patient<sup>17</sup> nor in the subgroup of traumatic brain and abdominal injuries<sup>16</sup>. Similarly, the

rate of hospital infections were not different between the two groups<sup>17-18</sup>. The early EN group mainly demonstrated a reduction in infection rates, potentially due to immunity activation from Peyer's patches within the Gut-Associated Lymphoid Tissue (GALT) in the terminal ileum. These patches detect antigens from food particles, prompting immunoglobulin; a secretion from the mucosa of the gut and respiratory tract<sup>19</sup>.

In hemodynamically unstable patients, splanchnic blood flow is reduced to prioritize perfusion to vital organs; such as the brain and heart. Norepinephrine (NE), a common vasopressor, maintains blood pressure by stimulating alpha-1 adrenergic agonists, causing systemic vasoconstriction. This can significantly decrease splanchnic blood flow, potentially leading to bowel ischemia, and feeding intolerance, which causes subsequent aspiration pneumonia<sup>20</sup>. The presence of a vasopressor does not constitute absolute contraindications for EN; however, its dosage should be considered. Early EN, utilizing a vasopressor at an equivalent dose of NE less than 0.14 mcg/kg/min, does not increase the rate of feeding intolerance<sup>21</sup>. In comparison to delayed EN, early EN combined with NE of less than 0.3 mcg/kg/min has been associated with a reduced mortality rate. In cases of high-dose vasopressors, with NE exceeding 0.3 mcg/kg/min, no difference was observed between early EN and delayed EN<sup>22</sup>. This aligns with the NUTRIREA-2 trial results that showed no significant impact on mortality rates when comparing early EN to early PN, with a median NE of 0.56 mcg/kg/min<sup>18</sup>. Despite similar mortality rates, the SCCM and ASPEN guidelines still advise against EN in cases of uncontrolled shock.

In addition to patients with uncontrolled shock, hypoxemia, hypercapnia with acidosis, gastrointestinal bleeding or obstruction in addition to abdominal compartment syndrome, are conditions that are not suitable for early EN. Hence, PN becomes the alternative for nutritional therapy<sup>11</sup>. A EPaNIC trial compared early PN with delayed PN, started

on day 8 of admission, in nutrition-at-risk patients and it found that the early PN group experienced longer ICU stays and higher infection rates, particularly among patients undergoing abdominal and pelvic surgeries. Notably, in this study, nearly 20 percent of participants in each group had a BMI greater than 30 kg/m<sup>2</sup> and a mean bodyweight of 75 kg, which may have enabled them to tolerate delayed PN<sup>23</sup>. In contrast, a recent trial by Gao et al.; conducted in post-abdominal surgery patients, the population had a mean BMI of 23 kg/m<sup>2</sup> and a mean BW of 62 kg, demonstrated that initiating PN on post-operative day 3 significantly reduced nosocomial infections compared to starting on day 8, with no observed difference in mortality<sup>24</sup>. As previously mentioned, a lower body weight may suggest reduced energy reserves to endure critical illness. Hence, individual risk stratification for malnutrition should be performed in addition to specific nutritional support being provided in accordance with SCCM and ASPEN recommendations. This indicates initiating PN within 7 to 10 days for patients that are unlikely to meet nutritional goals via EN regarding risk, or as soon as possible after ICU admission for high risk malnutrition<sup>11</sup>. WTA recommendations state that traumatic patients having one of the following criteria: BMI under 18.5 kg/m<sup>2</sup> before treatment, unintentional weight loss exceeding 10% in the past three months or receiving less than 75% of daily energy requirements in the last seven days, should commence PN within 48 hours if EN is unsuitable. For non-malnourished traumatic patients, PN may be started if nutritional goals are not met via EN within seven days<sup>25</sup>.

#### Optimal calorie intake to achieve goals

The caloric requirements of patients vary significantly due to a multitude of physiological factors. Several methods exist to ascertain REE; including predictive equations like the Harris-Benedict<sup>26</sup>, Ireton-Jones, Penn State<sup>27</sup>, and weight-based equations as well as indirect calorimetry (IC)–which measures REE by calculating oxygen consumption and carbon dioxide production. However, current evidence

suggests a low correlation between these predictive equations and IC<sup>28–31</sup>.

