Journal of Clinical and Nursing Research, 2025, Volume 9, Issue 9
http://ojs.bbwpublisher.com/index.php/JCNR
Online ISSN: 2208-3693
Print ISSN: 2208-3685

Efficacy of Early Enteral Nutrition Therapy in ICU Patients with Respiratory Failure and its Impact on Blood Gas Analysis Indicators

Xiaoyan Liu

ICU, Suzhou BenQ Medical Center, Suzhou 215000, Jiangsu, China

Abstract: *Objective*: To explore the effectiveness of early enteral nutrition therapy in ICU patients with respiratory failure. *Methods*: A total of 76 ICU patients with respiratory failure, admitted from May 2024 to May 2025, were included in the study. They were divided into an observation group and a control group using a random number table method, and relevant treatment indicators were compared. *Results*: The total effective rate in the observation group was higher than that in the control group ($p < 0.05$). After treatment, the observation group showed superior lung function, organ function, health status, nutritional status, body mass index, and blood gas analysis indicators compared to the control group ($p < 0.05$). *Conclusion*: Early enteral nutrition therapy is effective in treating ICU patients with respiratory failure and is beneficial for improving their lung function, nutritional status, and blood gas parameters, making it worthy of promotion.

Keywords: Early enteral nutrition; ICU respiratory failure; Blood gas indicators; Lung function

Online publication: Oct 17, 2025

1. Introduction

ICU patients are constantly in a state of metabolic disorder due to their diseases and face a high risk of malnutrition [1]. Particularly, ICU patients with respiratory failure, whose conditions are severe, experience accelerated neuroendocrine and protein metabolism rates under the influence of stress responses, directly affecting the normal functioning of their gastrointestinal tracts [2]. Additionally, the consumption of respiratory muscles and secretion of inflammatory mediators in these patients lead to rapid protein breakdown and increased energy consumption. Even with mechanical ventilation, patients may still experience issues such as respiratory muscle atrophy, significantly increasing their risk of malnutrition [3]. To address this situation and prevent malnutrition, it is necessary to implement enteral nutrition interventions. For a long time, respiratory failure patients have primarily relied on intravenous nutrition to meet their nutritional needs; however, this approach is associated with numerous complications [4]. Currently, early enteral nutrition is employed in the treatment of ICU patients. It not only supplies the necessary nutrients but also helps protect the intestinal mucosal barrier function, enhances

intestinal immune function to a certain extent, and accelerates the pace of recovery from illness [5]. Therefore, this study takes ICU patients with respiratory failure as the primary research subjects and applies early enteral nutrition in their treatment, focusing on exploring the application value of this treatment method.

2. Materials and methods

2.1. Basic information

The study selected ICU patients with respiratory failure (n = 76) as the subjects, with the earliest admission time being May 2024 and the latest being May 2025. The participants were randomly divided into two groups using a random number table method, named the observation group (n = 38) and the control group (n = 38), respectively. Control group: 22 males and 16 females, aged between 24 and 72 years, with an average age of (50.03 ± 4.75) years. In the observation group, the male-to-female ratio was 21:17, with the oldest patient aged 74 years and the youngest 22 years, and a median age of (50.06 ± 4.68) years. Comparison of the enrollment data between the two groups indicated $p > 0.05$, showing significant comparability. All patients provided informed consent and signed consent forms. The study was approved by the hospital's ethics committee.

2.2. Methods

Control group (parenteral nutrition treatment): Upon admission to the ICU, professional healthcare workers systematically assessed the patients' height, weight, muscle mass, BMI, and other relevant indicators, while also conducting liver and kidney function tests and blood biochemical indicators examinations to scientifically formulate a treatment plan. Based on the patients' actual conditions, their energy requirements, and the energy concentration of the nutritional formula were comprehensively considered to develop a nutritional support plan. Typically, the total daily energy intake for patients should be controlled between 20–30 Kcal per kilogram of body weight, while the protein intake should be 1.2–2.0 grams per kilogram of body weight. Calories should be provided to patients in accordance with the principle of gradual progression. Regular monitoring of their blood glucose, nutritional indicators, and electrolyte balance should be conducted to effectively avoid complications. Appropriate adjustment measures should be taken based on the monitoring results.

