Journal of Clinical and Nursing Research, 2024, Volume 8, Issue 3
http://ojs.bbwpublisher.com/index.php/JCNR
Online ISSN: 2208-3693
Print ISSN: 2208-3685

# Study on the Accuracy of Serum Prealbumin Level in Predicting the Prognosis of Patients with Critical Respiratory Illness

**Xiang Wang, Zuozhou Xie, Jinhong Zhao, Yi Liu***

Kunming Second People's Hospital Kunming 650203, Yunnan Province, China

***Corresponding author:** Yi Liu, liuyi714@126.com



**Abstract:** *Objective:* To analyze the accuracy of serum prealbumin levels in predicting the prognosis of patients with critical respiratory illness. *Methods:* Fifty patients with critical respiratory illness admitted to our hospital from October 2022 to September 2023 were selected and divided into an observation group and a control group after condition assessment, with 25 cases in each group. The results of cholinesterase (ChE), prealbumin (PALB), albumin (ALB), aspartate aminotransferase (AST), total protein (TP), and forced expiratory volume ($FEV_1$)/Predicted (Pred) of the two groups were measured. *Results:* The ChE levels of the observation group were lower than those of the control group, while the PALB and ALB levels of the observation group were higher than those of the control group ($P < 0.05$). The AST, TP, and $FEV_1$/Pred levels of the observation group were higher than those in the control group ($P < 0.05$). *Conclusion:* Serum PALB levels can be used as the main indicator for prognosis in critically ill respiratory patients.

**Keyword:** Serum prealbumin; Respiratory critical illness; Prognostic level; Accuracy

**Online publication:** March 24, 2024

## 1. Introduction

Malnutrition is a complication that often occurs in critically ill patients. For patients with pulmonary infection, its occurrence and development are closely related to the patient's ventilator dependence, which may lead to prolonged hospitalization and increased medical expenses. According to relevant studies, the incidence rate of malnutrition among hospitalized patients was 30%–60% [1]. For critically ill patients, the incidence rate of malnutrition can reach more than 40%. This shows that malnutrition adversely affects the prognosis of patients. The assessment and monitoring of the nutritional status of critically ill patients can achieve the purpose of effectively improving prognosis. Since infection and respiratory failure may lead to an excessive consumption of body nutrients, the incidence of malnutrition in such patients will increase significantly. Therefore, timely and accurate nutritional assessment of patients with respiratory critical illness and targeted nutritional support based on the assessment results is crucial. Serum prealbumin (PALB) has good evaluation significance in acute and chronic hepatitis and cirrhosis and is a good indicator of clinical nutrition. However, there are few studies

on the correlation between serum PALB levels in critically ill patients with respiratory disease. This article analyzed the PALB levels and prognosis of critically ill respiratory patients admitted to our department to determine the accuracy of PALB in the prognosis of critically ill patients with respiratory diseases.

## 2. Materials and methods

### 2.1. Basic data

Fifty patients with respiratory critical illness admitted to the hospital from October 2022 to September 2023 were selected. Based on the hospitalization stage, 25 survivors were included in the observation group and 25 critically ill patients were included in the control group. The observation group consisted of 13 males and 12 females aged 50–74 years old, with an average age of 55.28 ± 9.66 years. The mean body mass index (BMI) was 22.39 ± 3.56 kg/m$^2$ and the mean duration of the disease was 15.38 ± 5.32 years. The control group consisted of 14 males and 11 females aged 52–73 years old, with an average age of 55.31 ± 9.42 years. The mean BMI was 22.41 ± 3.50 kg/m$^2$ and the mean duration of the disease was 15.40 ± 5.30 years. The assessment of the baseline information of the two groups showed no significant difference ($P > 0.05$).

The patients were diagnosed under normal atmospheric conditions at sea level to measure their partial blood oxygen pressure ($PaO_2$), with permission to breathe air while remaining stationary. The $PaO_2$ measured was 60 mmHg. Inclusion criteria: (1) Patients diagnosed with respiratory illness according to the gold standard diagnostic principle of respiratory failure; (2) blood pressure maintained within the normal range; (3) complete clinical results. Exclusion criteria: (1) Patients with heart function imbalance; (2) patients with cancer.