IC offers a more precise measurement of REE than predictive equations; although, it may be unavailable in some settings and requires complex equipment. Clinical comparisons of REE estimation methods were performed in both the TICACOS pilot study and the EAT-ICU trial. These studies evaluated clinical outcomes in critically ill patients receiving calories, based on IC guidance versus weight-based predictive equations, providing 25 kcal/kg/day. The TICACOS pilot study showed that IC-guided energy delivery led to lower mortality and infection rates; however, it was linked to a longer duration of mechanical ventilation<sup>32</sup>. Conversely, the EAT-ICU trial found no significant differences in mortality, mechanical ventilation duration nor infection rates<sup>33</sup>. A recent meta-analysis by Watanabe S et al. with 1,178 critically ill patients on mechanical ventilation, indicated that IC-guided energy delivery might improve 90-day mortality compared to predictive equations; however, results lacked statistical significance<sup>34</sup>. Although, IC does not demonstrate a significant mortality benefit compared to predictive equations, overfeeding due to inaccurate caloric predictions can lead to hyperglycemia, hypercarbia and elevated blood urea nitrogen. Therefore, IC remains the preferred method for measuring REE in traumatic critically ill patients when available<sup>35</sup>.

Phase-based nutrition therapy has become significant due to changes in the body's energy expenditure after injury. During the ebb phase, mostly occurring within the first three days post-injury, resting energy expenditure decreases; wherein, energy is primarily derived from endogenous hepatic gluconeogenesis, reducing the need for exogenous energy. Hypocaloric feeding in the early phase of critical care has shown benefits. Research by Zusman et al. suggests that increasing caloric intake from 0.0% up to 70.0% of the measured REE correlates with a reduction in mortality. However, exceeding 70% of REE is associated with higher mortality, longer hospital stays

and extended mechanical ventilation<sup>36</sup>. Similarly, a post-hoc analysis of the NEED trial revealed that each 5 kcal/kg/day increase in mean energy delivery during the first week was associated with an approximate 13% reduction in 28-day mortality<sup>37</sup>. Furthermore, the NUTRIREA-3 trial, a multicenter randomized controlled trial conducted in France, demonstrated that hypocaloric feeding at a rate of 6 kcal/kg/day during the first seven days had no significant difference in 90-day mortality; although, there were shorter durations for both ICU discharge and weaning from mechanical ventilation when compared to standard feeding at 25 kcal/kg/day<sup>38</sup>.

The individualized nutrition support in specific phases is recommended in the current practice guidelines (Figure 1). WTA recommends initiating hypocaloric feeding, providing approximately 70.0 to 80.0% of REE. This corresponds to 15 to 20 kcal/kg/day for patients with a low to moderate risk of malnutrition, as indicated by a mNUTRIC score of 5 or less or an NRS score of 5 or less. This regimen is typically maintained for the first four days, after which feeding can be advanced to meet 100.0% of the REE by day five. Conversely, patients at high risk of malnutrition, defined as having a mNUTRIC score exceeding 5 or a NRS score exceeding 5, or those with a pre-injury weight loss exceeding 10% of their body weight, should be started on a more aggressive feeding regimen of 100% of REE or 25 to 30 kcal/kg/day<sup>25</sup>. These recommendations contrast with guidelines from SCCM and ASPEN, which suggest that low-nutrition-risk patients (defined as having a mNUTRIC score of 5 or less or an NRS score of 3 or less, and are unable to maintain volitional intake) do not require specialized nutrition therapy during the first week of hospitalization<sup>11</sup>. The ESPEN recommends that hypocaloric feeding be administered in the early phase of injury and increased to 80.0 to 100.0% of the measured REE after day three. To estimate REE, IC is preferred over predictive equations. If IC is unavailable, initiating hypocaloric feeding at approximately 70% of the REE, calculated from predictive

equations, is recommended over isocaloric feeding during the first week<sup>10</sup>.

