CLINICAL OBSERVATIONS

Medical nutrition therapy for patients with malnutrition post–intensive care unit discharge: A case report of recovery from coronavirus disease 2019 (COVID-19)

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Abstract

Patients discharged from an intensive care unit (ICU) are frequently malnourished and experience ongoing inadequate nutrition intake because of a variety of barriers, which may lead to further declines in nutrition status. The coronavirus disease 2019 (COVID-19) pandemic has drawn increased awareness to this vulnerable patient population and the importance of nutrition rehabilitation to promote optimal recovery from acute illness. Despite this, there are no formal guidelines addressing medical nutrition therapy during the post-ICU recovery phase. This review provides an overview of the nutrition management of patients during the post-ICU recovery phase with a specific focus on COVID-19. A case study will demonstrate how medical nutrition therapy improved the nutrition status and quality of life for a patient who became severely malnourished after a prolonged hospitalization for COVID-19.

KEYWORDS
COVID-19, intensive care unit, malnutrition, medical nutrition therapy, rehabilitation

INTRODUCTION AND STATEMENT OF PURPOSE

Malnutrition is prevalent among patients who are critically ill and is associated with poorer outcomes.[1,2] There are numerous guidelines addressing the nutrition management of patients who are critically ill, including those published by the American Society for Parenteral and Enteral Nutrition (ASPEN) & Society for Critical Care Medicine (SCCM),[3] the European Society for Clinical Nutrition and Metabolism,[4] and the Canadian Clinical Practice Guidelines.[5] However, there are no guidelines addressing the nutrition needs of patients following intensive care unit (ICU) discharge. Poor nutrition intake often continues after ICU discharge because of barriers such as anorexia, weakness, depression, anxiety, and delirium,

which may lead to further declines in nutrition status.[6–10] The need for ongoing nutrition care to promote nutrition rehabilitation and to optimize outcomes in this patient population has been increasingly recognized, particularly for patients who are malnourished.[11]

The purpose of this manuscript is to review the nutrition management of patients during the post-ICU recovery phase, including the etiologies that initially contribute to malnutrition during an ICU stay and the physiologic, psychological, cognitive, and metabolic sequelae of critical illness which contribute to ongoing inadequate nutrition intake after ICU discharge. Specific references to coronavirus disease 2019 (COVID-19) will be highlighted given the widespread pandemic and the particularly hypercatabolic nature of this disease which may prolong post-ICU recovery.[12] A case study, we will showcase these

principles and demonstrate how medical nutrition therapy (MNT) improved the nutrition status and quality of life for a patient who became severely malnourished after a prolonged hospitalization for COVID-19.

LITERATURE REVIEW

COVID-19 is caused by the novel coronavirus SARS-CoV-2 that was originally identified in the city of Wuhan of China's Hubei province in late December of 2019.[13] COVID-19 typically presents with influenza-like symptoms including cough and fever and weakness though gastrointestinal symptoms including nausea, vomiting, diarrhea, dysgeusia, and hyposmia have also been reported.[14] Because of the high incidence of disease and high rate of transmission, the World Health Organization declared COVID-19 a pandemic in early 2020.[15] As of the time of this writing (January 15, 2021), there have been 23,193,703 reported cases of COVID-19 in the United States with 387,255 deaths.[16] Worldwide cases exceed 91 million.[17] Although most individuals are either asymptomatic or present with only mild symptoms, some individuals will develop severe symptoms including acute respiratory distress syndrome (ARDS) and multiorgan failure, requiring admission to an ICU.[14] In total, approximately 20%–30% of patients will require hospitalization with 5%–10% of patients requiring admission to an ICU.[18] Black and Hispanic individuals are at greater risk of severe illness from COVID-19 that may be due to biological factors, socioeconomic disparities, and a relatively higher prevalence of comorbidities seen in comparison with other racial and ethnic groups.[19,20] Other populations at higher risk for severe illness from COVID-19 include individuals who are older and/or with comorbidities, such as diabetes mellitus, cardiovascular disease, and chronic disorders of the kidneys, liver, and lungs.[21] These populations are also seen to have a higher risk of malnutrition.[22]

