Research Article

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Evaluation of Nutritional Needs of Intensive Care Unit Patients by Clinical Pharmacists

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ABSTRACT

Malnutrition in intensive care unit (ICU) patients affects disease progression and prolongs hospital stays. In this study, it was aimed to present the recommendations of clinical pharmacists in terms of nutrition in ICU patients.This study was conducted in the ICU between November 2022 and January 2023. Clinical pharmacists counseled patients on nutrition according to guidelines. Basal energy expenditure was calculated using the Harris-Benedict formula, and the most appropriate nutritional product was selected for the patients. Descriptive analyses were performed with SPSS v27.0.Total number of patients and recommendations were 41 and 71, respectively. Hundred percent of the recommendations were accepted. According to the reasons, the recommendation rates were categorized as feeding started (9.86%), feeding stopped (1.41%), feeding dose increased-reduced (28.17%), protein amount increased-reduced (35.21%), management of nutritional complications (15.49%), and changes in administration (9.86%). Enema (54.54%) for constipation, prokinetic metoclopramide (36.36%), and discontinuation of parenteral nutrition due to hyperglycemia (9.09%) were recommended for the management of nutritional complications. Examples of suggestions and explanations made regarding the nutritional status of the patients were given.In this study, recommendations were made for most ICU patients to eat more calories and protein. Clinical pharmacists can prevent malnutrition with other healthcare professionals.

Keywords: Basal energy expenditure, Clinical pharmacy, Critically ill, Intensive care unit, Malnutrition

1. Introduction

Malnutrition is defined as "a condition resulting from nutritional deficiencies, altering body composition (decreased lean mass), poor physical and mental function, and deterioration in clinical outcomes due to disease [1]. Malnutrition in intensive care unit (ICU) patients affects disease progression and prolongs hospital stays [2]. The prevalence of malnutrition in critically ill patients hospitalized in the ICU varies between 38 and 78% [3]. Nutritional support during critical illness is widely accepted and used to maintain the metabolic process and minimize potential complications. However, severe malnutrition is still a major problem for many critically ill patients [4]. In critically ill patients, malnutrition can lead to a significantly increased risk of hospital readmission and mortality [5]. Identifying factors associated with malnutrition and insufficient energy intake is essential to improving nutritional support [6]. Current European Society for Parenteral and Enteral Nutrition (ESPEN), American Society for Parenteral and Enteral Nutrition (ASPEN), and Turkish Society of Clinical Enteral & Parenteral Nutrition (KEPAN) guidelines support the initiation of enteral nutrition for all patients with ICU stays longer than 48 hours and without contraindications [7, 8]. Patients who received trophic enteral nutrition (EN) for up to 6 days had a lower incidence of gastrointestinal intolerance compared to patients who received full EN [9]. The term "trophic feeding" refers to the administration of a low dose of well-balanced EN to a patient in an amount that is insufficient to meet the patient's nutritional requirements but that does produce some favorable gastrointestinal or systemic benefit [10]. Patients who are critically ill may benefit from receiving exogenous delivery of proteins or amino acids in order to reduce protein losses and speed up their road to recovery. Unfortunately, the optimal dose of protein for critically ill patients is unknown, and nutritional societies worldwide generally recommend 1.2 to 2.5 g/kg/day for the dose of protein in critically ill patients [11]. The amount of protein that patients require on a daily basis differs according to the comorbidities that they face now with and the condition that they are currently suffering from. Patients suffering from conditions such as burns and injuries may especially require a significantly greater protein intake. In addition, additional glutamine supplementation is an approach that is recommended by the guidelines for use in the treatment of these individuals [7]. However, given that nutritional products might result in a wide variety of adverse effects, it is crucial that patients receive them with extreme caution.

Pharmacists are engaged in direct patient care and are responsible for promoting the maintenance and recovery of a patient's optimal nutritional status and designing or modifying treatments according to the needs of said patient. Studies have demonstrated that patients can benefit from pharmaceutical care and interventions provided by a pharmacist. One study demonstrated that through pharmacist interventions, drug-related problems were identified in almost 30% of patients receiving nutrition support therapy, and 85% of those interventions yielded positive clinical outcomes [12].