#### Recommended daily protein intake for traumatic patients

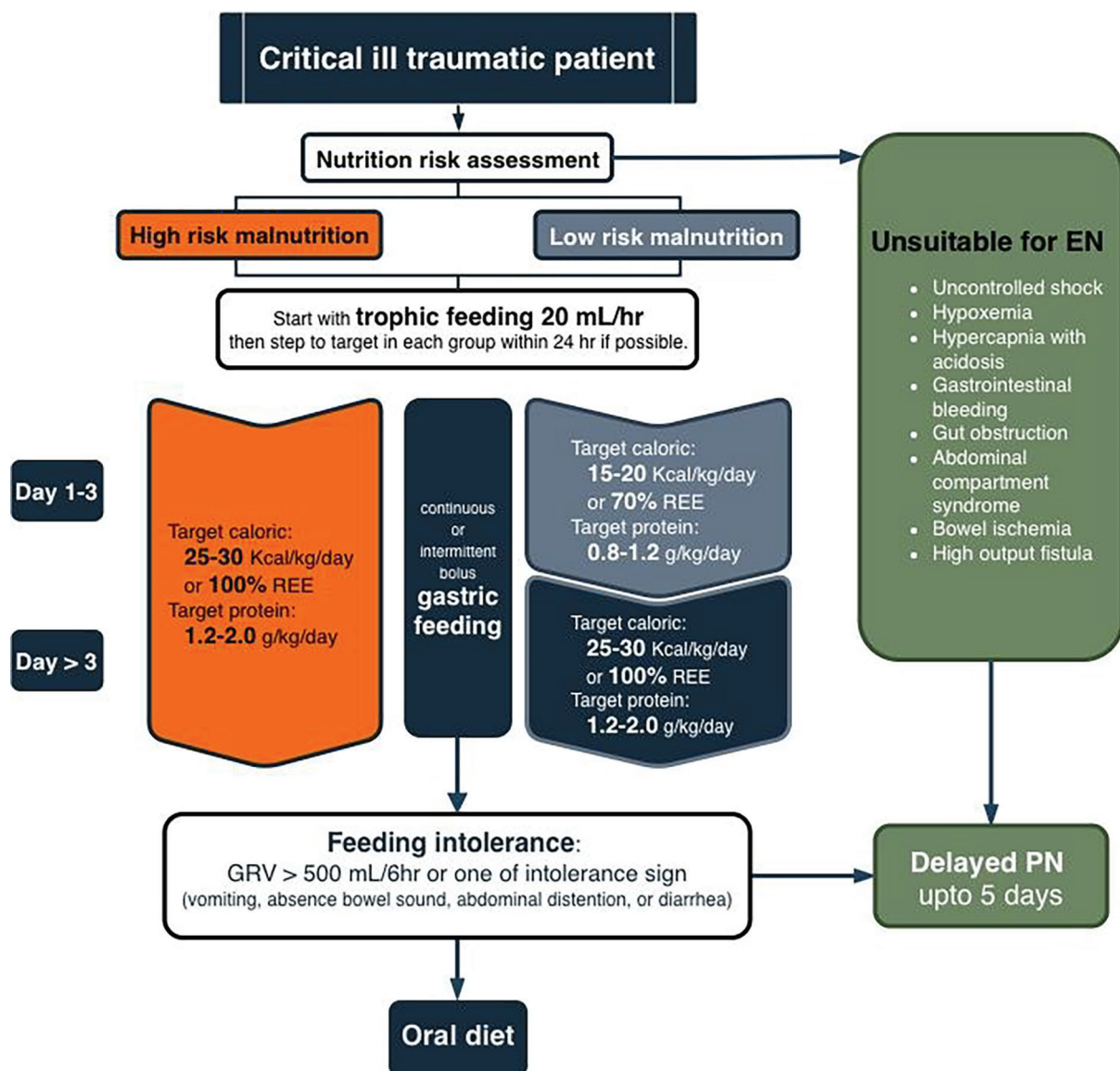
Following an injury, physiological changes in energy requirements also affect the balance between protein catabolism and metabolism. During the ebb phase, the daily protein requirement decreases similarly to energy needs. However, in the flow phase amino acids, catabolized from skeletal muscle and internal organs, serve as substrates for hepatic gluconeogenesis; necessitating an increased protein requirement to maintain in vivo protein equilibrium<sup>39</sup>. Higher or lower protein in critical patient can impact clinical outcome, as protein intakes below 0.8 g/kg/day are associated with increase mortality<sup>40</sup>. Conversely, higher protein intake does not reduce mortality rates, nor does it show any significant advantages in terms of ICU length of stay<sup>37,40,41</sup>, duration of mechanical ventilation<sup>40,42</sup>, functional outcomes or health related quality of life<sup>43</sup>. Blood urea nitrogen, a byproduct of protein metabolism, should be monitored in individuals consuming high protein; especially more than 2.2 g/kg/day of protein. Each percentage increase in urea over time is associated with a 0.4% increase in 30-day mortality<sup>41</sup>. Phase-based protein intake appears advantageous. A slight increase of 0.2 g/kg/day in protein intake during the first week post-injury is associated with a significant decrease in 28-day mortality; especially in patients with lactate levels of 2 mmol/L or lower. This finding supports the PROTIVENT trial, which demonstrated a reduction in mortality rates for patients with initial protein intake below 0.8 g/kg/day over the first three days; which was subsequently increased to over 1.2 g/kg/day.