Malnutrition is prevalent among patients who are critically ill with cited prevalence rates ranging from 38% to 78%.[1] Malnutrition may result, in part, from inadequate nutrition provision during the patient's ICU stay. The 2016 ASPEN/SCCM nutrition support guidelines recommend that patients who are critically ill and at high nutrition risk receive nutrition support that meets at least 80% of their target energy requirements.[3] However, a large international multicenter observational study by Heyland et al[23] in 2015 found that 74% of patients did not meet this target. A recent nursing survey found that the three most commonly reported barriers toward the delivery of adequate nutrition were late initiation of enteral nutrition, feeding tube displacements, and nutrition being offset by other patient-care issues.[24] Further-

more, measures to improve nutrition adequacy, including volume-based feeding protocols and supplemental parenteral nutrition, may be underutilized.[23]

Aside from undernutrition, inflammation from disease has been increasingly recognized for its role in the pathogenesis of malnutrition. Inflammation accelerates protein catabolism, limits protein anabolism, increases resting energy expenditure (REE), and promotes anorexia.[25,26] The relationship between inflammation and malnutrition has been incorporated into the malnutrition diagnostic frameworks of the ASPEN and Academy of Nutrition and Dietetics (Academy) 2012 consensus recommendations[25] and in the Global Leadership Initiative on Malnutrition (GLIM)[26] criteria. It is recognized that inadequate nutrition provision in the patient who is acutely ill with severe inflammation (such as with trauma, burn injury, or sepsis) will lead to accelerated deterioration of nutrition status compared with inadequate nutrition provision in patients with inflammation of mild to moderate degree or with no inflammation.[27]

The relationship between inflammation and malnutrition is particularly relevant with regards to COVID-19. Severe COVID-19 may result in ARDS and/or multiple-organ failure associated with a cytokine release syndrome.[28] These syndromes have been associated with a profound inflammatory response.[25,26,28] This inflammatory response likely contributes to the hypermetabolism that has been documented in patients who are critically ill with COVID-19. Whittle et al[29] published their initial findings from the Longitudinal Energy Expenditure and Metabolic Effects in Patients with COVID-19 study. The authors found progressive hypermetabolism after the first week of ICU admission through the third week of ICU admission.[29] Mean REE measured via indirect calorimetry was 150% of that predicted by the Harris-Benedict equation, with some individuals exhibiting metabolic responses greater than two times predicted.[29] Similarly, Yu et al[30] published indirect calorimetry measurements for seven patients critically ill with COVID-19. Median measured REE was 4044 kcal/day (range: 2845 to 5414 kcal/day), or approximately 236% of predicted requirements.[30] Thus, estimating energy requirements via predictive or weight-based equations in patients who are critically ill with COVID-19 may significantly underestimate true energy requirements and lead to underfeeding. Indirect calorimetry is typically recommended as the criterion standard to assess energy needs in patients who are critically ill.[29] However, this has not been recommended in patients with COVID-19 because of the increased risk of equipment contamination and viral exposure to conducting personnel.[22,31] The theoretical risk of malnutrition in patients with COVID-19 has been demonstrated in two cross-sectional studies. One

study of 182 older inpatients with COVID-19 in Wuhan, China found a high prevalence of malnutrition (52.7%) when assessed using the Mini Nutritional Assessment (MNA).[32] Similarly, another study of patients who were critically ill with COVID-19 found that 66.7% of patients were malnourished when assessed using the GLIM criteria.[33] Of note, it is not yet known how long the hypermetabolic phase of COVID-19 lasts, though other acute inflammatory disease states such as sepsis[34] and burns[35] result in hypermetabolic states which may persist for months to years.

The risk of malnutrition in patients who are critically ill warrants assessment as malnutrition is associated with poorer outcomes.[1,2,36] A systematic review by Lew et al[1] concluded that malnutrition in patients who were critically ill was an independent risk factor for poorer outcomes including ICU length of stay, ICU readmission, infection, and mortality. Another large retrospective cohort study by Mogensen et al[2] of 6518 patients who were critically ill found that malnutrition was independently associated with increased mortality. Furthermore, malnutrition may lead to increased susceptibility to infection and disease burden which can lead to further declines in nutrition status.[31] Because of this, appropriate assessment and diagnosis of malnutrition as well as targeted interventions to prevent worsening malnutrition are warranted.[36] Because acute inflammation limits anabolism, the goals of nutrition support for the patient who is critically ill typically focus on preventing or delaying malnutrition rather than restoring nutrition status.[27] Conversely, after the acute illness phase (ie, during the post-ICU recovery phase), nutrition care plans should target optimizing energy and protein intake to promote restoration of nutrition status.[11]

