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Observation on the Efficacy of Budesonide Formoterol Powder Inhalation as an Adjuvant Treatment for COPD Associated with Pulmonary Heart Disease

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Abstract: *Objective:* In this study, we deeply explore the value of budesonide and formoterol powder inhalation as adjuvant therapy for patients with COPD and cor pulmonale. *Methods:* The time node was selected from 2021.5 to 2023.2, and a total of 50 patients were included, all with COPD and pulmonary heart disease. Two groups were divided into two groups by random grouping, taking budesonide formoterol powder inhalation and conventional treatment, respectively, and then the efficacy was compared. *Results:* The treatment effect of the observation group was higher than that of the control group, and the result comparison was $P < 0.05$. The pulmonary function indicators were all higher than those of the control group, $P < 0.05$; the PaCO2 index of the observation group decreased and was lower than that of the control group; the PaO2 index increased, and was higher than that of the control group, $P < 0.05$; the incidence of adverse reactions in the observation group was lower than that of the control group, $P < 0.05$. *Conclusion:* When treating COPD patients with cor pulmonale, taking budesonide formoterol powder inhalation can improve the therapeutic effect, improve lung function indicators and PaCO2 and PaO2 indices, reduce adverse reactions, and ensure the safety of patients during treatment.

Keywords: Budesonide formoterol powder inhalation; COPD with pulmonary heart disease; Efficacy

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1. Introduction

Chronic obstructive pulmonary disease (COPD) is a common disease in the respiratory system. The disease has a high incidence rate and a certain degree of infectivity. The disease has the characteristics of recurrence and is not easy to cure. After the patient develops the disease, he will show symptoms such as cough, sputum, shortness of breath, etc., resulting in damage to his heart and lung function. Therefore, COPD patients with pulmonary heart disease are very common, which harms the patient's normal life and reduces their quality of life. The pathogenesis of COPD with cor pulmonale is very complex. At this stage, clinical treatment is mainly based on drug treatment. The main ingredients are β2 receptor agonists and glucocorticoids [1]. Usually, once the drugs contain these two substances, the condition of COPD patients with cor pulmonale will be improved. In recent years, inhalant drugs have become very popular. They can affect the patient's body only through the airway and effectively reduce the patient's gastrointestinal reaction. Therefore, this type of drug is

frequently used by doctors. Budesonide and formoterol powder inhalation is one of these drugs. After the drug enters the patient's body, it fully exerts its corresponding effect, which can not only ensure the safety of the patient's use of the drug, but also ensure the therapeutic effect [2]. Based on this, this article focused on a group study of 50 COPD patients with cor pulmonale. The two groups of patients received different treatment methods, focusing on exploring the therapeutic effect of budesonide and formoterol powder inhalation. The report is as follows.

2. Materials and methods

2.1. General information

The time node was selected from 2021.5 to 2023.2, and a total of 50 patients were included, and they were divided into two groups by random grouping. In the control group, there were 13/12 male and female cases; the age range was 49 to 77 years old, with an average age of (59.57 ± 9.65) years; in the observation group, there were 14/11 male and female cases; the age range was 50 to 79 years old, with an average age of (59.67 ± 14.31) years. Comparison of baseline data between the 2 groups: $P > 0.05$.

Inclusion criteria: (1) All patients meet the diagnostic criteria for COPD with cor pulmonale; (2) Have not taken glucocorticoids, β2 receptor agonists and other drugs in the recent past; (3) Patients are informed of this study and sign an informed consent form.

Exclusion criteria: (1) Patients with severe respiratory infections; (2) Patients who have taken glucocorticoids, β2 receptor agonists and other drugs without authorization in the recent past; (3) Patients have severe cardiovascular disease or severe liver and kidney dysfunction; (4) Patients are allergic to the drugs in this study.

2.2. Treatment methods

The control group received conventional symptomatic treatment, including anti-infection, acid-base, and electrolyte supplementation [3]. At the same time, measures such as antiasthmatic, oxygen inhalation, and expectoration are implemented according to the patient's specific symptoms.

On the basis of the control group, patients in the observation group were additionally treated with budesonide and formoterol powder inhalation. Among them, the budesonide formoterol powder inhalation is produced by AstraZeneca AB [4], with the national drug approval number HJ20140458. Specifications: Each inhalation contains 320 μg of budesonide and 9.0 μg of formoterol fumarate. It is treated by inhalation, twice a day, and rinsing the mouth with water after completion.

A course of treatment lasts for 7 days, and patients in both groups continued to receive treatment for 3 courses.