In terms of the development of the disease, the nutritional status of patients who are currently being treated in the ICU is an essential issue. The purpose of nutritional support is to reduce the harmful effects of critical disease on nutritional status, such as enhancing energy deficits and catabolism, while also preventing or reversing malnutrition if it exists. Because there is a potential for malnutrition in patients who have been admitted to the ICU, it is crucial that nutritional support be initiated without delay. Feeding should be started as soon as possible, and ideally within the first 48 hours of the patient being admitted to the hospital if the patient is hemodynamically stable.

In this study, it was aimed to identify nutritional deficiencies that cause important health problems for patients in the ICU and to present recommendations for solving them by identifying clinical pharmacists.

2. Material and Methods

This study was carried out in the anesthesiology and reanimation intensive care unit with a 26-bed capacity the Inonu University Turgut Ozal Medical Center in Malatya, Türkiye. Two professors, one assistant professor, and four physicians are in charge of the ICU. Specialists and resident physicians also work alternating shifts. Two clinical pharmacy residents joined ICU and infectious disease physicians, nurses, and technicians for rounds on weekdays. Patients over the age of 18 who were treated in the ICU for more than 24 hours and were receiving food or waiting to be fed were included in the study. This study was carried out by evaluating the nutritional status of patients hospitalized in the ICU between November 2022 and January 2023. Clinical pharmacists evaluated patients in terms of their nutritional state and categorized patients into several categories based on the results of these evaluations. They examined the components of the products that were already in existence at the hospital and assessed them based on how well they suited the needs of the patients. Clinical pharmacists made recommendations verbally to the responsible physicians about the nutritional status of patients in line with current ESPEN, ASPEN, and KEPAN guidelines and recorded them. Basal energy expenditure was calculated using the Harris-Benedict formula, and the most appropriate nutritional product was selected based on individual requirements. In addition, demographic characteristics of the patients were recorded. Descriptive analyzes were performed with the Statistical Package for Social Sciences (SPSS) v27.0. The categorical variables were given in number (percentage) and continuous variables were given in median [interquartile range]. This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Selcuk University (April 11, 2023/194).

3. Results and Discussion

In our study, the basal energy expenditure of the patients was calculated using the Harris-Benedict formula. While making the calculation, the amount of energy that should be taken in total was calculated by taking into account the stress factors. For example, it has been found that the daily calorie requirement is higher in trauma and sepsis patients due to higher stress status [13].

Forty-one patients, 60.98% of whom were male, were included in the study. The mean age of the patients included in the study was 63.78 ± 19.03. The characteristics of the patients are given in Table 1.

Abnormalities of breathing, pedestrian injuries in collision with a car, pick-up truck, or van, and subarachnoid hemorrhage are the most common diagnoses of patients admitted to the ICU.

It was found that the main cause of death in the patients was cardiac arrest.

Concerning the patients' current nutritional conditions, 71 different recommendations were provided and all of them were accepted by the physician. The number of recommendations per patient on nutrition was found to be 1.73. These suggestions are categorized among themselves and given in Figure 1.

The majority of the recommendations made were to increase the amount of protein and calories. Depending on factors such as age, disease, and level of protein depletion, daily protein requirements can range from 0.8 g/kg/day (healthy adults) to 1.5 g/kg/day (or even higher in rare circumstances) [14]. Higher than 1.2 g/kg of protein is related with lower mortality in non-septic, non-energy overfed ICU patients; however, the exact amount of protein that should be given to critically ill patients is uncertain [15]. It has been discovered that the effect of protein consumption on critically ill individuals is time dependent. A steady rise in protein consumption from a low level during the first two days of an ICU stay to an intermediate level during days 3-5 and then to a high-level beginning on day 6 is related with lower mortality at six months [16]. In our study, 2 g/kg/day protein intake was recommended for some patients such as severe burns and trauma. After controlling the content of the nutritional product taken by the patients, it was determined whether it contained sufficient protein. If a protein deficiency was detected, it was recommended to add protein-specific additional products to the patient's prescription. Nutritional products are grouped among themselves according to their low and high protein content. The protein level of the nutritional product that the patient is using can be evaluated, and if necessary, an alternative nutritional product that is more suited to the patient's needs can be utilized instead. At the same time, in cases where the calorie needs of the patients were not sufficient, it was recommended to increase the dose of the nutritional product in order to reach the target calorie amount. If patients do not obtain appropriate nutrition, it may lead to unfavorable clinical outcomes, such as an increased infection rate, a lengthened period of stay in the ICU and the hospital, and a delay in weaning from mechanical breathing [17]. As was indicated before, the primary goal of obtaining the target gradually.

