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Observation on the Efficacy of Budesonide Suspension and Terbutaline Aerosol Combined in the Treatment of Respiratory Tract Infections

Yingshu Lang
Kunshan Rehabilitation Hospital, Kunshan 215300, Jiangsu, China

Abstract: *Objective:* To analyze the actual clinical value of budesonide suspension combined with terbutaline aerosol solution in the treatment of respiratory tract infections. *Methods:* 68 patients with respiratory infections admitted to our hospital from January 2025 to December 2025 were selected as samples for this study. All patients were divided into two groups using a random number table division method, with the number of cases in each group being 34. The conventional group was only given budesonide suspension alone for aerosol intervention, while the experimental group was combined with terbutaline aerosol solution for simultaneous aerosol treatment. The results were compared. *Results:* The overall treatment effectiveness of the experimental group was higher than that of the conventional group ($p < 0.05$); there was no significant difference in the levels of infection-related laboratory indicators between the two groups of patients before treatment ($p > 0.05$). After clinical intervention, the improvement of various indicators in the experimental group was better than that of the conventional group ($p < 0.05$); there was no significant difference in the incidence of adverse reactions between the two groups of patients after medication ($p > 0.05$). *Conclusion:* Budesonide suspension combined with terbutaline aerosol solution for clinical intervention in respiratory tract infections can significantly improve the overall treatment effect of the disease, while promoting the effective recovery of infection-related laboratory indicators without increasing the risk of adverse reactions.

Keywords: Budesonide suspension; Terbutaline aerosol solution; Respiratory tract infection; Efficacy; Laboratory indicators

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1. Introduction

Respiratory tract infection is a clinically common respiratory disease, including upper and lower respiratory tract infections. Bacterial and viral invasion and external physical and chemical stimulation are the main causes of the disease. Most sick people will be accompanied by typical symptoms such as cough, phlegm, wheezing, and chest tightness. When the disease progresses more seriously, it can easily induce complications such as difficulty breathing and secondary lung infection. It not only interferes with the patient's daily routine and physical and mental state, but also poses a potential threat to life safety in critical conditions [1]. The core direction of clinical treatment for respiratory infections focuses on the relief of infection control symptoms and the recovery of lung function. Atomized inhalation drug administration has become the current mainstream intervention method. This approach allows the drug to directly contact the respiratory

mucosal tissue. It not only takes effect quickly but also reduces the possibility of systemic adverse symptoms. Therefore, it is widely used in clinical diagnosis and treatment [2]. Budesonide suspension is a commonly used glucocorticoid drug in clinical practice. With its outstanding anti-inflammatory and mucosal edema-eliminating effects, it can effectively inhibit the inflammatory stress response in the respiratory tract and relieve airway spasm. However, it is difficult to quickly relieve patients' coughing, wheezing, and other discomforts when used alone. There are certain limitations in the overall control effect of infection-related symptoms [3]. Terbutaline aerosol solution is classified as a β2 receptor agonist. It can relax the bronchial smooth muscle tissue in a short period of time to relieve airway spasm and help improve the body's ventilation status. However, relying solely on this drug is difficult to achieve the ideal anti-inflammatory effect, nor can it curb the continued development of the infection from the root cause. Our hospital included 68 cases of respiratory tract infections for clinical observation and analyzed the actual effect of budesonide suspension combined with terbutaline aerosol solution.

2. Materials and methods

2.1. General information

68 patients with respiratory infections admitted to our hospital from January 2025 to December 2025 were selected as cases and divided into two groups using the random number table method. There were 34 cases in the experimental group, 19 men and 15 women, aged 18 to 72 (45.62 ± 8.35) years old. There were 34 cases in the conventional group, 18 men and 16 men respectively, aged 19 to 73 (46.15 ± 8.28) years old. There was no statistical significance in the comparison of general data between the two groups, $p > 0.05$.

2.1.1. Inclusion criteria

(1) Meet the diagnostic criteria for respiratory tract infection;
(2) Aged 18 to 80 years old;
(3) No history of drug allergy.

2.1.2. Exclusion criteria

(1) Combined with serious organ diseases;
(2) Presence of bronchiectasis, tuberculosis, and other respiratory diseases;
(3) Pregnant or lactating women.

