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Correlation between serum albumin, prealbumin and ventilator dependence in patients with COPD

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ABSTRACT

Objective: To investigate the correlation between the serum albumin, prealbumin and ventilator dependence in patients with COPD. **Methods:** Serum albumin and prealbumin of 44 COPD patients using breathing machine>48 h were tested at admission, 1 week, 2 weeks treatment. According to the existence of ventilator dependence, divided the patients into the ventilator dependence group and the ventilator independence group, compare the albumin, prealbumin average of two groups, evaluate the correlation between the serum albumin, prealbumin and ventilator dependence in patients with COPD. **Results:** Albumin levels reduced in both groups after 1 week treatment, but there was no statistically significant difference. Albumin levels reduced in both groups after 2 weeks treatment, but more significantly in the ventilator dependence group, the difference had statistical significance. Prealbumin levels in the ventilator independence group after 1 week treatment didn't reduced, but reduced in the ventilator dependence group, the difference was statistically significant. Prealbumin levels reduced in both groups after 2 weeks treatment, but more significant in the ventilator dependence group, the difference had statistical significance. **Conclusion:** Serum albumin and prealbumin levels were correlation with the ventilator dependence in patients with COPD. But prealbumin can more sensitively and more early predict the ventilator dependence in patients with COPD suffered from malnutrition.

1. Introduction

Chronic obstructive pulmonary disease (COPD) is characterized by continuous limited airflow, it can be prevented and treated, its limited airflow is more progressive development, correlated with chronic inflammation of the airway and lung tissue for the tobacco, harmful particles and other harmful gases. COPD airway obstruction, insufficient pulmonary ventilation or ventilation/blood flow ratio imbalance results in lack of oxygen and carbon dioxide retention, respiratory failure, even need to build artificial airway for serious patients, application of mechanical ventilation. Using ventilator for more than 2 weeks, can generate significant dependence, called as ventilator dependence, a major complication of mechanical ventilation[1]. Malnutrition is a basic reason for the ventilator dependence, one of the most important reason.This study is to investigate the correlation between the serum albumin, prealbumin and ventilator dependence in patients with COPD.

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2. Data and methods

2.1. General data

Select 18 COPD patients from March 2013 to March 2015 in our hospital with invasive mechanical ventilation for more than 2 weeks (ventilator dependence group), 12 male and 6 female cases, aged 58 to 87y (63.36±14.28); Select 26 COPD patients with invasive mechanical ventilation for less than 2 weeks (ventilator independence group), 16 male and 10 female cases, aged 55 to 84y (67.58 ±15.21); All patients were accord with the diagnostic

criteria of the guide of diagnosis and treatment of chronic obstructive pulmonary disease (2013 revision) formulated by COPD group of the Chinese medical association[2].

2.2. Methods

According to the existence of ventilator dependence, divided the patients into the ventilator dependence group and the ventilator independence group, analyze the general data, disease severity on admission, basic diseases of two groups.Compare the albumin, prealbumin average of two groups at admission, 1 week, 2 weeks treatment by Olympus AU-680 fully automatic biochemical analyzer. All patients were treated according to the diagnostic criteria of the guide of diagnosis and treatment of chronic obstructive pulmonary disease (2013 revision) formulated by COPD group of the Chinese medical association.

2.3. Statistical methods

Data were analyzed by SPSS 13.0 statistical software, comparison between count data set by *chi*-square test, measurement data with Mean ± SD, the mean comparison between groups using *t* test. Difference was statistically significant ($P<0.05$).

3. Results

3.1. General information

General information, including gender, age, basic diseases and APACHE][score between two groups at admission were no statistical difference ($P>0.05$), as shown in table 1.

3.2. Albumin levels

Albumin levels didn't decrease at admission, comparison between the two groups have no statistical differences. Albumin levels reduced in both groups after 1 week treatment, but there was no statistically significant difference. Albumin levels reduced in both groups after 2 weeks treatment, but more significantly in the ventilator dependence group, the difference had statistical significance, as shown in table 2.

3.3. Prealbumin levels

Prealbumin levels didn't decrease at admission, comparison between the two groups have no statistical differences. Prealbumin levels in the ventilator independence group after 1 week treatment didn't reduced, but reduced in the ventilator dependence group, the difference was statistically significant. Prealbumin levels reduced in both groups after 2 weeks treatment, but more significant in the ventilator dependence group, the difference had statistical significance, as shown in table 3.

4. Discussion

Due to loss of appetite, negative nitrogen balance, increased work of breathing, abnormal expression of inflammatory markers, Patients with COPD prone to weight loss, muscle protein decomposition, skeletal muscle contraction impairment and bone metabolic abnormalities[3,4]. Malnutrition of COPD have many causes: 1.

Table 1.

General data between two groups patients at admission.