Guidelines have similar perspectives on the initiation of the feeding process after critically ill patients are admitted to the ICU and recommend that feeding begin within the first 48 hours [7, 8]. Patients who are in critical condition typically benefit more from EN and parenteral nutrition (PN) than they do from

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Table 1. The characteristics of the patients

Gender (n, %)	
Male	25 (60.98)
Female	16 (39.02)
Age, years (median, [25th percentile – 75th percentile])	67 [54-76]
Duration of hospitalization, days (median, [25th percentile – 75th percentile])	27 [14-46]
Presence of surgery (n, %)	23 (56.09)
Presence of mechanical ventilation support at admission (n, %)	23 (56.09)
APACHE II (median, [25th percentile – 75th percentile])	19 [12-24.25]
Admission diagnosesa (n, %)	
Dyspnoea	4 (9.76)
Sepsis, unspecified	3 (7.32)
Subarachnoid haemorrhage	3 (7.32)
Cerebral infarction, unspecified	3 (7.32)
Bacterial pneumonia, unspecified	3 (7.32)
Pedestrian injured in collision with car, pick-up truck or van	3 (7.32)
Mortality (n, %)	26 (63.41)

APACHE II: Acute physiology and chronic health evaluation II

[a]The top two diagnoses were given.

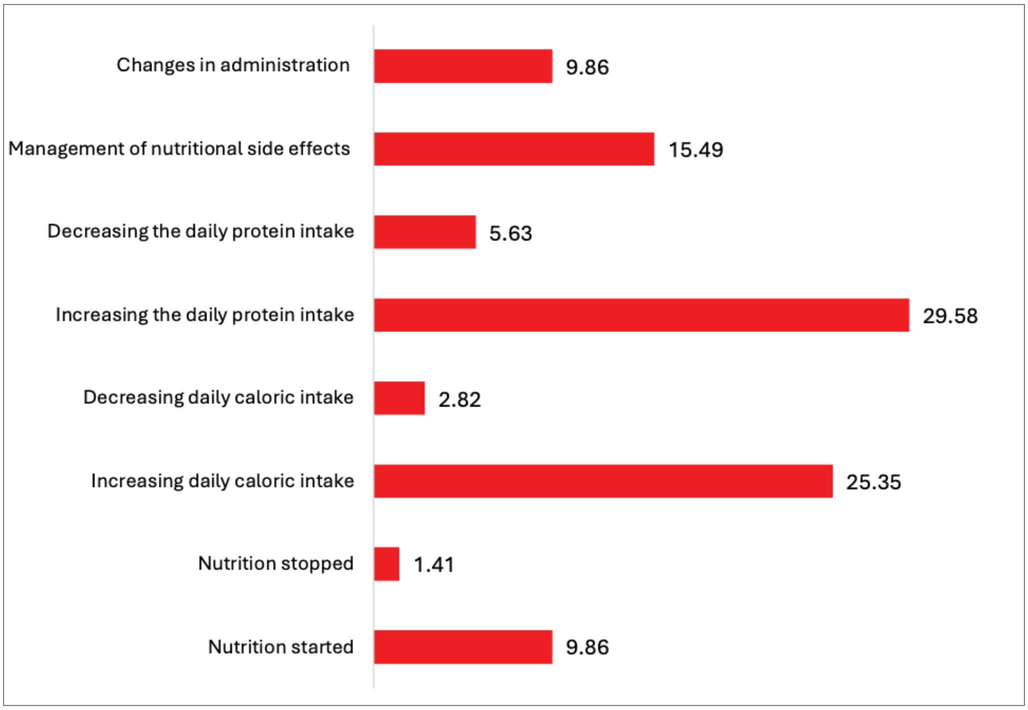

Figure 1. Distribution of recommendations for patients' nutritional status

oral nutrition since they cannot swallow. The common recommendation among guidelines is to aim for a higher level if possible; for instance, EN rather than PN; alternatively, oral feeding should be favored over EN [7]. Clinical conditions associated with significant functional disorders of the gut, obstruction of the gastrointestinal tract, gastric residual volume > 500 mL/6 h, or severe metabolic and circulatory instability are examples of conditions that should not be treated with EN [18, 19]. In general, the use of EN as compared to PN resulted in a much lower rate of infectious complications and a shorter length of duration remained in the ICU [20]. On the other hand, the incidence of gastrointestinal complications such as vomiting, and diarrhea was found to be much higher in the EN group than in the PN group [21].