### 2.2. Method

All patients were treated with antibiotics, oxygen therapy, bronchodilator treatment, and non-invasive ventilation upon admission.

### 2.3. Observation indicators

#### 2.3.1. Serum level

Patients were told to maintain a morning fasting state upon enrolling in this study. The serum record was kept centrifuged after 3 mL of fasting venous blood was drawn and processed. The acetylthiocholine method was used and a kit was selected to complete the recording of serum levels, with a reference value of cholinesterase (ChE) at 5–12 kU/L. The immunoturbidimetric method was used to select a kit to complete the measurement of PALB levels, with a reference value of 250–400 mg/L as the benchmark. Among them, PALB was measured with reagents provided by Zhongyuan Huiji Biotechnology Co., Ltd.

During the admission stage, 5 mL of fasting venous blood was drawn in the early morning, centrifuged at 3000 rpm for 15 minutes, and the serum was stored in a -70°C refrigerator. The complete albumin (ALB), aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), and total serum protein (TP) were measured, where the Beckman Coulter Experimental Systems (Suzhou Co., Ltd) provided all measurement reagents and standards.

The latex immunoturbidimetric method (immunoelectrophoresis, IPE) was utilized for the assay. All assay reagents and standards were provided by Beckman Coulter Experimental Systems (Suzhou Co., Ltd) to determine the levels of hypersensitive C-reactive protein (hypersensitive-CRP).

The severity of the respiratory disease was measured using the Acute Physiology and Chronic Health Score (APACHE II).

The patient's lung function level was measured using the Masterscreen lung function test system

equipment (CareFusion Germany 234 GmbH, Germany), where the forced expiratory volume in one second ($FEV_1$/predicted value (Pred)) percentage, forced vital capacity (FVC), and forced vital capacity ratio ($FEV_1$ / FVC) were analyzed.

### 2.4. Statistical analysis

Statistical analysis was carried out using the SPSS 21.0 software. In the form of a normal distribution test, measurement data were expressed as mean ± standard deviation and compared using a *t*-test. Count data were expressed as % and analyzed using the chi-squared ($\chi^2$) test. The analysis of multiple groups was confirmed by variance and the model hypothesis Cox model processing was completed at the same time to determine the prognostic factors of the patients. Results were considered statistically significant at $P < 0.05$.

## 3. Results

### 3.1. Serum ChE and PA values

As shown in **Table 1**, the ChE levels of the observation group were lower than those of the control group, while the PALB and ALB levels of the observation group were higher than those of the control group ($P < 0.05$).

**Table 1.** ChE and PALB levels between the two groups ($n = 25$, mean ± standard deviation)

| Group | ChE (kU/L) | PALB (mg/L) | ALB (g/L) |
|---|---|---|---|
| Observation group | 3.60 ± 0.50 | 156.81 ± 21.14 | 36.60 ± 3.55 |
| Control group | 4.89 ± 0.69 | 124.23 ± 20.69 | 25.51 ± 4.22 |
| *t* | 7.5694 | 5.5070 | 10.0551 |
| *P* | 0.0001 | 0.0001 | 0.0001 |

### 3.2. Analysis of clinical results

As shown in **Table 2**, the AST, TP, and $FEV_1$ /Pred values in the observation group were higher than that of the control group ($P < 0.05$).

**Table 2.** Comparison of clinical results ($n = 25$, mean ± standard deviation)

| Group | APACHE III (point) | AST (U/L) | ALT (U/L) | ALP (U/L) | TP (g/L) | Hs-CRP (mg/L) | $FEV_1$/Pred (%) | $FEV_1$/FVC (%) |
|---|---|---|---|---|---|---|---|---|
| Observation group | 24.39 ± 11.21 | 26.66 ± 4.19 | 21.19 ± 3.19 | 46.39 ± 7.70 | 69.36 ± 9.53 | 12.29 ± 6.56 | 57.71 ± 10.21 | 68.61 ± 10.32 |
| Control group | 44.40 ± 15.65 | 23.34 ± 3.20 | 22.29 ± 4.50 | 67.44 ± 11.21 | 55.23 ± 6.45 | 19.19 ± 3.17 | 51.54 ± 8.56 | 67.34 ± 9.19 |
| *t* | 5.1972 | 3.1485 | 0.9971 | 7.7390 | 6.1394 | 4.7352 | 2.3154 | 0.4595 |
| *P* | 0.0001 | 0.0028 | 0.3237 | 0.0001 | 0.0001 | 0.0001 | 0.0249 | 0.6479 |

### 3.3. Related factors

The risk factor assessment and logistic regression analysis showed that, after controlling for factors like gender and age, serum PALB was an independent risk factor for death.