Patients in the observation group received early enteral nutrition therapy. During the treatment process, their vital signs were continuously monitored, and their early nutritional needs were systematically assessed to determine the nutritional risk level. The progression of the condition was analyzed using relevant indicators. The formulation of an early enteral nutrition plan was completed based on the patient's defecation, abdominal distension, and bowel sounds. After inserting a gastric tube, gastric juice should be effectively drained without infection, followed by the insertion of a jejunal tube to maintain tube patency. During the first three days of treatment, the proportion of calories should be appropriately increased based on the patient's physical condition. The calorie intake for enteral nutrition therapy should be gradually transitioned from 25–50%, and then to over 70% without compromising therapeutic efficacy. If no abnormalities occur within three days post-treatment, the calorie intake can be increased to 100%. During the treatment period, nutritional calories should be calculated based on the patient's basal energy expenditure to further enhance the rationality of calorie supply.

2.3. Evaluation indicators

(1) Analyze the therapeutic effects between groups.

(2) Compare the pulmonary function, organ function, health status, nutritional status, body mass index, and blood gas analysis indicators of patients before and after treatment.

2.4. Statistical analysis

Data processing: SPSS 21.0 statistical software; Data description: Count data as (n%), measurement data as (mean ± standard deviation (SD)); Difference testing: Count data as χ^2, measurement data as t; $p < 0.05$ is considered the basis for expressing statistical differences.

3. Results

3.1. Comparison of therapeutic effects between the observation group and the control group

The total effective rate in the observation group was significantly higher than that in the control group, with $p < 0.05$. (**Table 1**)

Table 1. Comparison of therapeutic effects between the two groups (n/%)

Group	n	Markedly Effective	Effective	Ineffective	Total Effective
Observation	38	21 (55.26)	16 (42.11)	1 (2.63)	37 (97.37)
Control	38	18 (47.37)	12 (31.58)	8 (21.05)	30 (78.95)
t-value					6.1758
p-value					0.0129

3.2. Study on pulmonary function before and after treatment in both groups

Before treatment, there were no significant differences in the indicators between the two groups, with $p > 0.05$. After treatment, the relevant indicators in the observation group were significantly different from those in the control group, with $p < 0.05$ (**Table 2**).

Table 2. Analysis of changes in pulmonary function in the observation group and the control group (mean ± SD)

Group	n	FEV1 (L)		FVC (L)		PEF (L/min)	
		Before Treatment	After Treatment	Before Treatment	After Treatment	Before Treatment	After Treatment
Observation	38	1.03 ± 0.27	1.84 ± 1.14	45.59 ± 10.05	60.58 ± 13.12	46.53 ± 11.13	58.77 ± 13.36
Control	38	1.01 ± 0.23	1.23 ± 1.05	45.63 ± 10.02	50.33 ± 10.14	46.56 ± 11.11	52.23 ± 10.32
t-value		0.3476	2.4262	0.0174	3.8105	0.0118	2.3881
p-value		0.7291	0.0177	0.9862	0.0003	0.9906	0.0195

3.3. Comparison of changes in organ function and health status between the observation group and the control group

After treatment, significant differences were observed in the indicators between the two groups, with $p < 0.05$. (**Table 3**)

Table 3. Comparison of changes in organ function and health status before and after treatment in both groups (mean ± SD)

Group	n	APACHE II Score (points)		SOFA Score (points)	
		Before Treatment	After Treatment	Before Treatment	After Treatment
Observation	38	28.49 ± 4.21	18.33 ± 2.13	7.33 ± 1.23	5.04 ± 0.31
Control	38	28.53 ± 4.23	22.37 ± 3.18	7.31 ± 1.21	6.26 ± 2.14
t-value		0.0413	6.5068	0.0715	3.4780
p-value		0.9672	0.0000	0.9432	0.0008

3.4. Analysis of nutritional status and body mass index before and after treatment in both groups

Before treatment, there were no significant differences in the relevant indicators between the two groups, with $p > 0.05$. After treatment, the indicators in the observation group were significantly different from those in the control group, with $p < 0.05$. (**Table 4**)

Table 4. Study on changes in nutritional status and body mass index in the observation group and the control group (mean ± SD)

Group	n	Hemoglobin (g/L)		Serum Protein (g/L)		Body Mass Index (kg/m^2)	
		Before Treatment	After Treatment	Before Treatment	After Treatment	Before Treatment	After Treatment
Observation	38	100.08 ± 10.04	139.98 ± 12.24	30.39 ± 5.73	46.68 ± 5.43	20.11 ± 3.42	26.67 ± 4.47
Control	38	100.11 ± 10.01	111.65 ± 11.69	30.41 ± 5.78	35.57 ± 5.21	20.13 ± 3.44	22.25 ± 4.53
t-value		0.0130	10.3180	0.0151	9.1009	0.0254	4.2813
p-value		0.9896	< 0.001	0.9880	0.0000	0.9798	0.0001