In our study, a total of 11 recommendations were made for the management of nutritional complications. These are as follows: For EN, there was a risk of nausea, vomiting, constipation, diarrhea, and aspiration, while electrolyte imbalances and hyperglycemia were seen for PN. Guidelines support the use of prokinetic agents such as metoclopramide or erythromycin, which accelerate gastric emptying and thus prevent early satiety in patients with gastric feeding intolerance [7]. In our study, metoclopramide 10 mg 3 times a day for 72 hours was recommended for patients with gastrointestinal intolerance and gastric residual volume greater than 500 ml.

In situations of constipation caused by nutrition, either the nutritional content was reduced and an alternative nutrition product that was more suited in terms of fiber was recommended, or the patient was recommended drugs that can be used in the treatment of constipation, such as enemas. Likewise, in cases where nutrition-related diarrhea is considered, it was suggested that after investigating the etiology of diarrhea (infection, drugs, diseases, etc.), the content of the nutritional product could be checked for fiber, and a more suitable product could be selected. In addition, antidiarrheal drugs have also been recommended in some cases. In the treatment of diarrhea caused by EN, it is recommended to reduce the infusion rate, replace the currently used product with soluble fiber products, and administer anti-diarrheal drugs after infectious causes have been excluded [18, 22].

Another situation recommended by the guidelines in the case of nutrient-related diarrhea is that the diet should be given continuously rather than intermittently [23]. In our study, it was recommended that a patient who was fed intermittent nutrition should be fed continuously in the case of nutrition-related diarrhea, and the resolution of diarrhea was observed a few days after the recommendation. This recommendation is also an example of a change in the way the nutritional product is administered.

Most of the metabolic complications, especially hyperglycemia, are preventable for patients using PN. Blood electrolytes, especially blood sugar, potassium, and phosphate, should be monitored very closely [24]. When hyperglycemia due to PN developed, it was recommended that the patient discontinue PN treatment and begin insulin therapy in order to bring the patient's blood sugar level back under control. At the same time, daily checks were made to look for electrolyte imbalances, and deficient electrolytes were quickly replaced.

Refeeding syndrome can be seen in patients fed both EN and PN. Refeeding syndrome can be defined as the potentially fatal shifts in fluids and electrolytes that may occur in malnourished patients receiving artificial refeeding. The underlying causative factor of refeeding syndrome is the metabolic and hormonal changes caused by rapid refeeding, whether enteral or parenteral [25]. Serum hypophosphatemia is considered to be the "hallmark clinical sign" of refeeding syndrome; nevertheless, patients frequently present with concomitant metabolic abnormalities, such as hypokalemia, hypomagnesemia, fluid overload, and thiamine deficiency [26]. Refeeding syndrome patients may develop respiratory failure, heart failure, delirium, rhabdomyolysis, hemolytic anemia, convulsions, coma, excess infections, and death due to significant metabolic abnormalities [27]. Most current recommendations for avoiding refeeding syndrome are general and vague; they provide recommendations for slow increases, gradual progression, or moderate energy gains and reaching target needs within 3–7 days [24]. In our study, after the total calorie intake of the patient was determined, the treatment was started with a lower dose, and the patient's calorie intake was tried to be brought to the recommended level gradually within a few days, thus minimizing the risk of refeeding syndrome.

Examples of the recommendations and explanations made to the responsible physicians regarding the nutritional status of the patients are given in Table 2.

In addition, products that are particular to certain diseases were chosen after the comorbidities of the

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Table 2. Examples and explanations of the recommendations made about the nutritional status of the patients

