

# Common Controversies in Critical Care Nutrition: Review of Latest Evidences

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## Abstract

**Context** Critical care nutrition favorably influences patient prognosis and remains an essential component of overall patient care. Various guidelines and literature discuss the modalities, benefits, and other finer details of nutrition in intensive care units. Critical care nutrition is still an emerging modality and hence, ambiguity/subjectivity exists in various aspects. Clear recommendations are not there, especially when it comes to diverse topics such as nutrition screening/assessment, underfeeding patients, types of nutrition formulae, monitoring nutrition adequacy, and tolerance and likewise. This article is an attempt to address couple of these concerns and review the latest evidences/guidelines in context of nutrition screening/assessment and monitoring tolerance by measuring gastric residual volumes (GRVs).

**Evidence Acquisition** Various literature including existing guidelines, original articles, and review articles published till September 2019 and discussing the specifics of nutrition screening/assessment and monitoring tolerance by measuring gastric residuals were searched on popular scientific databases such as PubMed, Scholar Google, and Embase and reviewed for contextual relevance.

**Results** Majority of the recommendations/evidences in this regard are either inconsistent or incomplete. Most of the tools that are recommended for nutrition screening/assessment of critical care patients are not validated for this population. Majority of literature is unanimous on not recommending biochemical parameters to be used for this purpose. Recommendations for the acceptable values of GRVs are consistent but subjectivity exists on the frequency of measurement, timing of measurement in relation to meals, and other variables.

**Conclusion** Till the time, nutrition screening/assessment tools for critical care patients are validated in large multicentric settings, it would be prudent to adhere to the recommendations of existing guidelines. Similarly, GRV practices and cutoff values can be followed from relevant guidelines.

## Keywords

- ▶ enteral nutrition (EN)
- ▶ gastric residual volumes (GRVs)
- ▶ intensive care unit (ICU)

## Introduction

Nutrition is now regarded as very important in critical care settings (intensive care units, ICUs). Pathophysiologic changes in critical illness result in stress catabolism. There is systemic inflammatory response and associated organ

dysfunction complications that result in increased stay in ICUs and higher mortality.

Tube feeding remains the preferred way of providing enteral nutrition (EN) for these patients.<sup>1,2</sup> It helps to counteract the catabolic state, thus preventing further metabolic/substrate derangements and loss of muscle mass.

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Nutrition had been known for an adjunctive benefit in ICUs, helping to provide energy/proteins to such patients. The perceived benefits were to support nutrition adequacy as well as preserve lean body mass. Now, it is well understood that nutrition has therapeutic benefits as well. Nutrition helps to attenuate metabolic response to stress and prevent oxidative cellular injury. This in turn modulates innate immunity favorably.<sup>2</sup> Clinical improvement in ICUs may be achieved by timely and adequate EN along with meticulous glycemic control. Therapeutic use of EN may reduce disease severity and associated complications, decrease ICU stay, and improve patient prognosis.<sup>1,2</sup>

However, controversies still exist in certain domains of enteral feeding in critically ill patients. Practical challenges haunt the implementation of recommendations such as continuous feeding, irrelevance of gastric residual volumes (GRVs), underfeeding, trophic feeding, nutritional screening, or assessment and likewise.

### **Nutrition Screening/Assessment: Key Recommendations and Discrepancies**

Nutrition screening and assessment are distinct processes. Screening denotes identifying the patients, who are at risk of getting malnourished, either due to nutrition inadequacy or any illness. On the other hand, nutrition assessment helps to diagnose malnutrition as well as quantify the degree of malnutrition. American Society of Parenteral and Enteral Nutrition (ASPEN) guidelines 2016 recommended an early nutrition screen within 48 hours of admission for all hospitalized. Patients identified at-risk would need a formal nutrition assessment (tools of which have been discussed later in this section).<sup>2</sup>

Tools such as malnutrition screening tool, malnutrition universal screening tool, mini nutritional assessment, short nutritional assessment questionnaire, and subjective global assessment (SGA) are often used for this purpose.<sup>3</sup> Few studies showed that patients at malnutrition risk are likely to benefit more from early and adequate nutrition intervention. The incidence of nosocomial infections and overall total complications is less in such patients.<sup>4,5</sup>

Mehta et al<sup>1</sup> recommended SGA tool for nutritional assessment of all ICU patients, to be done preferably by the qualified nutritionists, dedicated to ICUs. Mehta et al's<sup>1</sup> guideline is the only guideline recommending the role of dieticians and their coordination with intensivists in performing nutritional assessment in ICU patients.

