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Early nutritional strategies in ICU: Comparing mortality and outcomes of enteral versus parenteral nutrition

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ABSTRACT

Introduction: Critical illness often leads to a hypermetabolic state, increasing the risk of malnutrition, which can exacerbate patient outcomes in the ICU. The choice between early enteral nutrition (EN) and early parenteral nutrition (PN) remains a debated topic, with conflicting evidence on their impact on mortality and other clinical outcomes. This study aims to compare the effects of early EN and PN on ICU mortality, length of stay (LOS), and duration of mechanical ventilation in critically ill patients.

Methods: A retrospective observational study was conducted in the ICU of Wahidin Sudirohusodo Hospital, Makassar, Indonesia, from April 2022 to March 2023. A total of 752 patients were analyzed. Patients were divided into two groups based on the type of early nutritional support received: early EN (n=293) and early PN (n=459). Clinical outcomes included ICU mortality, LOS, and mechanical ventilation duration were assessed.

Result: Early EN group had significantly lower ICU mortality (17.1% vs. 27.9%, p<0.001), shorter ICU LOS (median 3 days vs. 4 days, p<0.001), and reduced duration of mechanical ventilation (median 1 day vs. 2 days, p<0.001) compared to the early PN group. Despite higher caloric intake in the PN group (8.6 kcal/kg/day vs. 6.6 kcal/kg/day, p=0.001), this did not translate into better outcomes.

Conclusion: Early enteral nutrition is associated with improved survival, shorter ICU stay, and decreased mechanical ventilation duration compared to early parenteral nutrition. Clinicians should prioritize EN in the management of critically ill patients while cautiously evaluating the indications for PN.

KEYWORDS

Critical care, intensive therapy, nutritional support.

INTRODUCTION

Critical illness is often associated with a hypermetabolic state, leading to increased energy expenditure, catabolism, and nutrient depletion. Inadequate nutritional support in this phase can worsen patient outcomes, contributing to prolonged ICU stays, increased infection rates, and higher mortality. In the intensive care unit (ICU), early initiation of nutritional support is recognized as a key intervention to mitigate the adverse effects of malnutrition, reduce complications, and improve survival rates[1,2].

The choice between enteral nutrition (EN) and parenteral nutrition (PN) in critically ill patients is a subject of ongoing debate among clinicians[3-5]. Enteral nutrition, which involves delivering nutrients directly into the gastrointestinal tract, is often preferred due to its role in preserving gut integrity, supporting immune function, and reducing infection rates. Studies have shown that EN supports gastrointestinal integrity, reduces bacterial translocation, and is associated with better clinical outcomes, including reduced incidence of infections and shorter ICU stays[6-8]. Conversely, parenteral nutrition bypasses the gastrointestinal tract and may lead to gut atrophy and an increased risk of infections. However, PN remains essential for patients who cannot tol-

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erate enteral feeding, such as those with severe gastrointestinal dysfunction[5,9,10].

Despite extensive research, the comparative impact of early EN versus PN on key clinical outcomes, such as mortality and length of stay (LOS), remains contentious. Some studies favor EN, associating it with improved outcomes, while others suggest that early PN may prevent malnutrition-related complications in specific patient populations[4,11].

This study aims to contribute to this body of knowledge by analyzing the effects of early enteral and parenteral nutrition on ICU mortality and length of stay in a diverse critically ill population. Given the increasing focus on optimizing ICU care, understanding the comparative benefits of early EN and PN is crucial for evidence-based clinical decision-making. This study seeks to clarify the role of early nutritional interventions in improving patient outcomes and shaping future guidelines for critical care nutrition.

METHODS

Study Design

Retrospective observational study was conducted in the intensive care unit (ICU) of Wahidin Sudirohusodo Hospital, Makassar, Indonesia. The study was conducted over a 12-month period, from April 2022 to March 2023, and aimed to evaluate the association between different types of early nutrition and clinical outcomes, particularly mortality and length of stay. The study adhered to the ethical guidelines of the institutional review board, which approved the study protocol and ensured that patient confidentiality was maintained throughout the research process. The Ethic protocol number is 966/UN4.6.4.5.31/PP36/2023.

