Effect of Mechanical Ventilation Combined with Budesonide Suspension on Pulmonary Function Indices in the Treatment of Severe Asthma

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Abstract: Objective: To observe the effectiveness of different methods in the treatment of severe asthma. Methods: Ninety patients admitted from 2020.2 to 2022.8 were divided into groups A and B, 45 patients each, and all were given basic symptomatic treatment, group A was given nebulized inhalation of budesonide suspension, group B was mechanically ventilated on the basis of group A's protocol, and the treatment was compared between groups. Results: After 3 weeks of continuous treatment, the lung function (FEV1, PEF, FEV1/FVC) levels of patients in group B were higher than those in group A, and the difference reached a significant level ($P < 0.05$). The incidence of adverse reactions in groups A and B was 8.89% and 6.67% respectively, which was not statistically significant ($P > 0.05$). Conclusion: In patients with severe asthma, early mechanical ventilation with inhalation of budesonide suspension can improve lung function more rapidly and with higher safety, and is worth promoting.

Keywords: Severe Asthma; Mechanical Ventilation; Budesonide; Lung Function; Adverse Effects

Introduction

The elderly are at high risk of severe asthma, with symptoms such as coughing and dyspnoea, which can significantly reduce the quality of daily life, and can lead to emphysema and respiratory failure if not treated in a timely manner. Budesonide mixed suspension has anti-inflammatory and antispasmodic effects, thus reducing the patient's symptoms, but the long-term effect of monotherapy is not good, so many doctors recommend that patients receive a combination of treatment, the author's department combined mechanical ventilation and budesonide treatment of severe asthma disease, and achieved more satisfactory results, the following analysis of treatment.

1. Data and methods

1.1 General information

The data of 90 patients with severe asthma filed in the Department of Pathology from 2020.2 to 2022.8 were extracted and analyzed. All the above selected patients had a clear diagnosis of severe asthma disease23], were conscious, could cooperate with the instructions given by the medical staff, knew the purpose of this study and cooperated actively to complete it. The groups were divided as follows.

Group A (n=45): (m/f) 28/17, age 33-74 (54.7±5.2) years, duration of illness 3-6 (4.2±1.5) d.

Group B (n=45): (m/f) 26/19, age 31-78 (55.4±5.5) years, duration of illness 2-8 (4.5±1.3) d.

The above baseline data of patients in groups A and B were not statistically significant ($P > 0.05$).

1.2 Methods

The basic treatment consisted of nutritional support, anti-infection and correction of acid-base disorders. Group A received 2 ml of budesonide suspension + 2 ml of saline by nebulised inhalation twice a day. Group B was treated with a BiPAP (positive pressure ventilator) in addition to the control group, with the inspiratory and expiratory pressures set at 8~18 ㎝ H2O and 4~10 ㎝ H2O respectively.

Patients in each group were treated continuously for 3 weeks.

1.3 Observation indexes

(1) Pulmonary function: [maximal expiratory volume in the 1st s (FEV1), maximal peak expiratory flow rate (PEF), FEV1/exertional spirometry (FVC)].

(2) Adverse effects.

1.4 Statistical processing

SPSS 33.0 software was used to process the data, and, rate (%) indicated the measurement and count data respectively, X^2 test. It was calculated that if $P < 0.05$, the difference reached the level of significance.

2. Results

2.1 Pulmonary function

After treatment, all the patients in group B had higher values of lung function index test than group A, and the difference reached the significance level ($P < 0.05$). Table 1.

Table 1 Comparison of lung function indicators before and after treatment between groups of patients $(\bar{x} \pm s)$

Time	Group（n）	FEV1（L）	PEF(L/s）	FEV1/FVC（%）
Before treatment	Group B（45）	1.48±0.18	2.07±0.56	45.94±3.14
	Group A（45）	1.50±0.14	2.11±0.54	45.81±3.22
After treatment	Group B（45）	2.23±0.16	3.03±0.59	67.21±4.33
	Group A（45）	1.74±0.20	2.28±0.65	53.17±3.37

2.2 Adverse reactions

In terms of adverse reaction rate, the difference between Group A vs Group B was 8.89% vs 6.67%, which was not significant ($p>0.05$). Table 2.

Table 2 Comparison of adverse reactions in patients between groups

Group（n）	sound of shouting	Facial discomfort	Rash	Total occurrence（%）
Group B（45）	1	0	2	3（6.67）
Group A（45）	2	1	1	4（8.89）

3. Discussion

The occurrence and development of asthma disease is strongly associated with the action of a variety of cytokines, and epidemiological surveys have revealed that there are currently 30 million diagnosed cases of asthma in China, and that the incidence of the disease will increase progressively in the context of a deteriorating atmospheric environment. Patients with severe asthma commonly suffer from airway smooth muscle spasm, airflow obstruction and increased functional residual air volume, so treatment of these patients requires early clearance of airway secretions, reduction of the inflammatory response, relief of airway obstruction and restoration of lung function.

In this study, after 3 weeks of continuous treatment, the FEV1, PEF and FEV1/FVC test values of patients in Group B were all greater than those in Group A, suggesting that patients in this group had better lung function improvement. The inhalation of budesonide by nebulisation allows the drug to reach the disease site directly, acting precisely on the airway mucosa, producing a significant inhibitory effect on the activity of immune cells, gradually relieving the spasm state and reducing the secretion of inflammatory substances, thus achieving good local anti-inflammatory effect and increasing the bioavailability of the drug. In practice, however, patients with severe asthma commonly have symptoms associated with respiratory muscle fatigue and their own poor sensitivity to budesonide, making it difficult to effectively control symptoms in around 10% of patients, and therefore requiring combined mechanical ventilation therapy. Non-invasive positive pressure ventilation is a reliable connection between the patient and the mask or nasal mask, which artificially simulates the normal breathing process, with a high level of inspiratory pressure, overcoming high airway resistance, reducing respiratory muscle fatigue symptoms, lowering oxygen consumption, reasonably regulating the ventilation and blood flow ratio, and thus improving alveolar ventilation and blood gas exchange efficiency [3]. The safety of treatment is an issue of great concern to the majority of patients, therefore, this topic observed the occurrence of adverse reactions, 8.89% and 6.67% in groups A and B respectively, the difference is not significant, which shows that the implementation process of the treatment plan in group B is safer and the majority of patients can participate in the treatment with confidence.

In conclusion, for patients with severe asthma, early mechanical ventilation and inhalation of budesonide suspension can improve lung function more rapidly and with a higher safety profile, which is worthy of popular application.

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