Unfortunately, research indicates that patients are not meeting their nutrition requirements after ICU discharge. Peterson et al[6] found that the average nutrient intake of a cohort of 50 patients post-ICU discharge met <55% of requirements over a 7-day follow-up period. Ridley et al[7] found that the median nutrition intake of a cohort of 32 patients discharged from an ICU met 79% and 73% of energy and protein requirements, respectively, over a 28-day period. Nutrition intake was better in patients who were receiving supplemental enteral nutrition vs those on oral diet alone.[7] Wittholz et al[8] conducted a prospective cohort study of 28 patients who were critically ill and admitted for trauma injury. After discharge from ICU, patients met 64% and 72% of energy and protein requirements, respectively, over a 5-day period.[8] Furthermore, patients lost significant weight (mean weight loss = 2.6 kg; 95% confidence interval (CI), −0.98 to −4.2; $P = .004$) and muscle mass as measured via ultrasound (mean loss = 0.23 cm; 95% CI, 0.06–0.40; $P = .01$) over this timeframe.[8] Chapple et al[9] investigated the nutrition intake of 51

ICU survivors 3 months after ICU discharge compared with healthy controls. The ICU survivors had significantly lower calorie intake compared with healthy controls (1876 vs 2291 kcal, $P = .021$).[9] Additionally, 71% of the ICU survivors reported that their appetite was lower than prior to ICU admission.[9]

Patients encounter many barriers to adequate nutrition intake during the post-ICU recovery phase that may relate to features of post-ICU syndrome (PICS).[37] PICS refers to the physical, psychological, and/or cognitive sequelae of critical illness resulting in impairments in quality of life post-ICU discharge.[12] These impairments include critical illness polyneuropathy, limitations in physical function, depression, anxiety, posttraumatic stress disorder, and impairments in memory, attention, and processing.[38] It is important to note that these impairments may persist for years.[38] The prevalence of various features of PICS is shown in Table 1. Risk factors for PICS relate to the severity of critical illness, age, and comorbidities.[38] There is concern that COVID-19 may result in a relatively greater incidence of PICS compared with other disease states given the relatively longer length of stay these patients experience and social isolation that may contribute to depressive symptoms.[12]

Merriweather et al[10] conducted a descriptive study to identify factors which contribute to poor nutrition intake in hospitalized patients who have been discharged from an ICU. Identified factors included physiologic barriers (including weakness, poor appetite, early satiety, dysgeusia, pain, and sleep disturbances) and psychological barriers (including depression, anxiety, and delirium).[10] The authors highlighted the theme of patients adjusting to dysfunctional bodies which are unable or limited in their usual ability to perform daily activities.[10] Patients reported "feelings of anxiety, stress, fear, concern, and frustration in relation to their altered bodies."[10] These physiologic and psychological sequelae remained present in some patients at 3 months post-ICU discharge.[10]

MNT presents as a key therapeutic strategy to optimize nutrition intake, promote nutrition rehabilitation, and potentially improve outcomes for malnourished patients entering the post-ICU recovery phase. Unfortunately, there are no published guidelines for the nutrition management of patients during this phase. Recommendations are adapted from research of malnutrition associated with other disease states and/or expert opinions. For instance, severely malnourished (yet otherwise healthy) participants in the Minnesota Starvation Study required up to 3000–4200 kcal/day to support weight regain.[39] Similar requirements are seen in the anorexia nervosa population with suggested energy targets of 30–40 kcal/kg/day, increasing up to 70–100 kcal/kg/day in some cases to adequately support weight restoration.[40] Similarly, energy

TABLE 1 Prevalence of features of post-ICU syndrome[37]

Feature	Examples	Prevalence
Physical impairments	ICU-acquired weakness, critical illness polyneuropathy	25%–80%
Cognitive impairments	Impairments in memory, attention, processing, and problem solving	30%–80%
Psychological impairments	Anxiety, depression, posttraumatic stress disorder, sleep disturbances	10%–50%

Abbreviations: ICU, intensive care unit.

requirements for patients during the post-ICU recovery phase may be significantly elevated. An initial range of 30–35 kcal/kg/day has been suggested; these targets may need to be adjusted upwards to promote ongoing weight restoration.[11] Protein requirements for patients during the post-ICU recovery phase are also elevated to support rebuilding of lost lean tissue mass. A range of 1.5–2.5 g/kg/day of protein has been suggested.[11]

Therapies for nutrition rehabilitation may include anabolic steroids (eg, oxandrolone), anticatabolic agents (eg, propranolol), and oral nutrition supplementation (ONS).[11] In particular, ONS with β-hydroxy-β-methylbutyrate (HMB) may be considered as an intervention to promote restoration of muscle mass.[11] A randomized-controlled, double-blind study by Deutz et al[41] found that consumption of ONS containing HMB by malnourished, older adults resulted in a significantly lower 90-day mortality ($P = .018$; 95% CI, 0.27–0.90) and improved nutrition status and body weight compared with a placebo supplement.