Current guidelines align in their recommendations, with WTA, SCCM and ASPEN all advising a protein intake ranging from 1.2 to 2.0 g/kg/day, with the possibility of increasing the maximum dose in cases of multiple traumas or burns<sup>11,25</sup> (Table 1). ESPEN recommends a

progressive increase in protein intake, starting at 1.3 g/kg/day<sup>44</sup>. Although, the maximum dose of protein was not mentioned in their recommendation, the author advises monitoring blood urea nitrogen to prevent excessive protein intake.

#### Enteral nutrition administration

Enteral nutrition should be initiated via the gastric route when there are no contraindications. This is in accordance with the guidelines from ESPEN<sup>10</sup>, SCCM, ASPEN<sup>11</sup>, and WTA<sup>25</sup>. Whilst post-pyloric feeding may



High risk malnutrition defines as NRS  $\geq 3$  or mNUTRIC  $\geq 5$  or NT2013  $\geq 3$  or NAF B to C; Low risk malnutrition defines as NRS  $< 3$  or mNUTRIC  $< 5$  or NT2013  $< 3$  or NAF A

**Figure 1** Algorithm for evaluation and management of enteral nutrition in traumatic critical ill patients

offer benefits; such as reduced incidence of pneumonia<sup>11</sup>, GRV<sup>45</sup> and feeding intolerance<sup>10</sup>, it does not show any advantages in ICU length of stay or mortality rates<sup>46</sup>. Due to the expertise required for post-pyloric tube placement, associated delays, and its less physiological nature compared to gastric EN, routine use of the post-pyloric route is not justified<sup>10</sup>.

A meta-analysis of RCTs, prior to 2017, indicated that continuous gastric feeding resulted in a lower incidence of diarrhea compared to intermittent feeding<sup>10</sup>. However, recent analyses; including newer data from 8 RCT, found no significant differences in mortality, ICU stay, diarrhea, vomiting nor pneumonia among adult mechanical ventilated patients after receiving nasogastric

tube feeding<sup>47</sup>. Continuous feeding offers the advantage of a higher proportion of patients achieving 80% of target calories; although, the median time to reach target calories remains unchanged<sup>48</sup>.

Feeding intolerance, a significant complication during enteral feeding, requires careful monitoring. SCCM and ASPEN recommend continuing EN with GRV of less than 500 mL in the absence of intolerance<sup>11</sup>. A meta-analysis as of 2022 defined feeding intolerance by GRV and gastrointestinal symptoms, finding that intolerance defined as GRV more than or equal 250 ± 50 mL with any gastrointestinal symptoms; defined as vomiting, absence bowel sound, abdominal distension or diarrhea, was linked to higher all-cause hospital mortality<sup>49</sup>.