ASPEN guidelines 2016<sup>2</sup> stated that tools such as nutritional risk screening (NRS) 2002 and the nutrition risk in critically ill (NUTRIC) score identify patient's current nutrition status as well as disease severity.<sup>2</sup> Hence, they have been widely used to identify and assess nutrition risk in ICU settings. Patients at "risk" are defined by an NRS 2002 score >3 and those at "substantial risk" with a score ≥5 or a NUTRIC score ≥5 (if interleukin-6 [IL-6] is not included, otherwise >6).<sup>2,4,5</sup> Since IL-6 levels are usually not done, Heyland et al have shown that a NUTRIC score ≥5 will still indicate

high nutrition risk.<sup>6</sup> Interestingly, none of the parameters used in NUTRIC score are nutritional!<sup>7</sup>

Singer et al<sup>7</sup> (European Society of Parenteral and Enteral Nutrition, [ESPEN] guidelines 2018) disagreed with the recent ASPEN guidelines 2016<sup>2</sup> and stated that "gold standard" to define "at risk patient" and the malnourished patient in ICU is still lacking. This guideline stated the need to redefine "malnutrition associated with acute critical illness."

Ten nutrition screening tools were identified by a systematic review in this regard and subsequently five of them were further reviewed for prognostic values.<sup>8</sup> NRS 2002 had low bias and malnutrition risk identified with this tool appeared to be an independent risk for significant hospital mortality ( $p = 0.03$ ). NRS 2002 and MUST (Malnutrition Universal Screening Tool) are easily and quickly doable in ICUs. Both have the strongest predictive value for mortality, among all the commonly used tools in this regard. Since both are not validated prospectively, at best only expert opinions are available for their use.<sup>9</sup>

Going a step ahead, Mehta et al<sup>1</sup> recommended using computerized tomography or ultrasonography for the assessment of lean muscle mass in such patients. Utility of these two tools was reiterated by ESPEN 2018 guidelines.<sup>7</sup> Another easily available machine tool available for assessing the same in conscious patients (especially in the patients with adult respiratory distress syndrome) is hand dynamometer.<sup>10,11</sup> Bioelectrical impedance (BI) methods can be used in otherwise stable patient with no fluid compartment shifts.<sup>12</sup> However, the BI machines are very costly, and it is difficult to find such a stable patient in ICUs; BI tools are uncommon in use.

Despite no unanimity on the specifics of screening or assessment tools and their preference over the others in ICU patients, most of the existing literature are unanimous to recommend that biochemical markers such as c-reactive protein, albumin, and others cannot be relied upon for the assessment of nutrition status of ICU patients.<sup>1,2,7</sup>

### **Gastric Residual Volumes: Key Recommendations and Discrepancies**

Delayed gastric emptying is common in ICU patients. Patients on enteral feeding are closely monitored for gastric emptying delays while assessing EN tolerance and preventing feed aspiration. A survey conducted by Metheny et al found over 97% of nurses measuring GRV for monitoring EN feed tolerance. They took GRV threshold levels of 200 to 250 mL for interrupting EN.<sup>13</sup> Such practices of GRV measurement for monitoring gastric emptying are not standardized, hence unreliable. It fails to differentiate physiological secretions from the volume of EN fed. Around 4500 mL of physiological secretions including saliva and gastric juices reach stomach on daily basis, which are equivalent to ~188 mL/hour, in healthy subjects. This figure may vary in ICU patient and is enough to confound the GRV interpretations. Hence, the definition of "high" GRV still remains variable.<sup>14,15</sup> Debate also continues about the utility of checking GRVs, acceptable volumes, frequency/timing for GRV measurement,

and time to interrupt/restart feeding. Despite majority of evidences support not using GRVs to assess gastric emptying, the method is still widely practiced.