Post-ICU clinics have emerged to help manage the complex, multidisciplinary needs of patients after ICU discharge.[12] The following case study reviews the nutrition management of a patient who was referred to a post-ICU clinic after becoming severely malnourished from a prolonged admission for COVID-19.

SUMMARY OF CASE

The participant of this case report is a 69-year-old male with a past medical history of type 2 diabetes mellitus and hypertension. He presented to an outside hospital with complaints of cough, fever, and mild dyspnea for one week and was found to have COVID-19. He was started on treatment with hydroxychloroquine, azithromycin, and solumedrol, the latter of which was discontinued because of significant hyperglycemia. He demonstrated clinical improvement and was transferred to a field hospital for further management due to the admitting hospital's bed shortage. On day 8 of hospitalization, he became hypoxic with an oxygen saturation of 91% despite treatment with a nonrebreather mask and was transferred to another acute care hospital. Upon transfer, he was managed on a medical floor bed because of a shortage of stepdown and ICU beds. His weight was 158 lb with a body mass index (BMI) of 24.2 kg/m².

On day 12, he was referred to the hospital's Clinical Nutrition service because of poor nutrition intake. His laboratory results were consistent with an acute inflammatory response: serum albumin level = 1.9 g/dl (reference range: 3.2–4.8 g/dl); C-reactive protein = 14.2 mg/dl (reference range: <0.9 mg/dl); and interleukin-6 = 88 pg/ml (reference range: <5 pg/ml). The patient was maintained on a clear liquid diet over the first week of admission because of hypoxia and high risk for decompensation requiring intubation. After one week, his oxygenation improved and he was advanced to a regular diet. On day 17, his weight had declined to 151 lb, indicating a loss of 4.5% body weight over 9 days. He was diagnosed with severe protein-calorie malnutrition at that time using the ASPEN/Academy malnutrition consensus criteria.[25] His nutrition intake was primarily optimized via ONS because of shortness of breath and poor tolerance for solid consistencies. A nutrition-focused physical exam was not conducted to reduce staff exposure to the virus. By day 21, he was documented to be eating adequately. There was no evidence of refeeding syndrome, likely because of gradual increases in the patient's oral intake as his appetite improved and nutrition interventions were implemented. Clinical staff continued to record adequate nutrition intake throughout his hospitalization until discharge on day 61. However, the patient was still progressively losing weight, suggesting that his nutrition requirements were underestimated. See Table 2 for a summary of the patient's weight during and posthospitalization. His hospital course was complicated by persistent hyperglycemia and ARDS resulting in post-ARDS interstitial lung disease with fibrosis. He had lost 14% of his body weight over 1 month as a result of worsening malnutrition and muscle disuse; consequently, he was severely deconditioned. The patient was discharged home on day 61 with physical therapy, occupational therapy, and visiting nurse services. His weight upon discharge was 136 lb with a BMI of 20.9 kg/m².

TABLE 2 Patient's weight from hospital admission to postdischarge

Days since admission	Weight, lb	BMI, kg/m²	Approximate daily calorie intake	Comment
8	158	24	0 (nothing by mouth)	Transfer to inpatient hospital
17	151	23	700	Diagnosed with severe malnutrition
61	136	20.7	1300	Discharge from hospital
132	124	18.9	1000	Initial nutrition assessment
145	127	19.3	1600	First reassessment
172	127	19.3	1800–2000	Follow-up contact

Abbreviations: BMI, body mass index.

The patient was referred to a post-ICU clinic approximately 2.5 months after hospital discharge because of his severe deconditioning. Upon assessment by a pulmonologist, he was diagnosed with PICS given all the clinical features of PICS (including physical, psychological, and cognitive impairments) despite not being admitted to an ICU. He was referred to the clinic's registered dietitian (RD) for MNT to address his malnutrition and promote nutrition rehabilitation.