### 3.4. Intervention effect

As shown in **Table 3**, the total efficiency of the observation group was higher than that of the control group ($P < 0.05$).

**Table 3.** Comparison of intervention effects ($n$ = 25)

| Group | Cured | Better | Died | Total efficient rate |
|---|---|---|---|---|
| Observation group | 1 (4.00) | 24 (96.00) | 0 (0.00) | 100.00 |
| Control group | 0 (0.00) | 21 (84.00) | 4 (16.00) | 84.00 |
| $\chi^2$ | | | | 4.3478 |
| $P$ | | | | 0.0370 |

## 4. Discussion

ChE is a glycoprotein formed in liver cells and is a key indicator of the liver's function of protein synthesis. The results of this study have confirmed that in patients with respiratory failure caused by pulmonary infection, hypoxemia accelerates the synthesis of central nervous system ChE, thereby accelerating the decomposition of ChE, which results in hypoxia, physical discomfort, and infections. PALB is an acute-related reaction protein substance synthesized and secreted from liver tissue simultaneously [3]. The results showed that the decrease in serum PALB levels and liver parenchymal damage were closely correlated. As supported by the corresponding results, the half-life of serum ChE and PALB becomes shorter and is influenced by exogenous factors, thereby reflecting the liver reserve effect. In this study, the ChE levels of the observation group were lower than those in the control group, while the PALB and ALB levels of the observation group were higher than those in the control group ($P < 0.05$). It was confirmed that when the patient's condition worsens, the serum PALB and ALB decreases.

As humans age, their body functions gradually weaken and are easily affected by chronic underlying diseases. When a patient suffers from respiratory failure due to lung infection, the body's catabolism speed accelerates and the synthesis speed decreases, resulting in malnutrition. Relevant studies have shown that 25%–40% of such patients were malnourished, which ultimately leads to an increased risk of respiratory failure [4]. This study confirmed that the patients admitted to the intensive care unit (ICU) were relatively older and suffered from multiple underlying diseases. Nearly 20% of the patients suffer from respiratory diseases such as chronic obstructive pulmonary disease (COPD) [5], coronary cardiology disorders of atherosclerotic heart disease (CHD) [6], hypertension, diabetes [7], and malnutrition. Malnutrition can further increase the body's protein catabolism rate, thereby reducing respiratory muscle function, and making it more difficult for patients to wean from the ventilator. Patients must be provided with corresponding nutritional support that can enhance the success rate of weaning patients with respiratory failure from mechanical ventilation. Ultimately, the goal is to improve prognosis. Therefore, early assessment of the patient's nutritional status and carrying out appropriate interventions can improve clinical efficacy.

Previously used clinical methods to assess nutritional status include Patient-Generated Subjective Global Assessment (PG-SGA) [8], Detailed Nutritional Assessment (DNA), and Prognostic Inflammation and Nutritional Index (PINI). However, these assessment methods have shortcomings, such as complicated steps and high requirements for patient cooperation. Hence, they are unsuitable for patients with critical respiratory illness. Blood biochemical indicators have lower requirements for patient cooperation and are universally applied in clinical practice. PALB is produced from liver cells and has a half-life of 2 days. If the nutritional intake within 3 days is unbalanced, the concentration of serum PALB in the plasma decreases. Therefore, serum PALB levels can be used to diagnose malnutrition in patients with respiratory illness. Simultaneous recording of serum TP [9], ALB, triglycerides, and total cholesterol provided higher sensitivity for the detection