ASPEN 2016 guidelines state that GRV of 200 to 500 mL is alarming and measures to reduce feed aspiration should be undertaken.<sup>2</sup> However, there is no clarity on whether this recommendation is for conscious or unconscious patients or both. Subjectivity also exists in interpreting this recommendation like whether this cutoff is for 4 to 6 hourly or 24 hourly monitoring; and is it for continuous or bolus tube feeding patients? To clarify this ambiguity, Mehta et al<sup>1</sup> recommended 6 to 8 hourly GRV monitoring in all high-risk patients who are on bolus/intermittent feeds, with a cutoff value of 300 to 500 mL. The same guidelines recommended continuous feeding in such high-risk patients to obviate need for frequent GRV measurements. Whenever measured, it should be preferably done with syringe aspiration instead of suction pump.<sup>1</sup>

Patients with established EN and fair tolerance don't need GRV monitoring.<sup>16</sup> Springer et al (ESPEN 2018 guidelines)<sup>9</sup> recommended delaying EN feeding if GRV is >500 mL/6 hours. Canadian critical care systematic reviews 2018<sup>17</sup> also mention a threshold of 500 mL and state that there is no significant difference between GRV of 250 mL versus 500 mL on effecting infections, mortality, and ICU/hospital length of stay. Reducing the frequency of GRV measurement from every 4 hours versus up to every 8 hours is found to be associated with a reduction in episodes of vomiting/regurgitation.

Increased feeding tube clogging, EN interruptions, and consumption of nursing time/resources are key adverse consequences of frequent GRV measurements. This results in nutritional inadequacy and may adversely affect clinical outcomes.<sup>14</sup>

Little evidence is available about returning or discarding the aspirated GRVs. Booker et al found lower potassium levels, when gastric contents were discarded rather than returning.<sup>18</sup> Canadian critical care systematic reviews 2018<sup>17</sup> mention that returning GRVs was not associated with higher gastric complications. However, feeding tubes were frequently occluded when the GRVs were returned.<sup>18</sup> This underlined the importance of routine water flushes after GRV checks.

## Discussion

It remains unclear if the available nutrition screening tools appropriately identify patients at malnutrition risk and subsequently requiring detailed nutritional assessment. Intensivists should check the clinical settings and population with regard to the tool validation. This will help them to determine the appropriateness of using the same in their clinical settings. The ESPEN guidelines 2003<sup>19</sup> state that the purpose of nutrition screening is to predict the probability of a better or worse outcome due to nutrition factors and whether nutrition treatment is likely to influence this. The screening tools used for community malnutrition focus more on nutrition variables to find out starvation/malnutrition

and identify at-risk patients. However, the clinical aspects of disease should be considered along nutritional parameters measurement in ICUs, to identify the prospective benefits of nutrition intervention.<sup>19</sup>

GRV measurement is also an unreliable method to monitor nutrition tolerance, which often results in undesirable feeding interruptions and nutritional inadequacy. GRV thresholds are not standardized and so are the acceptable frequency, timing, and fate of aspirate.<sup>20</sup> Patient positions, syringe (size) used to aspirate, its diameter, and distal tube location also influence the GRV accuracy.<sup>21,22</sup> Alternative techniques such as scintigraphy, paracetamol absorption test, breath tests, refractometry, ultrasound, and gastric impedance for gastric emptying or tolerance monitoring are also available. These appear to be more sensitive than measuring GRV; however, all these are still to be validated in context of ICU settings. Costing and technical expertise required remain an issue when adopting any of them on mass scale for clinical routine.

## Conclusion

Nutrition screening/assessment is important to identify patients, who may benefit from nutrition intervention. The validation of tools identified and discussed is questionable in critical care settings. Choosing the appropriate tool for critical care setting and nutrition care goals remains at discretion of clinicians. A standardized and validated method for evaluating EN tolerance in the critically ill patients is needed to avoid unnecessary interruptions in nutrition care and ensuring nutrition adequacy goals. Indiscriminate usage of GRV measurements should be avoided.

Since large validation studies are available for nutrition screening/assessment tools and GRV measurement, it will be appropriate to adhere the latest guidelines/evidences in day-to-day clinical practice in ICUs.

### Conflict of Interest

None.

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