3.5. Comparison of changes in blood gas analysis indicators between the observation group and the control group

After treatment, significant differences were observed in the blood gas indicators between the two groups, with $p < 0.05$. (**Table 5**)

Table 5. Comparison of blood gas analysis indicators before and after treatment in both groups (mean ± SD)

Group	n	PaO_2 (mmHg)		$PaCO_2$ (mmHg)	
		Before Treatment	After Treatment	Before Treatment	After Treatment
Observation	38	50.09 ± 10.09	86.12 ± 10.32	60.43 ± 10.07	50.33 ± 10.14
Control	38	50.11 ± 10.13	73.09 ± 10.53	60.48 ± 10.12	55.54 ± 10.03
t-value		0.0086	5.4478	0.0216	2.2518
p-value		0.9981	0.0000	0.9828	0.0273

4. Discussion

The progression of illness in ICU patients is relatively rapid, with most being critically ill cases that present significant treatment challenges and often yield unsatisfactory prognostic outcomes [6]. Moreover, ICU patients face a heightened risk of bacterial infections and are more prone to complications, with respiratory failure being the most prevalent [7]. Respiratory failure refers to a condition where the patient's respiratory function is compromised, making it difficult to ensure normal gas exchange and affecting oxygenation status, manifesting in symptoms such as increased respiratory difficulty, confusion, and even coma [8]. In ICU patients with respiratory failure, gastrointestinal function is often impaired, leading to decreased metabolic capacity and ineffective nutrient absorption, thereby increasing the risk of malnutrition and significantly impacting their immune function [9]. These patients also face significant challenges in terms of food intake, making it difficult to provide the necessary nutrients for their bodies. Consequently, in cases where nutritional support is inadequate, the incidence of malnutrition significantly rises.

In clinical practice, parenteral nutrition therapy primarily involves providing essential nutrients to the body intravenously, aiming to match nutritional requirements as closely as possible and ensuring necessary nutritional support [10]. This treatment approach bypasses the digestive tract, making it more suitable for patients with abnormal intestinal function [11]. However, it is important to note that parenteral nutrition therapy increases the risk of complications (such as thrombosis and phlebitis), hinders the recovery of intestinal function, and may lead to reduced intestinal motility or mucosal atrophy, thereby impeding the patient's overall recovery process [12]. In contrast, early enteral nutrition support can protect the intestinal mucosal barrier function in patients, reducing the risk of bacterial translocation or dysbiosis of the intestinal flora, and preventing malnutrition and other adverse events [13]. For ICU patients with respiratory failure who are unable to consume nutrients orally, early enteral nutrition therapy not only stabilizes their intestinal function but also prevents intestinal atrophy and functional failure [14].

Based on the comparative results of the aforementioned data, it was observed that the total treatment effectiveness rate in the observation group was higher than that in the control group, with $p < 0.05$. The results indicate that this treatment method is effective. After receiving early enteral nutrition therapy, the pulmonary function indicators in the observation group were all superior to those in the control group, with $p < 0.05$. This confirms that this treatment regimen significantly improves pulmonary function in ICU patients with respiratory failure. Following treatment, the observation group demonstrated superior organ function, health status, nutritional status, body mass index (BMI), and blood gas analysis indicators compared to the control group, with $p < 0.05$. This suggests that early implementation of enteral nutrition therapy for patients is beneficial for improving their organ function, and effectively regulates BMI and blood gas indicators, with proven efficacy [15].

5. Conclusion

Overall, early enteral nutrition therapy has a positive impact on the pulmonary function and blood gas analysis indicators of ICU patients with respiratory failure. It effectively prevents the proliferation of harmful bacteria through the use of microbiota, significantly reducing the risk of infection. To a certain extent, it accelerates the improvement of patients' nutritional status, enhances organ function, and holds high clinical value for promotion and application [16].

Disclosure statement

The author declares no conflict of interest.

References

[1] Lv Y, Cao Z, Zhong H, et al., 2024, The Impact of Early Enteral Nutrition Therapy on the Nutritional Status and Pulmonary Function of Patients with Severe Respiratory Failure. Food and Nutrition in China, 30(5): 84–88.

[2] Pan L, Xu L, Meng N, et al., 2023, The Effects of Different Proportions of Early Combined Enteral and Parenteral Nutrition on Patients with Chronic Obstructive Pulmonary Disease Complicated by Type II Respiratory Failure. Chinese Journal of General Practice, 21(2): 203–206.