2.3. Observation indicators

(1) Treatment effect: Markedly effective: The patient's symptoms are eliminated and all lung function test indicators are normal; Effective: The symptoms are significantly relieved, but there are still slight abnormalities in lung function indicators, and continuous medication is required; Ineffective: There is no significant change in symptoms and lung function indicators before and after treatment.

(2) Lung function indicators: including forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), and rate in one second (FEV1/FVC) [5].

(3) Blood gas indicators: including arterial blood carbon dioxide partial pressure (PaCO2), arterial blood oxygen partial pressure (PaO2)

(4) Adverse reactions: Statistics include nausea, headache, dizziness, infection, etc.

2.4. Statistical methods

The SPSS 26.0 software was used to process the data involved in the study. Measurement data were expressed as "mean ±

standard deviation (SD)" and tested by "t"; count data were expressed as "[n/(%)]" and tested by "χ^2". $P < 0.05$ indicated that the difference was significant.

3. Results

3.1. Treatment effects of two groups of patients

The total probability of treatment effect for patients in the observation group is 96.00%, which is obviously 76.00% higher than that of the control group. The difference is $P < 0.05$. See **Table 1** for details.

Table 1. Treatment effects of two groups of patients

Group	n	Effective	Valid	Invalid	Total probability
Observation group	25	22 (88.00%)	2 (8.00%)	1 (4.00%)	24 (96.00%)
Control group	25	8 (32.00%)	11 (44.00%)	6 (24.00%)	19 (76.00%)
χ^2					4.1528
p					0.0420

3.2. Improvement of lung function in two groups of patients

The FEV1, FVC and FEV1/FVC of the observation group were significantly higher than those of the control group, with a difference of $P < 0.05$. See **Table 2** for details.

Table 2. Pulmonary function index of two groups of patients

Group	FEV1(L)		FVC(L)		FEV1/FVC(%)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Observation group (n = 25)	0.85 ± 0.15	1.86 ± 0.24	1.54 ± 0.53	2.34 ± 0.45	46.54 ± 4.45	66.75 ± 5.46
Control group (n = 25)	0.86 ± 0.21	1.49 ± 0.27	1.52 ± 0.56	1.96 ± 0.42	46.52 ± 4.73	61.43 ± 5.85
t	0.1937	5.1211	0.1296	3.0866	0.0153	3.3241
p	0.8472	0.0000	0.8973	0.0034	0.9878	0.0017

3.3. Blood gas indicators of two groups of patients

The PaCO2 index of the patients in the observation group decreased and was lower than that of the control group; the PaO2 index increased and was higher than that of the control group, with a difference of $P < 0.05$. See **Table 3** for details.

Table 3. Blood gas indicators of the two groups of patients

Group	n	$PaCO_2$		PaO_2	
		Before intervention	After intervention	Before intervention	After intervention
Observation group	25	7.56 ± 1.35	5.45 ± 0.68	6.79 ± 1.36	9.86 ± 0.68
Control group	25	7.78 ± 1.36	6.64 ± 0.74	6.84 ± 1.47	8.79 ± 0.75
t		0.5740	5.9204	0.1248	5.2846
p		0.5686	0.0000	0.9012	0.0000

3.4. Adverse reactions of patients in the two groups

The total probability of adverse reactions in the observation group was 4.00%, which was significantly lower than the

28.00% in the control group. The difference was $P < 0.05$. See **Table 4** for details.

Table 4. Adverse reactions of patients in the two groups

Group	n	Disgusting	Dizziness	Headache	Infection	Total probability
Observation group	25	1 (4.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (4.00%)
Control group	25	2 (8.00%)	1 (4.00%)	3 (12.00%)	1 (4.00%)	7 (28.00%)
χ^2						5.3571
p						0.0210

4. Conclusion

COPD with cor pulmonale is a chronic inflammatory disease involving multiple systems, with complex pathological mechanisms and diverse clinical manifestations. The core feature of this disease is extensive inflammatory infiltration in pulmonary blood vessels, alveoli, and airways. These inflammatory reactions will continuously release pro-inflammatory factors such as leukotrienes and IL-8, leading to airway remodeling, increased pulmonary vascular resistance, and progressive decline in lung function. Patients often present with persistent cough, sputum production, dyspnea and other symptoms. In severe cases, they can develop into respiratory failure and right ventricular dysfunction, which greatly affects the patient's quality of life [6]. From the perspective of pathogenesis, COPD with cor pulmonale is the result of multiple factors such as genetic susceptibility, environmental exposure, and immune regulation imbalance. This complex etiological background makes the development of treatment options face many challenges. Although there are currently a variety of clinical treatments such as bronchodilators, glucocorticoids, and oxygen therapy, the treatment effects are often difficult to achieve expectations due to individual differences, drug tolerance, adverse reactions, and other issues. In addition, long-term use of certain drugs may lead to the development of drug resistance and even potential damage to liver and kidney function, further limiting treatment options [7]. With the development of precision medicine and molecular biology technology, treatment strategies for COPD with cor pulmonale are gradually moving towards individualization and targeting. Cutting-edge technologies such as biomarker-based drug screening, the development of new anti-inflammatory drugs, and gene therapy provide new possibilities for improving patient prognosis. In the future, how to minimize drug side effects while ensuring efficacy will become the core goal of clinical research. Through multidisciplinary collaboration and in-depth exploration of evidence-based medicine, it is expected to provide patients with safer and more durable treatment options, thereby significantly improving their quality of life and prolonging their survival.

