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Nutritional priorities in patients with severe COVID-19

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Abstract

Purpose of review: The COVID-19 pandemic has altered the profile of critical care services internationally, as professionals around the globe have struggled to rise to the unprecedented challenge faced, both in terms of individual patient management and the sheer volume of patients that require treatment and management in intensive care. This review article sets out key priorities in nutritional interventions during the patient journey, both in the acute and recovery phases.

Recent findings: This review covers the care of the acutely unwell patient, and the evidence base for nutritional interventions in the COVID-19 population. One of the biggest differences in caring for critically ill patients with acute respiratory failure from COVID-19 is often the time prior to intubation. This represents specific nutritional challenges, as does nursing patients in the prone position or in the setting of limited resources. This article goes on to discuss nutritional support for COVID-19 sufferers as they transition through hospital wards and into the community.

Summary: Nutritional support of patients with severe COVID-19 is essential. Given the longer duration of their critical illness, combined with hypermetabolism and energy expenditure, patients with COVID-19 are at increased risk for malnutrition during and after their hospital stay.

Key words or phrases:

Nutritional delivery; COVID-19; Respiratory failure; Recovery

Introduction

The COVID-19 pandemic has altered the profile of critical care services internationally, as professionals around the globe have struggled to rise to the unprecedented challenge

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faced, both in terms of individual patient management and the sheer volume of patients that require treatment and management in intensive care. With advancements in therapies to treat acute COVID-19 infections, clinicians, patients and national governing bodies are increasingly aware that surviving COVID, or survivorship needs to be equally prioritised. Comprehensive reporting of survivorship post-hospitalization for COVID infection are now available, and while these are grim reading, it is clear that, in the main, COVID survivorship is phenotypically similar to post-intensive care syndrome, which has mature domains for research and for simple clinical interventions[1,2]. This review article sets out key priorities in nutritional interventions during the patient journey, both in the acute and recovery phases.

The Acutely unwell patient

Primum non nocere

Whilst incorrectly often ascribed to the Hippocratic Oath, the adage of "*first, do no harm*" is a defining sentiment of modern critical care practise. The first wave of the pandemic saw many interventions (both nutritional and non-nutritional) being used and touted as preventative. We now know these were likely the result of moral panic (concerns that things were so bad that something had to be done) or moral blindness (the need to do things rapidly without due diligence)[3]. No new, specific nutritional intervention or supplement has been demonstrated to improve outcomes in patients who are critically ill with COVID-19. Vitamin D supplementation has perhaps the highest profile, yet its role is unclear, with only observational data available, and therefore only hypothesis generating[4]. Observational data on Vitamin D deficiency in critically ill patients without COVID have failed to translate into benefit from Vitamin D supplementation[5]. Similarly, despite observational data, Vitamin C and Zinc have yet to demonstrate a signal for efficacy in patients with COVID-19[6,7]. Probiotics remain highly topical, but supportive data are being developed, and it should be noted that no signal for benefit was seen in the unselected critically ill population[8,9].

What is clear is that intensive care teams struggle to deliver adequate nutrition to patients, with or without COVID-19 infection. Feed stoppages for surgery and other interventions are routine and vary across institutions.[10] This variation results in critically ill patients having feed stoppage prior to surgery for 4 –12 hours, and 2–12 hours prior to airway procedures and similarly after the procedure.[10] Feed is further stopped for up to 0–12 hours to facilitate transfers for diagnostic imaging.[10] On extubation, dysphagia is common, further impeding oral intake[11]. These interruptions, in addition to lack of access, feeding intolerance and interruptions for diagnostic imaging, result in patients receiving on average of 60% of their energy and protein requirements, leading to malnutrition.[12]

Patients would be better served by critical care teams focussing on delivering basic nutritional requirements, as opposed to reaching for unproven and untested interventions such as those detailed above. Focusing strained resources and manpower away from evidence-based recommendations may indirectly lead to harm.

Nutritional Delivery in the Not Intubated Critically Ill Patient with COVID-19

One of the biggest differences in caring for critically ill patients with acute respiratory failure from COVID-19 is often the time prior to intubation. In patients without COVID, this time is often short, on the order of a few days. However, in patients with COVID, this time can be on the order of weeks. Patients with acute hypoxic respiratory failure from COVID often have prolonged periods of time on high flow nasal cannula or non-invasive ventilatory support. In many patients, current practice is to delay intubation for as long as possible. While this may improve overall outcomes, it often results in critically ill patients spending prolonged time on oxygen support devices that make it difficult to consume adequate oral intake. While early in the critical illness patients may be able to tolerate being off non-invasive ventilation for meal breaks, as their acute respiratory failure progresses, these meal breaks are tolerated less well, or not at all. These instances should be anticipated, and a nasogastric feeding tube should be placed early in patients with lingering hypoxia in order to facilitate supplemental or essential nutritional support.