Patient Selection

The study population included all patients admitted to the ICU during the study period. Exclusion criteria for the study were, patients below 18 years old, patients who died within 48 hours of ICU admission and patients who were discharged from the ICU within 48 hours.

Data Collection

Data for the study were collected from medical records, which provided detailed information on patient demographics, clinical characteristics, nutritional intake, and clinical outcomes. Demographic data included age, sex, height, weight, and body mass index (BMI). The clinical characteristics collected included the type of admission, and nutritional risk. The type of admission was categorized based medical or surgery admission. The nutritional risk was assessed using the mNutric score, which is a validated tool for identifying ICU patients who may benefit from nutritional support. Nutritional intake was assessed based on the average calorie and protein intake during ICU stay. Early nutrition was defined as type of nutrition was given for the patient in less than 48 hours after ICU admission. The clinical outcomes assessed included ICU and hospital length of stay (LOS), duration of mechanical ventilation, and ICU mortality.

Statistical Analysis

The normality of continuous data was assessed using the Shapiro-Wilk test, which is a statistical test that evaluates whether a dataset follows a normal distribution. Depending on the distribution, continuous variables were expressed as either mean ± standard deviation (SD) or median and interquartile range (IQR). Categorical variables were presented as numbers and percentages. For continuous variables, the Student's t-test or Mann-Whitney U test was used for between early enteral nutrition and early parenteral nutrition group comparisons. For categorical variables, the chi-square test or Fisher's exact test was used, depending on the sample size and distribution of the categories. A p-value of < 0.05 was considered statistically significant. Statistical analysis for the study was performed using SPSS 25.0 (IBM Corp., Armonk, NY).

RESULTS

A total of 1189 patients were admitted to the ICU from April 2022 to March 2023. Among these patients, 677 were excluded due to various reasons, including being under 18 years of age (n = 83), death within 48 hours of admission (n = 49), and discharge from the ICU less than 48 hours (n = 306). The final analysis included 752 patients, divided into two groups based on their early nutrition intake: early enteral nutrition (n = 293) and early parenteral nutrition (n = 459).

The baseline characteristics was displayed at table 1. The median age was similar between the groups and had equal distribution of men and women. There were no significant differences in height, weight, or Body Mass Index in both groups. Regarding nutritional risk as assessed by the modified Nutrition Risk in the Critically Ill (mNutric) score also indicated that most patients in both groups were at low nutritional risk, with 88.4% in the enteral group and 84.3% in the parenteral group being classified as low risk.

The study compared the impact of early enteral nutrition versus early parenteral nutrition on calorie and protein intake, as well as several key clinical outcomes, in critically ill patients (table 2). The analysis revealed that patients receiving early parenteral nutrition had a higher median calorie intake (8.6 kcal/kg/day) compared to those receiving early enteral nutrition (6.6 kcal/kg/day), with a statistically significant difference (p=0.001). While protein intake was also slightly higher in the early parenteral group (0.4 kcal/kg/day) than in the early enteral group (0.3 kcal/kg/day), this difference approached but did not reach statistical significance (p=0.057). In terms of clinical outcomes, early enteral nutrition was associated with several advantages. Patients in the enteral

