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EDITORIAL

# Challenges and considerations in delivering nutritional therapy in the ICU during COVID-19 pandemic

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Coronavirus disease 2019 (COVID-19) has created unprecedented challenges for healthcare workers in Singapore and across the world. Providing clinical nutrition and metabolic care to patients with COVID-19 has been highly challenging. In this issue of the *Annals*, Lew et al.[1] reported the results of a multicentre retrospective observational study on critically ill patients with COVID-19 in the intensive care unit (ICU). The authors found that more than 25% of these patients lived with obesity and/or diabetes, and a large majority have received neuromuscular blockade (70%), prone therapy (45%) and dialysis (37%). The median ICU and hospital length of stay (LOS) was 11.0 days (interquartile range [IQR] 7.0–21.8) and 31.0 days (IQR 19.3–44.0), respectively, for patients who recovered from COVID-19.[1] In this editorial, we discuss how the results from Lew et al. have implications on nutritional support practices and future research direction in Singapore.

There were significant nutritional concerns observed from the results of the study. Firstly, due to COVID-19, none of the study sites performed nutritional assessment as physical examination for the patients was required.[1] Secondly, refeeding hypophosphataemia, a potentially serious complication, was found in 6% of the cohort. Thirdly, prone therapy was not associated with a higher incidence of high gastric residual volume (GRV) in patients on enteral tube feeding. Fourthly, only 54% of the patients met their minimal goal energy (≥15kcal/kg actual body weight) requirements, and none of the patients met their minimal goal protein (≥1.2g/kg actual body weight) requirements during their ICU stay. Lastly, late enteral nutrition (initiated >36 hours) was associated with higher hospital mortality (adjusted relative risk 9.0, 95% CI 2.3–36.0).

**Safety of implementing nutrition support.** Before the availability of vaccinations and an adequate supply of personal protective equipment, healthcare professionals were concerned with how to safely insert feeding tubes or determine enteral feed intolerance via the usual methods of gastric residual volumes.[2] The generally used weight-based predictive equations are considered less accurate, while indirect calorimetry—a gold standard for measuring energy needs—was deemed impractical due to the difficulty in ensuring sterility.[2,3]

Nutritional assessment was not considered an essential aspect of nutritional therapy during the pandemic due to the difficulty in performing a physical assessment, as shown by Lew et al.[1] One of the general concerns in the ICU is the determination of caloric and protein requirements of critically ill patients.[2,4] To overcome this, the authors suggested that nutritional screening tools that do not involve physical assessment could be used in the ICU; alternatively, clinicians could focus on risk factors such as age, length of time with minimal intake before initiation of nutritional intervention, and specific metabolic disturbances (e.g. hypokalaemia, hypomagnesaemia and hypophosphataemia).

**Obesity, diabetes and metabolic disturbances in COVID-19.** The difficulty in assessing the nutritional needs of critically ill patients with obesity is exacerbated during the pandemic. The prevalence of obesity in the study by Lew et al. (54%) was disproportionally higher than the prevalence (10.5%) in Singapore, which is concerning. It is known that for some time, the obesity paradox described by observational data provided some reassurance that patients who are overweight or obese (Class I and II) have better outcomes with lower mortality rates, compared to patients with a normal body mass index.[5]

However, COVID-19 has invalidated this obesity paradox. Obesity increases COVID-19 infection, hospitalisation, the severity of disease, ICU admission and mortality.[6] Similarly for diabetes, a common comorbidity in patients with obesity, where a higher risk of hospitalisation, ICU admission and mortality has also been observed.[6]

Electrolyte and metabolic disturbances should be routinely monitored in ICU patients. Although Lew et al.

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found refeeding hypophosphataemia in only 6% of the patients observed, a recent study reported a higher rate of 36%.[7] Due to the difficulties in providing nutritional therapy for these patients, their risk of refeeding syndrome may increase throughout the ICU stay.