of adverse reactions. Current studies have shown that patients with relatively low serum PALB levels have a higher mortality rate. Patients with PALB < 150 mg/L require parenteral nutrition support. If the PALB increase rate was < 40 mg/L after 7 days of treatment, this indicated that the patient has a poor prognosis and would need to complete enteral/parenteral nutrition intake. According to the research data, the results confirmed that the PALB levels in the control group were lower than in the observation group. The results confirmed that for patients undergoing hemodialysis treatment, the PALB levels of the control group were lower than those in the observation group. Reduced protein levels can be a major factor in predicting readmission rates and death [10]. For patients with traumatic shock and infection, the results confirmed that the observation group had higher ALB levels than the control group. The study also showed that the CRP/PALB value was higher in patients with severe infection and those with multiple organ dysfunction. This study confirmed through logistic regression analysis that PALB was an independent risk factor for death in patients with respiratory illnesses. At the same time, it was believed that nutritional support can regulate the level of various patient indicators and improve the quality of prognosis.

## 5. Conclusion

The serum PALB levels were able to accurately predict the prognosis of patients with critical respiratory illness.


## Funding

Funded Project "Correlation Study Between Prealbumin Levels and the Weaning Time of Mechanical Ventilation in Patients with Respiratory Failure Due to Pulmonary Infection" (Project No. 2022-03-02-009)


## Disclosure statement

The authors declare no conflict of interest.

## References


[1] Liu J, Zhang X, Hu M, 2023, Predictive Value of Serum C-Reactive Protein, Prealbumin, and Red Blood Cell Volume Distribution Width in The Prognosis of Patients with Severe Pneumonia Complicated by Respiratory Failure. Journal of Clinical and Pathology, 43(1): 22–28.

[2] Wang Q, 2023, Effects of Early Enteral Nutrition Support Care Under the Intensive Feeding Process on The Nutritional Status and Cardiopulmonary Function of Patients With Acute Exacerbation of Chronic Obstructive Pulmonary Disease and Respiratory Failure. Heilongjiang Medicine, 47(4): 495–497.

[3] Yu Y, Zhan X, Ding Y, et al., 2021, Study on the Impact and Safety of Different Enteral Nutrition Timing on Serum BNP, Nutritional Status, and T-Cell Subsets in Patients with Severe Heart Failure and Respiratory Support. Chinese Emergency Resuscitation and Disaster Medicine Magazine, 16(8): 874–879.

[4] Cao S, Jin X, Zhao X, 2021, Effects of TPF-D on Inflammatory Immunity Levels and Serum Recombinant B-Cell Trophic Factor in Elderly Patients with Type 2 Diabetes and Severe Lower Respiratory Tract Infection. Sichuan Journal of Physiological Sciences, 43(10): 1667–1670.

[5] Zhang A, Lai W, Wang M, et al., 2023, Study on the Effect of Bifidobacterium Triple Live Bacteria Capsules Combined with Enteral Nutrition in The Prevention of Ventilator-Associated Pneumonia in Mechanically Ventilated Patients with Sepsis. Electronic Journal of Emerging Infectious Diseases, 8(3): 29–33.

[6] Huang K, Shu L, Zhou X, et al., 2023, The Predictive Value of Prealbumin, Albumin, and D-Dimer in the Severity and Prognosis of Acute Pulmonary Embolism. Journal of Guangxi Medical University, 40(7): 1206–1211.

[7] Pan K, Wang Z, Li G, et al., 2022, Effect of Nutritional Support on Children with Acute Lymphoblastic Leukemia Based on Standardized Processing and Analysis of Nutritional Status Data. China Medical Herald, 19(18): 86–89.

[8] Xu J, Gao Y, Zhao P, 2021, The Application Effects of Different Enteral Nutrition Catheter Placement Methods in Patients with Cerebrovascular Diseases Undergoing Mechanical Assisted Ventilation. Qilu Nursing Journal, 27(2): 138–139.

[9] Zhang Y, Jin L, Chen Y, 2022, The impact of the Application of Predictive Care Based on The Omaha System on Nutritional Status and Complication Control in Patients with Severe Craniocerebral Injury and Nasal Feeding. China Medical Herald, 19(28): 190–193.