2.2. Method

The conventional group only used budesonide suspension aerosol intervention, taking 1 mg of the drug with the help of an atomized inhaler, diluting it with 2 mL of normal saline and inhaling it twice a day, and controlled for 15 to 20 minutes each time, with 7 consecutive days as one course of treatment for a total of 2 courses. In the experimental group, based on using the budesonide suspension unchanged in the conventional group, an additional 0.5 mg of terbutaline atomized solution was added, mixed with the former and normal saline, and then atomized and inhaled twice a day, for 15 to 20 minutes each time, and also treated with 7 days as one course of treatment for 2 courses. During the treatment period, both groups were given symptomatic support such as cough relief, phlegm reduction, and fluid replenishment, and no other drugs that affected the efficacy were used.

2.3. Observation indicators

2.3.1. Compare the therapeutic effects of the two groups

Significantly effective means that the patient's cough, sputum, wheezing, and other related symptoms have completely subsided after treatment, and the pulmonary rales have also completely disappeared; effective means that the above

symptoms have been significantly relieved after treatment, and the pulmonary rales have decreased compared with before; ineffective means that the symptoms have not improved after treatment, or even worsened.

2.3.2. Compare infection-related laboratory indicators before and after treatment between the two groups

Before and after treatment, 5 mL of fasting venous blood was collected from the two groups of patients. After centrifugation, a fully automatic biochemical analyzer was used to detect white blood cell count, C-reactive protein, and procalcitonin.

2.3.3. Compare the occurrence of adverse reactions between the two groups

Including nausea, vomiting, hoarseness, and palpitations, the incidence of adverse reactions was calculated.

2.4. Statistical methods

Data were analyzed using SPSS 24.0. Measurement data that conform to normal distribution are expressed as mean plus or minus standard deviation and subjected to t-test; count data are expressed as percentage and subjected to χ^2 test. $p < 0.05$ represents a significant difference.

3. Results

3.1. Comparison of treatment efficacy between the two groups

The total effective rate of treatment in the experimental group was significantly higher than that in the conventional group ($p < 0.05$), see **Table 1**.

Table 1. Comparison of treatment efficacy between the two groups [n (%)]

Group	Effective	Valid	Invalid	Always efficient
Regular group (n = 34)	12(35.29)	11(32.35)	11(32.35)	23(67.65)
Experimental group (n = 34)	22(64.71)	10(29.41)	2(5.88)	32(94.12)
χ^2				7.703
p				0.006

3.2. Comparison of infection-related laboratory indicators between the two groups before and after treatment

After the intervention, the improvement degree of various indicators in the experimental group was better than that in the conventional group ($p < 0.05$), see **Table 2**.

Table 2. Comparison of infection-related laboratory indicators between the two groups before and after treatment ($\bar{x} \pm s$)

Group	White blood cell count (×10⁹/L) Before intervention	White blood cell count (×10⁹/L) After intervention	C-reactive protein (mg/L) Before intervention	C-reactive protein (mg/L) After intervention	Procalcitonin (ng/mL) Before intervention	Procalcitonin (ng/mL) After intervention
Regular group (n = 34)	12.56 ± 2.34	8.78 ± 1.65	35.67 ± 8.45	18.92 ± 6.34	1.89 ± 0.56	0.98 ± 0.32
Experimental group (n = 34)	12.63 ± 2.28	6.25 ± 1.32	36.12 ± 8.32	9.87 ± 5.21	1.92 ± 0.53	0.45 ± 0.21
t	0.125	6.982	0.221	6.431	0.227	8.074
p	0.901	0.000	0.826	0.000	0.821	0.000

3.3. Comparison of adverse reactions between the two groups

There was no significant difference in the incidence of adverse reactions between the two groups (P > 0.05). See **Table 3** for details.

Table 3. Comparison of adverse reactions between the two groups [n (%)]

Group	Disgusting	Vomiting	Hoarse voice	Palpitations	Overall incidence
Regular group (n = 34)	1 (2.94)	1 (2.94)	2 (5.88)	0 (0.00)	4 (11.76）
Experimental group (n = 34)	1 (2.94）	0 (0.00)	2 (5.88)	1 (2.94)	4 (11.76)
χ^2					0.142
p					0.707