Parameter	Ventilator dependence group (n=18)	Ventilator independence group (n=26)	P
Gender(Male/female)	12/6	16/10	$P>0.05$
Age	63.36±14.28	67.58±15.21	$P>0.05$
APACHE][score	14.38±6.24	15.36±7.13	$P>0.05$
Hypertension	6	9	$P>0.05$
Coronary heart disease	5	8	$P>0.05$
Diabetes	3	6	$P>0.05$

Table 2.

Albumin means comparison between two groups at different time points.

Group	At admission (g/L)	At 1 week treatment (g/L)	At 2 weeks treatment (g/L)
Ventilator dependence group	32.65±6.31	28.31±5.26	22.38±5.86
Ventilator independence group	33.29±5.65	28.67±5.94	28.12±5.37
P	$P>0.05$	$P>0.05$	$P<0.05$

Table 3.

Albumin means comparison between two groups at different time points.

Group	At admission (mg/L)	At 1 week treatment (mg/L)	At 2 weeks treatment (mg/L)
Ventilator dependence group	305.36±92.17	204.36±75.82	152.38±65.53
Ventilator independence group	290.36±85.35	281.59±78.38	247.52±71.32
P	$P>0.05$	$P<0.05$	$P<0.05$

Increased airway resistance, decreased lung compliance, increased oxygen consumption of breathing and diet reduce, patients with COPD prone to the malnutrition; 2. Repeated infection, hypoxia, hypercapnia, anxiety, patients are in a stress state for a long time, the catabolism hormone promote in the body, but the secretion of insulin are normal or reduce , the glycogen decompose and gluconeogenesis obviously, glucose utilize impediently, cause malnutrition; 3. A result of rising further decomposition of hormones in the body, protein decompose obviously, skeletal muscle release amino acids, and then consumed, branched chain amino acids decrease in the blood , cause negative nitrogen balance and malnutrition; 4. TNF-alpha, IL-8, IL-15, leptin and various cytokines of COPD patients are involved in the process of malnutrition. The common role of above factors resulted in malnutrition of COPD patients. So far, the reasons of ventilator dependence in COPD patients are considered as the following:(1) Malnutrition; (2) Respiratory muscle fatigue; (3) Cardiopulmonary insufficiency; (4) Psychological factors. Malnutrition is independent risk factors for disease progression and prognosis of COPD patients, closely associated with reduced lung function and well strength[5]. Nutritional deficiencies, decreased energy substrate and protein synthesis, increased glycogen dysplasia, alleviated muscle weight and muscle fiber structure damage, reduce the contraction of muscle force and endurance, well prone to fatigue. Studies have found well and peripheral muscle structure and biochemical abnormal function changes of patients with severe COPD, muscle group decrease significantly, due to long-term malnutrition. In addition, Protein intake decrease due to causes such as loss of appetite, decomposition of muscle protein and amino acid increase, cause muscle ATP enzyme availability reduced, eventually lead to muscle atrophy and fatigue[6]. Malnutrition can lead to fatigue of well, ventilator dependence, reasonable and effective nutrition support can improve the well structure and function, greatly improve the success rate of patients with ventilator dependent out of ventilator[7].

Serum prealbumin is a kind of glycoprotein synthesis by liver cells. It displays before albumin on electrophoresis, so called prealbumin, the characteristics of low content in serum and high conversion rate in the body, can be quickly detected in the blood after its synthesis in the liver. It is composed of four identical subunits, half-life of 0.5 days, their participation in T3, T4, vitamin and retinol protein synthesis. Determination of serum prealbumin can reflect the function of the liver synthesis and secretion of protein, a useful marker of protein energy malnutrition, help identify patients with malnutrition, evaluate its nutrition improvement[8]. Prealbumin is aiso negative acute phase proteins, obvious rise after 6 to 8h in critical patients suffered from inflammation, participate in the body's stress response. For short half-life, its level drops can reflect recent lack of nutrition. This study observed the COPD patients with mechanical ventilation treatment exist different decreased levels of albumin, prealbumin due to various factors, Prealbumin reduced more obviously and early in the ventilator dependence group patients. This may be different half-life of them, half-life of serum albumin is longer, relatively poor sensitivity for the short-term changes of nutritional status by diseases. And prealbumin is one of the evaluation of nutritional status and the important monitoring indicators of nutritional support on international, although few total content in the body, the high update rate and short half-life, may be better sensitivity[9]. This study also suggests in the prediction index of COPD patients with ventilator dependence, serum albumin and prealbumin can effectively forecast, but prealbumin can be more sensitive, more early to predict COPD patients with ventilator dependence due to malnutrition.

To sum up, serum albumin, prealbumin have certain effect to predict ventilator dependence among patients with COPD and evaluate nutritional support. Prealbumin's efficiency is better than that of albumin, can help to predict the likelihood of COPD patients with ventilator dependence and evaluate nutritional support effect for clinicians as soon as possible.

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