Nutritional delivery techniques

Over the last few years, stocks of feed pumps have on occasion been depleted. Global and local supply chains have further been affected by staff sickness and varying national decisions to close international borders. While intermittent or bolus feeding has not been shown to improve outcomes, safety data became available during the first wave of the pandemic[13]. A 6-times a day bolus feeding regimen was seen to be safe, with no increase in incidence of diarrhoea, vomiting, or increased gastric residual volumes. Of note serum glucose was not as well controlled, which needs to be considered in the setting of lower nursing ratios and dexamethasone treatment. However on balance, given the alternative of not feeding patients due to resource limitations, the British Dietetic Association recommends bolus feeding in the setting of a lack of feeding pumps[14]. Unfortunately, this may not extrapolate to patients nursed in the prone position, as there are no safety data to support the practice in patients undergoing prone positioning.

Prone positioning

Patients with severe COVID-19 infections develop acute respiratory failure, fulfilling Acute Respiratory Distress Syndrome (ARDS) Berlin definition criteria[15]. Pre-COVID evidence –based guidance for ARDS management include prone positioning, which may be applied for several days[15]. Data prior to the pandemic had been scanty[16]. The largest prospective observational study comprised of 51 patients, proned on average for 60 hours while receiving continuous nasogastric feeding[17]. No differences were seen in safety data between supine and prone position, and nutritional delivery was similar. On the basis of current, limited evidence, and balancing harm versus benefit, patients should continue to be fed enterally, regardless of positioning for management of ARDS. When feeding enterally in the prone position, it may be of benefit to raise the head of the bed or place the entire bed at an incline up to 30 degrees in an attempt to reduce the risk of aspiration.

Glucose control

Demographic data suggest that a third to half of patients' hospitalised for acute COVID-19 infection have evidence of hyperglycaemia, with or without pre-existing diabetes[18,19]. Dexamethasone is now a mainstay of treatment for COVID-19, and its use worsens glucose control. In the setting of strained resources, glucose monitoring may be sub-optimal, increasing the risk of episodic hypoglycaemia, which has significant adverse consequences for patients. Unfortunately, solutions do not seem obvious. Several experts have suggested continuous glucose monitoring, however this is unlikely to be accessible for the majority of critical care units[20]. What is needed is increased education on the interplay between feed stoppages and insulin infusions (risk of hypoglycaemia) and the varying need for insulin for acute to sub-acute phases, and with decreasing doses of Dexamethasone. In addition, enteral formulas that are lower in carbohydrates and contain whey protein may also reduce the incidence of hyperglycaemia and glucose variability[21].

Persistent Immunosuppression, Inflammatory catabolism Syndrome

Critically ill patients with COVID-19 have mean lengths of stay that may be far greater than that of non-COVID patients. In the UK the median length of stay in wave was between 7 and 12 days, rising to 20 days in patients requiring advanced respiratory support[22]. Recent data from indirect calorimetry demonstrate that these critically ill patients with COVID maintain high levels of hypermetabolism and increased energy expenditure for weeks[23]. Many critically ill patients without COVID develop a Persistent Immunosuppression, Inflammation, and Catabolism Syndrome (PICS) that results in longer-lasting residual physical, functional, mental and emotional co-morbidities. The even more prolonged ICU lengths of stay with hypermetabolism seen in critically ill patients with COVID place them at increased risk of developing PICS, a state characterised by intramuscular inflammation and altered muscle metabolism[24,25]. There exists a lack of clarity on the best nutritional practises in this setting, but patients are at risk of being over fed on two counts. Firstly protein delivered may not be utilised for protein synthesis. In this setting, amino acid oxidation will increase urea production (in itself harmless) but also tissue ammonia, which may worsen abnormal metabolism via cataperesis, be toxic to mitochondria, and alter muscle function[26]. Secondly, patients who are critically ill lose muscle mass at rates of 2–3% per day, and so will have significant loss of lean body mass by day 20, often reflected in a drop in serum creatinine[27,28]. It is highly likely that predictive equations will be inaccurate in these settings, leading to overfeeding, which is associated with adverse outcomes. Monitoring of actual resting energy expenditure may be useful in this setting, and the Urea-to-Creatinine ratio may offer a bedside diagnosis (In conjunction with clinical data) of altered metabolism[29].

Recovery: in hospital

When patients are discharged to the hospital wards from ICU, they continue to be at risk of malnutrition as a result of patient (lack of appetite, absence of taste or smell sensations, impaired swallowing, lack of activity), structural (staff training, meal documentation) and process (meal timing and delivery) factors.[30,31] Several of these factors may be addressable with staff awareness and education, but must be explicitly looked for and managed.