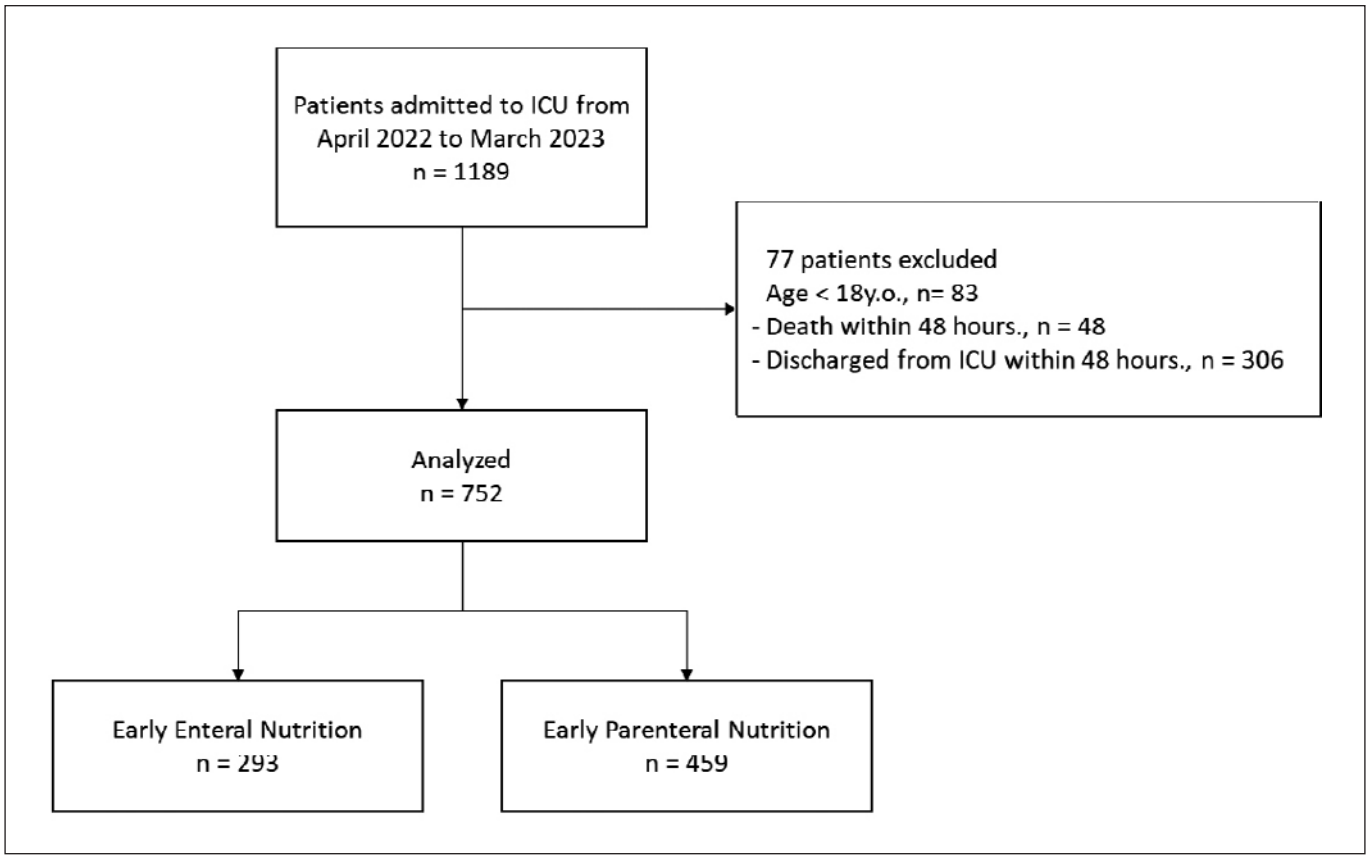

Figura 1. Flowchart of the study patients

group had a significantly shorter median ICU length of stay compared to those in the parenteral group (p<0.001). Additionally, patients receiving early enteral nutrition required less time on mechanical ventilation compared to parenteral group (p<0.001). Most notably, ICU mortality was significantly lower in the early enteral nutrition group, with a mortality rate of 17.1% compared to 27.9% in the early parenteral group (p<0.001).

DISCUSSION

This study compared the outcomes of early enteral nutrition (EN) versus early parenteral nutrition (PN) in critically ill patients, specifically examining ICU mortality, length of stay (LOS), and duration of mechanical ventilation. The key findings demonstrate that early EN is associated with significantly lower ICU mortality, shorter ICU LOS, and reduced duration of mechanical ventilation compared to early PN. These results highlight the potential advantages of prioritizing enteral over parenteral nutrition in the management of critically ill patients.

The observed benefits of early EN over PN can be understood through several mechanisms rooted in gastrointestinal physiology and immune function. Enteral nutrition supports the maintenance of gut integrity, which is crucial in critically ill patients. The gastrointestinal tract plays a vital role in immune function, acting as a barrier to pathogens. This reduces the risk of bacterial translocation and subsequent infections, which are significant contributors to morbidity and mortality in the ICU setting[3,12,13]. On the other hand, parenteral nutrition bypasses the gastrointestinal tract, leading to gut atrophy and an increased risk of infections due to the lack of enteral stimulation. This atrophy can compromise the integrity of the gut barrier, facilitating bacterial translocation and systemic inflammatory responses[14-16].