Recommendations	Examples	Explanations
Nutrition started	It is recommended to start at EN 20 cc/h.	EN should be started within the first 48 hours in hemodynamically stable patients hospitalized in the intensive care unit where oral intake is not possible.
Nutrition stopped	The patient was receiving high-dose supportive therapy at the same time as EN, so it was recommended to stop him feeding.	Many practitioners withhold enteral feeding to minimize the risk of intestinal ischemia upon decreased gastrointestinal blood flow, particularly when administering high-dose vasopressor support.
Increasing daily caloric intake	Since the current EN of the patient could not meet the daily energy needs, it was recommended to increase the EN dose.	The daily calorie intake of patients is calculated with the help of the Harris-Benedict formula and this target calorie amount is increased gradually.
Decreasing daily caloric intake	Since the current EN of the patient met more than the daily energy requirement, it was recommended to reduce the EN dose.	EN should be given as much as the patient can tolerate and should take.
Increasing the daily protein intake	Since the patient was taking EN only, a protein-containing product was recommended for use with EN, since there was a protein deficit.	Guidelines support1.2-1.5 g/kg/day of protein for critically ill patients. In fact, since protein loss is high in some patients, this rate can be increased up to 2 g/kg/day.
Decreasing the daily protein intake	Since the patient used both high-protein EN and a protein-specific product together, it was recommended to reduce the protein dose because it exceeded the daily protein intake.	It is not recommended for patients to take more protein than they should take daily.
Changes in administration	It was recommended that EN should be given instead of PN, since hyperglycemia developed while the patient was receiving PN and was able to receive EN.	PN is not recommended for patients who can take EN to increase the efficacy of the gastrointestinal tract.
Management of nutritional complications	Since the patient could not tolerate the product because vomiting occurred while taking EN, it was recommended that the EN dose be reduced and monitored.	If distention or vomiting develops during EN, the rate of feeding product should be reduced, and if the problem persists, feeding should be interrupted. In addition, prokinetic agents such as metoclopramide and oral erythromycin may be useful if delayed gastric emptying persists.

patients were taken into consideration. Formulas that are disease-specific are defined as having macro- and micronutrient profiles that are adjusted to meet the requirements of a particular disease and/or digestive or metabolic condition [28]. Examples of these formulas are diabetes, renal, liver, pulmonary, neurological, and immune modulation formulas [29]. For example, patients with lung diseases such as chronic obstructive pulmonary disease who prefer products high in protein and low in carbohydrates have been shown to have lower carbon dioxide concentrations in their airways. For this reason, these products come to the fore in product selection for such patients [30]. To give another example, the guidelines offer numerous recommendations for replacing proteins lost as a result of dialysis in patients with chronic renal failure, particularly those receiving dialysis. About 1.3–1.5 g/kg/day of protein is recommended for critically ill patients with acute kidney injury or chronic kidney disease receiving conventional intermittent renal replacement therapy, and 1.5–1.7 g/kg/day of protein is recommended for critically ill patients on continuous renal replacement therapy or long-term intermittent renal replacement therapy [31]. Patients undergoing dialysis should be checked for adequate nutrition in terms of protein. For these patients, protein-rich nutritional products or protein-specific products should be selected.

Some of the clinical pharmacist's responsibilities in the intensive care unit were outlined in 2000 by the ACCP and the Society of Critical Care Medicine. These responsibilities cover clinical, educational, scholarly, and administrative duties such as medical history, drug therapy evaluation, pharmacokinetic monitoring, education to other ICU staff and residents, supervision of the handling of experimental drugs, monitoring of adverse drug events (ADEs), participation in therapeutic committees and parenteral nutrition order evaluation [32]. According to a 2013 research nutrition monitoring, medication indicated but not prescribed, and dosage modification were the top 3 problems identified by the pharmacist [33]. The choice of nutrition that is disease-specific is an extremely crucial factor to consider. Since the state of the disease can be significantly altered while the patients are being treated in the ICU, we need to select these products in accordance with the comorbidities of the patients who will be utilizing them. Despite the limitations such as the short duration of the study and the small number of patients included, this study highlights the importance of clinical pharmacists in nutrition.

4. Conclusions

Nutrition products to be given to patients should be examined in detail in terms of content, especially energy and protein, and the most suitable product should be selected for the patient. Clinical pharmacists are able to supply consultation services to the ICU team in regards to the selection of the suitable product for the patient, the dosage, the management of nutritional complications, and the way of administration.

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Conflict of Interest

The authors declare that the contents in this article have no conflict of interest.

Statement of Contribution of Researchers

Concept – A.Ç., H.M.; Design – A.Ç., H.M., Z.Ü.G.; Supervision – Z.Ü.G.; Resources A.Ç., H.M.; Materials – A.Ç., H.M.; Data Collection and/or Processing – A.Ç., H.M.; Analysis and/or Interpretation – A.Ç., H.M., Z.Ü.G.; Literature Search – A.Ç., H.M., Z.Ü.G.; Writing – A.Ç., H.M., Z.Ü.G.; Critical Reviews – A.Ç., H.M., Z.Ü.G.

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