ASSESSMENT AND DIAGNOSIS

The onsite clinic was closed because of the COVID-19 pandemic, and thus, the assessment interview was conducted via telephone. The patient told the RD that he felt too weak to participate in a phone interview and so the interview was conducted with his daughter who had been managing most of his care. It was quickly apparent that the patient's functional status was severely impaired. The patient's daughter noted that he was working with physical therapy three times per week but was not making any progress. The patient was mostly bedbound, leaving his bed only three times a day to eat and pray. He was unable to wash himself, dress himself, or use the restroom without assistance from his family. He could not walk further than 20 steps or climb more than seven stairs before tiring out.

Based on his dietary recall, the RD estimated that the patient was consuming approximately 1000 calories per day and 45 g protein per day. Weakness and poor appetite were noted as significant barriers to eating. The patient requested his family puree his foods because of fatigue with chewing, fear of choking, and shortness of breath while eating. He was too weak to cut his own food. He typically drank one diabetes-specific ONS daily. He avoided standard ONS because of his history of diabetes and recent history of hyperglycemia which was difficult to manage.

Relevant medications included lantus, dulaglutide, metformin, and prednisone 5 mg daily on a taper. His weight had declined further since hospital discharge from 136 lb to 124 lb (height = 68 inches; BMI = 18.9 kg/m²). He described feeling "so frustrated" by his ongoing weight loss and inability to regain weight. Compared with his usual body weight prior to hospitalization of 158 lb, the patient had lost 22% of his body weight over 4.5 months. The RD inquired about physical findings with his daughter who noted that the patient was much thinner than usual and suggested at least a moderate degree of generalized muscle wasting. Blood glucose levels were well controlled within 80–180 mg/dl [42] and there were no other relevant or recent laboratory results. The RD noted that the patient had substantial family support at home to purchase and prepare foods.

The patient's energy requirements were initially estimated as 1700–2000 kcal/d (30–35 kcal/kg) and 85–115 g/d protein (1.5–2 g/kg).[11,40] Using the Academy/ASPEN consensus recommendations for diagnosing adult malnutrition,[25] the patient was assessed as severely malnourished based on his significant weight loss and moderate muscle mass depletion. The RD documented a nutrition diagnosis of severe acute disease-related malnutrition related to increased nutrient requirements secondary to COVID-19 as evidenced by significant 22% weight loss over 4.5 months and moderate muscle mass depletion.

NUTRITION INTERVENTIONS, OUTCOMES MONITORING, AND COMPARISON TO EVIDENCE

Comparing the patient's estimated nutrition intake to his nutrition requirements, the RD noted that the patient was meeting approximately 59% of his energy targets and 53%

of his protein targets; thus, the RD initially counseled the patient's daughter about increasing his energy and protein intake. The RD individualized the counseling session to prioritize increased fat and protein intake and to control carbohydrate intake given his recent significant history of hyperglycemia. The RD encouraged the patient's daughter to prepare foods liberally with oil, butter, or mayonnaise to increase the calorie content of meals. The RD suggested mixing a protein powder into the patient's pureed foods. The RD encouraged the patient to continue drinking the diabetes-specific ONS and to increase consumption to twice daily as tolerated. The patient's daughter noted that she had a blender at home, for which the RD provided recipes for calorie- and protein-dense smoothies. The RD encouraged small, frequent meals for the patient's poor appetite and to consume ONS and/or smoothies between meals. Finally, the RD encouraged the patient to continue monitoring his fingerstick blood glucoses at home. The RD and the patient's daughter agreed on the following goals: to meet 100% of the patient's estimated energy and protein requirements, to restore 1–2 lb per week, to demonstrate improvements in his functional progress with physical therapy, and to avoid hyperglycemia (ie, fingersticks > 180 mg/dl).[43] A follow-up appointment with the RD was recommended in 1–2 weeks.

The patient was seen for nutrition reassessment 2 weeks later. Again, the interview was conducted via telephone because of the ongoing COVID-19 pandemic. The patient requested that the RD speak with his daughter again, who had been managing most of his nutrition care. Based on a dietary recall, his nutrition intake had increased to 1600 calories/day (94% of his lower-end calorie goal) and 70 g/day protein (82% of his lower-end protein goal). His dietary recall was notable for increased fat and protein intake and more frequent snacks and mealtimes. His appetite had improved, though he occasionally refused midday snacks because of feeling full. He was drinking one to two diabetes-specific ONS per day, increased from one per day prior, along with protein powder mixed with his foods. He had not yet tried any homemade smoothies as he found cold textures unappealing. The patient's weight had increased from 124 lb to 127 lb. His daughter noted that he appeared more confident with his swallowing and was accepting a greater variety of food textures. His functional status had also improved. He was ambulating further with physical therapy and, with significant effort, was able to climb a set of stairs for the first time since hospitalization. Finally, the patient's fingerstick blood glucose values were well controlled. The RD evaluated the patient's goals and although he did not meet his energy and protein targets, his weight and functional status had clearly improved. The RD reinforced the same nutrition plan of care (including encouraging the consumption of small, frequent meals, and ONS between meals) and recommended following up within the next month.