**Table 1** Summary recommendations from current practice guidelines

|                         | ESPEN <sup>44</sup>                                                                                                                                                                                                                                                                           | SCCM and ASPEN <sup>11</sup>                                                                                                                                             | WTA <sup>25</sup>                                                                                                                                                                                                                                                                                                                                    |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nutrition assessment    | <ul style="list-style-type: none"> <li>NRS 2002</li> <li>Subjective global assessment</li> <li>Mini-nutrition assessment</li> </ul>                                                                                                                                                           | <ul style="list-style-type: none"> <li>NRS 2002</li> <li>NUTRIC score</li> </ul>                                                                                         | <ul style="list-style-type: none"> <li>NRS 2002</li> <li>mNUTRIC score</li> <li>History of pre-injury weight loss</li> </ul>                                                                                                                                                                                                                         |
| Time to initiate EN     | <ul style="list-style-type: none"> <li>Within 48 hours, if the patient can't maintain voluntary intake and there are no contraindications.</li> </ul>                                                                                                                                         | <ul style="list-style-type: none"> <li>Within 48 hours, if the patient can't maintain voluntary intake and there are no contraindications.</li> </ul>                    | <ul style="list-style-type: none"> <li>Within 48 hours and hemodynamics are controlled</li> </ul>                                                                                                                                                                                                                                                    |
| Contraindication for EN | <ul style="list-style-type: none"> <li>Uncontrolled shock</li> <li>Life threatening hypoxemia or hypercapnia</li> <li>Active upper GI bleeding</li> <li>Bowel ischemia</li> <li>High output intestinal fistula</li> <li>Abdominal compartment syndrome</li> <li>GRV &gt;500 mL/6hr</li> </ul> | <ul style="list-style-type: none"> <li>Hemodynamics unstable</li> </ul>                                                                                                  | <ul style="list-style-type: none"> <li>Gut obstruction</li> <li>Intestinal discontinuity</li> <li>High-output enterocutaneous fistula</li> <li>High-dose vasopressor</li> <li>Intestinal ischemia</li> <li>Documented intolerance to trials of EN</li> </ul>                                                                                         |
| Indication for PN       | <ul style="list-style-type: none"> <li>Contraindication for EN in 3–7 days</li> </ul>                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>High risk malnutrition and contraindication for EN</li> <li>Don't exceed 60% of caloric target by EN within 7–10 days.</li> </ul> | <ul style="list-style-type: none"> <li>High risk malnutrition and contraindicate for EN</li> <li>Don't achieve caloric target by EN within 5 days.</li> </ul>                                                                                                                                                                                        |
| Calories target         | <ul style="list-style-type: none"> <li>Predictive equation: Prefer hypocaloric feeding, &lt;70% of energy expenditure, in first 7 days</li> <li>IC: Prefer isocaloric feeding</li> </ul>                                                                                                      | <ul style="list-style-type: none"> <li>25–35 Kcal/kg/day depending on phase of trauma or indirect caloric meter guide</li> </ul>                                         | <ul style="list-style-type: none"> <li>Low risk malnutrition <ul style="list-style-type: none"> <li>Day 1–3: 15–20 Kcal/kg/day or 70–80% of REE</li> <li>Day &gt;3: 25–30 Kcal/kg/day or 100% REE</li> </ul> </li> <li>High risk malnutrition <ul style="list-style-type: none"> <li>Start with 25–30 Kcal/kg/day or 100% REE</li> </ul> </li> </ul> |
| Protein target          | 1.5–2.0 g/kg/day                                                                                                                                                                                                                                                                              | 1.2–2.0 g/kg/day                                                                                                                                                         | 1.2–2.0 g/kg/day                                                                                                                                                                                                                                                                                                                                     |
| Feeding intolerance     | GRV >500mL/6hr                                                                                                                                                                                                                                                                                | GRV >500 mL or clinical intolerance                                                                                                                                      | GRV >500 mL in unreliable physical exam or clinical intolerance                                                                                                                                                                                                                                                                                      |

### Nutrition supports open abdomen in trauma

In trauma scenarios, damage control surgery is recommended for patients with severe injuries exhibiting persistent hypotension, acidosis (pH less than 7.2), hypothermia (BT less than 34 °C), or coagulopathy, requiring an open abdomen for further evaluation. Abdominal compartment syndrome may develop following aggressive resuscitation or packing operations to control bleeding, further justifying the postponement of immediate abdominal closure<sup>50</sup>. An observational study by Burlew et al. involving data from 11 trauma centers that compared early EN and nil per os (NPO), showed that in patients without bowel injuries, EN correlated with a higher rate of fascial closure and significantly lower mortality. However, for patients with bowel injuries, early EN had no impact on fascial closure rates or mortality<sup>12</sup>. A meta-analysis of five observational studies indicated that EN significantly reduced mortality as well as the incidence of abdominal fistulas, but with the presence of heterogeneity<sup>51</sup>. Recent studies in Surgical and Trauma ICUs in France found that employing negative pressure therapy in an open abdomen setting with EN led to a lower incidence of secondary intra-abdominal complications; including anastomotic leaks and abscesses. Early EN, initiated within the first week, has been linked to increased open abdomen-free days<sup>52</sup>.

For patients with open abdomen, with or without bowel injury, current guidelines from the World Society of Emergency Surgery (WSES) advocate starting EN at 20 to 30 kcal/kg/day and 1.5 to 2.5 g/kg/day of protein within 48 hours, or as soon as gastrointestinal function is confirmed<sup>50</sup>. However, contraindications for early EN as gut obstruction, which is possibly due to bowel discontinuity after damage control surgery, bowel ischemia, high output fistula and unstable hemodynamics, must be excluded<sup>25</sup>. This is in line with recommendations from SCCM and ASPEN<sup>11</sup>, and the European Society of Intensive Care Medicine (ESICM)<sup>16</sup>.

### CONCLUSION

Effective nutritional management for trauma patients requires a personalized, phased strategy. Initial risk assessment utilizing tools; such as mNUTRIC, NRS 2002 scores, NT 2013 or the NAF score, is crucial for guiding interventions. For hemodynamically stable patients, early EN within 48 hours is essential. Optimal caloric intake can be calculated using predictive equations or IC measurements, as maintaining protein intake between 1.2 to 2.0 g/kg/day is important. Both calories and protein should be started with low amounts and progressively increased during specific phases after injury. Tailoring the route for delivery of nutrition, according to each patient's risk profile and metabolic state, is vital to reduce complications.

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