[3] Yang L, Xu F, Jin X, et al., 2023, Analysis of the Timing of Nasogastric Tube Enteral Nutrition and Changes in the Expression Levels of Enterogenic Infection Indicators in SAP Patients. Chinese Journal of Integrated Traditional and Western Medicine in Intensive and Critical Care, 30(2): 199–203.

[4] Xu C, Jin L, Zhang H, 2024, The Effects of Compound Lactobacillus Capsules Combined with Nutritional Support on Nutritional Biochemical Indicators and Intestinal Microecology in Patients with Severe Pneumonia. Journal of Xinxiang Medical University, 41(5): 449–454.

[5] Li F, Lu J, Yang N, et al., 2024, The Application Value of Enteral Nutrition Combined with Refined Strategies in ICU Patients with Respiratory Failure. Hebei Medical Journal, 46(18): 2784–2787.

[6] Liu Y, Guo X, Fang N, et al., 2024, The Application of Gastrointestinal Ultrasound Monitoring of Gastric Residual Volume in Nutritional Therapy for Neurocritically Ill Patients on Mechanical Ventilation. China Medical Herald, 21(1): 108–111.

[7] Zhu X, Wang J, Pan H, et al., 2024, Analysis of the Application Effect of an Information-Guided Enteral Nutrition-Related Diarrhea Management Process in Patients with Chronic Obstructive Pulmonary Disease Receiving Continuous Noninvasive Assisted Ventilation: A Before-and-After Mixed Cohort Study. Chinese Critical Care Medicine, 36(1): 62–67.

[8] Jiang Q, Yuan Y, Miao L, 2023, The Application of Nasal High-Flow Humidified Oxygen Therapy Combined with Early Enteral Nutrition in Patients with AECOPD Complicated by Respiratory Failure. Health Medicine Research and Practice, 20(2): 16–20.

[9] Kang L, Wu Y, 2024, Observation on the Effect of Predictive Nursing for Patients with COPD Complicated with Respiratory Failure Receiving Enteral Nutrition Support. In: Yulin Medical Association. Proceedings of the 5th National Forum on Medical Research (Vol. III). Affiliated Hospital of Inner Mongolia Medical University, 408–413.

[10] Liu Y, Ye F, Ma L, 2024, Observation on the Efficacy of Bifidobacterium Lactobacillus Triple Viable Bacteria Combined with Enteral Nutrition Support in Patients with Chronic Obstructive Pulmonary Disease Complicated with Respiratory Failure. Da Yi Sheng, 9(6): 44–47.

[11] Wang Q, 2023, The Impact of Early Enteral Nutrition Support Nursing under the Severe Feeding Protocol on the Nutritional Status and Cardiopulmonary Function of Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease and Respiratory Failure. Heilongjiang Medical Journal, 47(4): 495–497.

[12] Liu X, Xie F, Hao X, et al., 2023, The Application Effect of Combined Enteral-Parenteral Nutrition and Bilevel Positive Airway Pressure Ventilation on Patients with Acute Exacerbation of COPD Complicated with Type II Respiratory Failure. Journal of Guizhou Medical University, 48(3): 347–351.

[13] Jiang F, Lin S, 2023, Observation on the Effect of Sequential Invasive-Noninvasive Ventilation Combined with Enteral

Nutrition Support in the Treatment of Critically Ill Respiratory Failure Patients in the ICU. Electronic Journal of Modern Medicine and Health Research, 7(11): 16–18.

[14] Liu X, Xie F, Hao X, et al., 2023, The Application Effect of Combined Enteral-Parenteral Nutrition and Bilevel Positive Airway Pressure Ventilation on Patients with Acute Exacerbation of COPD Complicated with Type II Respiratory Failure. Journal of Guizhou Medical University, 48(3): 347–351 + 372.

[15] Yang Y, Bai Q, 2024, Exploration of the Application Effect of Combined Enteral-Parenteral Nutrition and Bilevel Positive Airway Pressure Ventilation on Patients with Acute Exacerbation of COPD Complicated with Type II Respiratory Failure. Journal of Qiqihar Medical University, 45(3): 238–241.

[16] Xia W, Ai H, Han R, 2022, The Impact of Early Enteral Nutrition Support Combined with Noninvasive Bilevel Positive Airway Pressure Ventilation on the Prognosis of Patients with COPD Complicated with Respiratory Failure. Medical Recapitulate, 28(11): 2283–2288.