**Prone positioning, extracorporeal membrane oxygenation and paralysis in the ICU.** During the early periods of the pandemic, basic nutrition principles were extrapolated from existing critical care nutrition guidelines, such as the American Society for Parenteral and Enteral Nutrition (ASPEN) and Society of Critical Care Medicine (SCCM) 2016 guidelines, recommending early gastric feeding with a gradual increase to goal. This included patients who required prone positioning, extracorporeal membrane oxygenation (ECMO), or paralysis by neuromuscular blockade.[8]

Patients with COVID-19 benefit from prone ventilation, which frequently requires the liberal administration of opiate analgesia, leading to gastrointestinal intolerance such as increased gastric residual volumes.[8] Although Lew et al. found no relationship between prone therapy and GRV, several guidelines recommend prokinetics and insertion of post-pyloric tubes.[2] However, there is no consensus on whether GRV should be monitored, at which time points, and at what cut-off values.[2]

**Nutritional requirements for the critically ill patient with COVID-19.** Only half of the patients observed by Lew et al. received an energy intake of 15kcal/kg/day. This contrasted with the findings by Chen et al.[9] where 75% of the ICU patients received 15–20kcal/kg/day. In this small observational study (n=8), ICU patients were referred to a multidisciplinary team of rehabilitative medicine specialists and allied health professionals (dietitians and occupational/physical/respiratory/speech therapists) for early rehabilitation.

Although the mean Acute Physiology and Chronic Health Evaluation II (APACHE II) scores of both ICU populations were similar, only a quarter of the patients received prone therapy in the study by Chen et al., compared to almost half of the patients examined by Lew et al. This difference had probably led to a lower caloric intake in the latter's patient group since patients on prone therapy may have more feeding disruptions.

Interestingly, the protein intake of patients from both studies was similarly low (<1.2g/kg/day), even though Chen et al. reported a higher caloric intake. This could be due to the choice of tube feeds secondary to fluid restriction, feeding intolerance, non-availability of high protein feeds, or different ICU feeding practices (e.g. Lew et al. reported the use of bolus protein doses but not Chen et al.).

Presently, slow and gradual energy and protein delivery is recommended during the first 5–7 days.[2] However, recommendations for energy and protein prescriptions vary between 20–30kcal/kg/day and 1.2–2.0g protein/kg/day.[2] The recently updated ASPEN/SCCM 2021 guidelines concluded that no significant difference in clinical outcomes was found between patients with higher versus lower levels of energy intake, and limited data were available for protein intake more than the current recommendations.[4]

Non-nutritional calories from propofol and/or dextrose administration should also be considered when evaluating energy delivery.[2] This is supported by another recent Singapore study where patients on continuous renal replacement therapy may receive up to 331kcal from trisodium citrate anticoagulant (which provides substrate intermediates for adenosine triphosphate [ATP] production through Kreb's cycle in the mitochondria).[10]

**Nutritional support practices in the ICU and post-ICU.** Late initiation of enteral nutrition (>36 hours) has been found by Lew et al.[1] to increase mortality by 9-fold. However, approximately 96% of the patients in the study were initiated on enteral nutrition within 36 hours of ICU admission, in line with existing guidelines (<48 hours).[2] The results would need to be interpreted with caution due to the small sample size for late enteral nutrition.

Limited studies focus on the long-term effects of COVID-19, particularly for critically ill populations. Therefore, while waiting for new evidence to emerge, it is beneficial to focus on improving the nutritional status of patients who may be malnourished to facilitate their post-ICU recovery. Dietary counselling with or without oral nutritional supplements (ONS) has been found to reduce complications and 6-month mortality for patients who are malnourished or at risk of malnutrition.[11] However, unsupervised provision of ONS without targeted education neither benefits the at-risk population[11] nor remains cost-effective as critically ill patients with COVID-19 tend to have extended hospitalisation.

**Conclusion.** Singapore institutions have performed well in the nutritional management of critically ill patients during the pandemic in terms of early initiation, monitoring and managing complications related to nutritional support. However, more must be done to achieve adequate nutritional intake for patients with long ICU stays. Future research on COVID-19 should focus on the clinical and nutritional outcomes of the post-ICU patient populations. More multicentre nutrition-related studies involving various institutions are encouraged, to increase the sample size of study populations and advance the quality of clinical nutrition research in Singapore.

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