The shorter ICU LOS and reduced duration of mechanical ventilation in the EN group may be attributed to the positive effects of enteral feeding on respiratory function. EN provides essential nutrients that support respiratory muscle function and reduce the risk of ventilator-associated pneumonia (VAP), a common complication in ICU patients[12,17]. By contrast, PN, particularly when overfeeding occurs, may increase the risk of hypercapnia due to excessive carbon dioxide production, necessitating prolonged mechanical ventilation[5,10].

The findings of this study have important clinical implications for the management of critically ill patients. Firstly, they underscore the importance of initiating EN as early as possible in ICU patients to leverage its benefits in maintaining gut

Table 1. Demographic and Clinical Characecteristic between Early Enteral and Early Parenteral Group

	Early Enteral (n=293)	Early Parenteral (n=459)	p Value
Age, year	50 [38, 60]	52 [38, 61]	0.225
Sex			0.733
Men	145 (49.5)	233 (50.8)	
Woman	148 (50.5)	226 (49.2)	
Height, cm	160 [155, 165]	160 [155, 165]	0.482
Weight, kg	60 [50, 65]	58 [50, 64]	0.256
BMI, kg/m2	22.6 [20.8, 24.9]	22.2 [20.4, 24.2]	0.200
BMI Category			0.120
<18.5	28 (9.6)	52 (11.3)	
18.5 - 22.9	127 (43.3)	213 (46.4)	
23 - 24.9	71(24.2)	102 (22.2)	
25 - 29.9	66 (22.5)	82 (17.9)	
>30	1 (0.3)	10 (2.2)	
Type of Admission			0.203
Surgical	229 (78.2)	340 (74.1)	
Medical	64 (21.8)	119 (25.9)	
mNutric Score			0.117
Low Risk	259 (88.4)	387 (84.3)	
High Risk	34 (11.6)	72 (15.7)	

Data are presented as n (%) or median [interquartile range].

integrity, reducing infection risk, and improving overall outcomes. This aligns with current clinical guidelines that recommend EN as the preferred method of nutritional support in critically ill patients, whenever feasible[1,2]. Moreover, the study highlights the potential risks associated with early PN, particularly in terms of increased mortality. While PN is indispensable in cases where EN is contraindicated or insufficient, its use should be carefully monitored to avoid overfeeding and manage potential complications[9,10].

One of the strengths of this study is the robust sample size and the comparison of EN and PN outcomes, providing valuable insights into the impact of these nutritional strategies in critically ill patients. The retrospective design allowed for the inclusion of a broad patient population, reflecting real-world clinical practice.

However, the study also has several limitations. The retrospective nature of the study may introduce selection bias, as the decision to initiate EN or PN could have been influenced by factors not fully accounted for in the analysis. Additionally, the study did not differentiate between various subtypes of critical illness, such as sepsis or trauma, which could influence the outcomes of nutritional interventions. Future prospective, randomized controlled trials are needed to confirm these findings and explore the nuances of nutritional support in specific ICU populations.

CONCLUSION

In conclusion, this study demonstrates that early enteral nutrition is associated with better clinical outcomes compared to early parenteral nutrition in critically ill patients. The findings support the preferential use of EN in ICU management, whenever feasible, to reduce mortality, shorten ICU stay, and decrease the duration of mechanical ventilation. Clinicians should be aware of the potential risks associated with PN and carefully evaluate the appropriate nutritional strategy for each patient to optimize outcomes.

Table 2. Calorie Intake and Clinical Outcomes Between Early Enteral and Early Parenteral Group

	Early Enteral (n=293)	Early Parenteral (n=459)	p Value
Calorie Intake, kcal/kg/d	6.6 [4.5, 9.4]	8.6 [4.5, 13.7]	**0.001**
Protein Intake, kcal/kg/d	0.3 [0.2, 0.5]	0.4 [0.2, 0.7]	**0.057**
ICU LOS, days	3 [2,6]	4 [2,9]	**<0.001**
Mechanical Ventilation, days	1 [0, 3]	2 [0, 6]	**<0.001**
ICU Mortality, n(%)	50 (17.1)	128 (27.9)	**<0.001**

Data are presented as n (%) or median [interquartile range].
ICU, Intensive Care Unit; LOS, Length of stay.

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