Transition to oral intake

There are no published guidance or data on the acceptable threshold for cessation of enteral nutrition support, which has led to underfeeding both post extubation and during the recovery phase of critical illness. After critical illness, underfeeding continues due to patient (muscle weakness, dysgeusia, and dysphagia) and healthcare delivery (feeding tube removal, system-wide factors related to the timing and provision of hospital food) factors[32]. The Post-Intensive Care Unit Presentation Screen tool is a validated tool for multi-disciplinary evaluation of patients following discharge from Intensive Care[33,34]. Patients who are eating less than or equal to half of their hospital meals are considered to be partially enteral tube feeding dependent, and those that eat less than three-quarters and "*require supplements and/or assistance throughout meals*" are considered to be vulnerable to malnutrition[35]. In a national service evaluation, two- thirds of critical illness survivors were at risk of malnutrition, and 10% of patients who required expert dietetic input based on these criteria did not receive any such input[35].

Dysphagia

Prolonged intubation or subsequent tracheostomies are common in the critically ill COVID patient, as a result of extended needs and uses of advanced respiratory support[22]. Laryngeal injury is unsurprisingly common, but is often undetected, leading to delays in increasing oral intake, contributing to hospital-acquired malnutrition in this vulnerable population[36]. Clinical evaluation of dysphagia can be augmented by the use of fibreoptic endoscopic evaluation of swallowing (FEES). This allows direct visualisation of swallowing function, allowing definitive diagnoses of dysphagia and nutritional planning. This is a specific importance for the COVID-19 critically ill patient, as laryngeal oedema is common, a result of numerous factors[37]. Close working with Speech and Language Therapists is therefore fundamental to ensure that decisions on whether the patient can receive oral intake, as well as the nature and consistency of the optimal oral intake, are made appropriately, promptly and definitively.

Synergism with exercise

As patients recover from critical illness, mobilisation and exercise rehabilitation are required to regain functional capacity, and to attempt to increase muscle mass. Exercise is a catabolic stimulus without adequate ingestion of protein[38]. Nutritional interventions are therefore inexorably linked to physical rehabilitation and adequate nutritional delivery is vitally important to any successful rehabilitation.

Restitution: in the community

Appetite

One of the heralding symptoms of SARS-CoV-2 infection is dysgeusia or ageusia[39]. Unfortunately, this symptom can linger for months, even when patients are recovering from their acute critical illness. This alteration or loss of smell and taste can make eating difficult. Patients may already lack an appetite from their chronic illness, inflammation, and lack of activity. Then, in addition, when food is offered to them, it is without flavor or

with unappealing taste. No treatment for the dysgeusia has been discovered, but the diets of patients recovering from COVID should be liberalized and numerous different foods should be offered to find food that is appealing. In addition to increasing physical activity as tolerated, appetite stimulants like marinol may increase patients' desire for food though the evidence for efficacy is lacking[40].

Exercise

As with post-ICU hospital stays, exercise is an important component of recovery. However, exercise is less effective, and potentially impossible, without adequate nutritional support as the two are synergistic[41]. Nutrition and exercise work together to re-build muscle that has been lost, regain strength, and rehabilitate patients back into functioning in society. During exercise, nutritional adequacy is essential to support muscle and strength building.

Meal Planning

Adequate meal consumption remains the ultimate goal of meal planning. The timing of meals should coordinate with sessions of exercise, ideally soon after exercise completes to allow for muscle building from protein intake[38]. In addition, meal planning should include multiple different foods and food types to round out nutritional stores and offer food that is appealing to the recovering patient.

Conclusions

Nutritional support of patients with severe COVID-19 is essential. Given the longer duration of their critical illness, combined with hypermetabolism and energy expenditure, patients with COVID-19 are at increased risk for malnutrition during and after their hospital stay. While no specific nutritional intervention has currently been demonstrated to improve outcomes, overall excellent nutritional support with macronutrients is a vital component to any recovery and rehabilitation. Unique challenges, such as prolonged treatment time on non-invasive ventilation and increased time treated in the prone position have required some adjustments in practice to ensure adequate nutrition is delivered throughout the course of the illness. Importantly, the close monitoring with nutritional support therapy must extend beyond the acute illness in the ICU and into the in-hospital recovery, rehabilitation, and post-hospital restitution periods in order to facilitate optimal long-term outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Main ideas:

- A focus on unproven therapies may be detrimental, as efforts should be concentrated on delivery appropriate, evidence-based nutrtion, which is challenging.
- Patients treated with non-invasive respiratory support often do not receive adequate nutrition.
- Bolus feeding is safe in the supine position, and may be used as an alternative when pump shortages occur.
- Transition to oral intake, dysphagia and systems based factors place patients discharged from ICU onto the hospital wards at risk of malnutrition.
- Recovery in the community needs to include exercise, meal planning and management of lack of appetite.