The treatment of COPD with pulmonary heart disease mainly focuses on controlling the symptoms of the disease, reducing the probability of potential dangers as much as possible, and comprehensively improving the patient's physical fitness and exercise endurance. In the treatment of COPD with cor pulmonale, oral medication is a very effective treatment method, and the inhaled method can allow the drug to have corresponding effects on the patient's airway. Budesonide and formoterol powder inhalation is an innovative compound drug for respiratory diseases such as chronic obstructive pulmonary disease (COPD) and pulmonary heart disease. Its unique design combines the dual action mechanisms of budesonide and formoterol, which significantly improve the therapeutic effect through synergistic effects, optimize the drug's onset speed and duration of action, and provide patients with a more efficient treatment plan [8]. Budesonide, a potent glucocorticoid, plays a key role in the management of lung inflammation. It can directly act on inflammatory cells and inhibit the release of inflammatory factors, thereby reducing lung tissue damage. In addition, budesonide's stabilizing effect on mast cells further inhibits the production of inflammatory mediators and significantly improves airway patency. This mechanism is particularly important in COPD patients because it can effectively reduce airway hyperresponsiveness and reduce the risk of acute exacerbation, thereby improving the patient's quality of life. Formoterol is a long-acting β2 receptor agonist that rapidly expands the bronchi and improves the patient's respiratory function

by enhancing the transcriptional expression function of β2 receptors. Its unique hydrophilic and lipophilic properties enable it to rapidly penetrate into target tissues and maintain stable drug concentrations over a longer period of time. This property not only improves the bioavailability of the drug but also reduces the patient's medication frequency and improves treatment compliance. The mechanism of action of formoterol is not limited to bronchodilation. It can also activate adenylyl cyclase to convert adenosine triphosphate (ATP) into cyclic adenosine monophosphate (cAMP), thereby relaxing vascular smooth muscle and improving pulmonary hemodynamics. This process helps relieve patients' dyspnea symptoms, effectively reduces pulmonary hypertension, and reduces the pathological burden of pulmonary heart disease. Budesonide formoterol powder inhalation delivers the drug directly to the lungs via inhalation, maximizing its local effects while minimizing systemic side effects. This method of administration not only improves the targeting of the drug, but also reduces the distribution of the drug throughout the body, thereby reducing potential adverse reactions [9].The drug's dual-effect mechanism not only significantly improves the patient's lung function, but also provides patients with a more comprehensive therapeutic effect by reducing inflammatory reactions and relieving airway obstruction symptoms. Moreover, both drugs have the effect of dilating the trachea and anti-inflammatory. When used together, the drug effects can overlap and have a better effect of relieving cough and resolving phlegm. Patients will also have fewer side effects after inhalation. Through group comparison in this study, it was found that the efficacy of conventional treatment is still mainly limited to improvement of typical symptoms such as dyspnea and edema, and it is also helpful to improve the survival rate in the acute phase. However, the medication in the observation group was extremely helpful in suppressing airway inflammation and reducing mucosal edema, delaying the progression of COPD from the source, thereby indirectly reducing the possibility of progression of arterial hypertension. This differentiation obviously provides a reliable basis for this adjuvant treatment [10]. Therefore, from a review of the overall clinical treatment status in the past, conventional treatment emphasizes life-saving as the basis, while focusing on controlling heart failure and preventing acute attacks. It is also the current irreplaceable basic treatment measure for COPD with pulmonary heart disease.

In summary, the most important value of adjuvant budesonide and formoterol lies in the long-term control and management of the disease. For example, after conventional treatment, anti-inflammatory airway expansion can delay the progression of the disease. Therefore, the optimal strategy is not to choose one of the two, but to add it to the conventional treatment. The effect of the auxiliary application is obviously better.

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Disclosure statement

The author declares no conflict of interest.

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