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Clinical Analysis of Early Application of Bi-level Positive Airway Pressure ventilation in the Treatment of COPD with Type II Respiratory Failure

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Abstract: Objective: To analyze the clinical efficacy of early application of bi-level positive airway pressure ventilation in the treatment of COPD with type II respiratory failure. **Method:** A total of 58 patients with COPD and type II respiratory failure admitted to our hospital from January 2017 to January 2019 were randomly divided into observation group and control group, with 29 cases in each group. Among them, the control group was received routine treatment while the observation group was treated with bi-level positive pressure airway ventilation in addition of conventional treatment. The arterial blood gas analysis, mortality rate and hospitalization time of these two groups before and after treatment were compared. **Result:** The blood pH, partial pressure of oxygen (PaO_2) and arterial oxygen saturation (SaO_2) of these two groups were significantly higher after the treatment while PaO_2 alone was decreased. The difference was statistically significant ($P<0.05$). The results of arterial blood gas analysis in the observation group were significantly improved compared with those before treatment. The mortality rate and hospitalization time were significantly less than the control group, and the difference was statistically significant ($P<0.05$). **Conclusion:** Early clinical application of bi-level positive airway pressure ventilation in the treatment of COPD with type II respiratory failure has a significant clinical effect in reducing the mortality rate and hospitalization time of patients, and thus it is worthy of clinical application.

Keywords: *bi-level positive airway pressure ventilation; COPD; type II respiratory failure; efficacy*

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1 Introduction

Chronic obstructive pulmonary disease (COPD) refers to a chronic bronchitis and/or emphysema characterized by airflow obstruction which can further develop into a common chronic disease of pulmonary heart disease and respiratory failure[1], in which respiratory failure can be divided in type I and type II. With the advancement of medical technology, non-invasive positive pressure ventilation has gradually been adopted to rescue respiratory failure. 58 patients with COPD and type II respiratory failure admitted to our hospital during the period from January 2017 to January 2019 were included in the study. The clinical application of early bi-level positive airway pressure ventilation in the treatment of COPD with type II respiratory failure was studied. The efficacy is as follows:

2 Data and methods

2.1 General information

During the period from January 2017 to January 2019, 58 patients with COPD and type II respiratory failure came to our hospital were randomly divided into observation group and control group with 29 cases in each group. Among them, 8 out of 21 patients in the control are females, aged 63-87 years old while 10 out of 19 patients in the observation group are females, aged 65-89 years old. There was no significant difference in gender and age between these two groups, $P>0.05$, which was not statistically significant.

2.1.1 Inclusion and exclusion criteria

Inclusion criteria: 1) All patients were diagnosed in accordance with the diagnostic criteria of the 8th edition of Internal Medicine and Diagnostics. 2) All patients were conscious and spontaneously breathing. 3) All patients were informed about the purpose and method of the study.

Exclusion criteria: 1) The patient's face was traumatized or the face was deformed due to surgery. 2) The patient was in a coma and was unable to breathe spontaneously. 3) The patient had liver and kidney failure. 4) The patient refused to cooperate.

2.2 Method

All patients underwent blood gas analysis before treatment. The patients in the control group were given conventional treatment, namely anti-infective therapy, low flow oxygen therapy and anti-asthmatic treatment. In the observation group, in addition of conventional treatment, BiPAP nasal mask ventilator was used for ventilation treatment. Spontaneous breathing timing mode (S/T) was selected, the respiratory rate is set to 10-12 beats per min, inspiratory positive airway pressure (IPAP) is slowly increased from the beginning 8-10 cm H_2O to 15-20 cm H_2O, expiratory positive airway pressure (EPAP) is set to 4-6 cm H_2O, oxygen flow rate is 4-6 L/min. During ventilation, appropriate adjustments were made based on the patient's condition.

2.3 Observation indicators

The results of arterial blood gas analysis, mortality rate and hospitalization time before and after treatment were recorded.

2.4 Statistical methods

The data obtained by this study were analysed by SPSS 20.0 statistical software. The count data was analysed by X^2 test, the measurement data was analysed by t test and the data was expressed in the form of mean±standard deviation (±s), $P<0.05$ represent statistical significance.

3 Results

3.1 Comparison of changes in blood gas analysis before and after treatment in both groups

The blood pH, partial pressure of oxygen (PaO_2) and arterial oxygen saturation (SaO_2) of both observation and control groups were all significantly increased compared with those before treatment, while $PaCO_2$ was decreased and the difference was statistically significant. The difference was statistically significant ($P<0.05$) as shown in Table 1.

Table 1. Comparison of changes in blood gas analysis before and after treatment in both groups (n=29)

Indicator	Observation group		Control group	
	Before treatment	After treatment	Before treatment	After treatment
Blood pH	7.14±0.09	7.41±0.08 △*	7.20±0.32	7.22±0.04 △
PaO_2 (mmHg)	55.52±3.99	95.12±3.12 △*	54.18±4.06	62.36±4.13 △
SaO_2	0.81±0.06	0.97±0.04 △*	0.87±0.07	0.91±0.08 △
$PaCO_2$ (mmHg)	81.24±3.28	56.81±3.48 △*	80.44±3.36	71.92±4.08 △

Note: Compared with before treatment, △$P<0.05$; compared with the control group, *$p<0.05$

3.2 Comparison of mortality rate and hospitalization time between two groups

The mortality rate and hospitalization time of the observation group were significantly lower than those of the control group, and the difference was statistically significant ($P<0.05$). See Table 2 for details.

Table 2. Comparison of mortality rate and hospitalization time between the two groups (n=29)

Group	Number of cases	Number of death cases	Mortality rate (%)	Hospitalization time (d)
Observation group	29	1	3.45	15.23±2.30
Control group	29	4	13.79	25.41±3.22
P			<0.05	<0.05

4 Discussions

COPD is a chronic respiratory disease that can often develop into pulmonary heart disease and respiratory failure. When COPD is complicated by respiratory failure, severe cases can threaten the patient's life[2]. With the continuous advancement of medical technology and concepts, some studies

have suggested that the early application of bi-level positive airway pressure ventilation in the treatment of COPD with type II respiratory failure is more effective[3]. The BIPAP ventilator is simple to operate, which can reduce the invasive treatments of tracheal intubation and tracheotomy and hence prevent the infection from aggravating the disease[4]. At the same time, it can save treatment costs and reduce the financial burden on patients and families. The results of this study have shown that early application of bi-level positive airway pressure ventilation in patients with COPD and type II respiratory failure can effectively improve CO_2 retention and hypoxemia while greatly reducing the mortality rate and decreasing the hospitalization time. The difference was statistically significant ($P<0.05$).

In conclusion, for patients who diagnosed with COPD and type II respiratory failure, early bi-level positive airway pressure ventilation can achieve high clinical efficacy and improvement of symptoms. It can also reduce and prevent tracheal intubation and organ incision. It can greatly reduce the mortality rate and hospitalization time and hence decrease the economic burden on patients. Thus, it is worthy of clinical application.

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