The RD arranged a follow-up phone call with the patient's daughter after 1 month. His daughter noted that his nutrition intake and functional status had improved further since the last reassessment, however his weight had plateaued at 127 lb. His daughter declined a full interview at that point as she felt that psychological symptoms were limiting him from making further progress in his recovery. These symptoms included anxiety, occasional sudden feelings of panic, and a depressed mood with irritability and frequent mood swings. The RD referred the patient to the clinic's psychologist for evaluation. The RD also noted for the next nutrition reassessment that the patient's estimated energy and/or protein requirements may need to be increased to promote ongoing weight restoration.

The RD contacted the patient's daughter 2 weeks later to arrange a follow-up appointment. Unfortunately, the RD learned that the patient had suffered a seizure and his family elected to take him to another institution because of fears that bringing him to the previous inpatient hospital would incite posttraumatic stress from his recent prolonged hospitalization. The patient was recently discharged and is scheduled for continued follow-up at the post-ICU clinic to address his nutrition rehabilitation.

The nutrition interventions utilized in this patient's case are consistent with published recommendations for patients with COVID-19 and/or during the post-ICU recovery phase. First, MNT should be tailored to meet a patient's elevated energy and protein requirements.[31] The patient was able to regain weight as a result of the RD's interventions, although these gains plateaued after 1 month. This issue is encountered in other populations of severely malnourished patients in which energy and/or protein intake may need to be progressively increased to promote ongoing weight restoration.[11,40] Second, MNT should address physiologic or psychological factors (including features of PICS) which may impair nutrition intake.[10] It should be noted that a significant barrier to adequate nutrition intake in patients during the post-ICU recovery phase is weakness, as this patient's case clearly demonstrates.[6,10,44] Patients may be too weak to shop, cook, or in some cases chew without tiring out. The RD should assess the availability of social support or other services to help manage this if present. This patient was profoundly weak; however, he was noted to have substantial family support at home to cook and prepare his meals. Third, liquid nutrition in the form of ONS and other calorie and protein-fortified beverages may be appropriate for patients with anorexia, early satiety, weakness, or shortness of breath.[31] Fourth, patients should be screened for micronutrient deficiencies and provided appropriate supplementation if there is

evidence of deficiencies.[31] Unfortunately, this was challenging in this case because of limitations in conducting a nutrition-focused physical exam remotely and because of the patient being unable to leave his residence for blood draws. Finally, RDs should assess for food insecurity.[31] Because of the increased rate of unemployment as a result of the pandemic, the food insecurity rate for 2020 is projected to be 15.6%, up from 11.5% in 2018.[45] RDs should connect patients with resources for accessing food for patients who are food insecure.[31]

CONCLUSIONS AND IMPLICATIONS

Malnutrition is prevalent among patients who are critically ill and upon ICU discharge.[1,2] Inadequate nutrition intake is seen to continue during the post-ICU recovery phase, which may result in worsening malnutrition.[6–9] Barriers to inadequate nutrition intake include elevated energy and protein requirements and physical, psychological, cognitive, and metabolic sequelae of critical illness, including features of PICS, which may persist for months to years even after resolution of the initial illness or injury which prompted ICU admission.[10,11,38] MNT is warranted for patients during the post-ICU recovery phase to address malnutrition, to correct nutrient deficiencies, and to assess for common barriers to nutrition intake which are seen during this time period. Energy and/or protein intake may need to be progressively increased to promote adequate weight restoration.[39,40]

Further research is needed to develop guidelines for the management of malnourished patients during the post-ICU recovery phase and to investigate the association between MNT and outcomes in this high-risk patient population.

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AUTHOR CONTRIBUTIONS

Ryan Burslem contributed to the conception and design of the manuscript; Anna Parker contributed to the design of the manuscript; Ryan Burslem contributed to the acquisition, analysis, and interpretation of the data and Ryan Burslem drafted the manuscript. Both authors critically revised the manuscript, gave final approval, and agree to be fully accountable for ensuring the integrity and accuracy of the work.

CONFLICT OF INTEREST

None declared.

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