4. Discussion

Respiratory tract infections often occur when the respiratory mucosa is invaded by pathogens or physically and chemically stimulated, causing mucosal inflammation, increased secretions, and airway spasm, leading to a series of symptoms [4]. The key to clinical treatment is to control the inflammatory response quickly, relieve airway spasm, and clear respiratory secretions, thereby improving the patient's ventilatory function and promoting improvement of the condition. As a local administration method, atomized inhalation can allow drugs to act directly on respiratory lesions, eliminating the need for oral drugs to be absorbed through the gastrointestinal tract. It has a faster onset of action and can reduce the adverse effects of drugs on the whole body. It plays a prominent role in the treatment of respiratory tract infections [5]. Budesonide suspension is a commonly used inhaled glucocorticoid in clinical practice. It mainly binds to intracellular glucocorticoid receptors to inhibit the activation and migration of inflammatory cells, reduce the release of inflammatory mediators, reduce respiratory mucosal congestion, edema, and inflammatory reactions, while enhancing mucosal defense function and reducing secretion production. Terbutaline aerosol solution is a short-acting β2 receptor agonist that can specifically bind to β2 receptors on bronchial smooth muscles, allowing the smooth muscles to relax to relieve airway spasm, improve pulmonary ventilation, and quickly relieve patients' wheezing, chest tightness, and other discomforts. The two drugs have different mechanisms of action, and their combined use can exert a synergistic effect to make up for the shortcomings of a single drug, thereby improving the effectiveness of treatment [6].

The data from this study show that the total effective rate of treatment in the experimental group can reach 94.12%, while that in the conventional group is only 67.65%. This result reflects that the overall efficacy of the two aerosolized drugs combined to treat respiratory tract infections is better than budesonide suspension alone. This clinical difference is mainly due to the fact that although the simple application of budesonide suspension can reduce the inflammatory response produced in the respiratory tract, its soothing effect on airway spasm is relatively weak, making it difficult to improve patients' wheezing and dyspnea quickly, and also limiting the overall treatment effect. Terbutaline aerosol solution has the effect of relaxing bronchial smooth muscle and relieving airway spasm. When used in conjunction with budesonide suspension, it can not only control the body's inflammatory response from the source and reduce the production of airway secretions, but also relieve airway spasm in time to restore normal ventilation, thereby accelerating the regression of various clinical symptoms and improving the overall treatment level [7].

Infection-related laboratory indicators are an important basis for reflecting the severity of respiratory infection and the effect of treatment. Among them, white blood cell count, C-reactive protein, and procalcitonin are commonly used clinical inflammatory indicators, and changes in their levels can directly reflect the control of inflammatory responses in patients. An increase in the white blood cell count usually indicates the presence of bacterial infection in the body. The more severe the inflammation, the more obvious the increase in the white blood cell count. C-reactive protein is an acute-phase reaction protein that will rise rapidly after inflammation occurs, and its level is positively correlated with the

severity of inflammation. Calcitonin is a specific inflammatory marker that increases significantly in bacterial infection but does not change significantly in viral infection, which can effectively reflect the type and severity of infection [8]. In this study, the decline rate of the experimental group after treatment was significantly greater than that of the conventional group. Combined treatment can more effectively reduce infection-related laboratory indicators, mainly because the anti-inflammatory effect of budesonide suspension and the bronchodilator effect of terbutaline aerosol form a synergistic effect. By inhibiting the activation of inflammatory cells and the release of inflammatory mediators, budesonide suspension fundamentally reduces the inflammatory response of the respiratory mucosa and reduces the stimulation of the body by pathogens, thereby promoting a decrease in inflammatory indicators such as white blood cell count, C-reactive protein, and procalcitonin. Terbutaline aerosol solution relieves airway spasm, improves pulmonary ventilation function, promotes the discharge of respiratory secretions, reduces the breeding and reproduction of pathogens in the respiratory tract, further reduces inflammatory responses, and assists in reducing the level of inflammatory indicators. The synergistic effect of the two drugs can control the inflammatory response in the body more quickly and effectively, allowing various laboratory indicators to return to normal as soon as possible, thereby accelerating the recovery of the patient's condition. In addition, combined treatment can shorten the time for inflammation control, reduce the sustained damage of inflammation to the respiratory mucosa, and avoid further aggravation of infection. This is also an important reason why the laboratory indicators of the experimental group improved more significantly.

Drug safety issues must be focused on in clinical treatment, especially the elderly and children who account for a large proportion of patients with respiratory tract infections. These groups have poor tolerance to drugs. Once adverse reactions occur, they will not only interfere with the normal progress of treatment, but also worsen the patient's condition in severe cases. In this study, both groups of patients experienced a small number of adverse reactions during treatment, such as nausea, vomiting, hoarseness, and palpitations. The total incidence of adverse reactions in the conventional group was 11.76%, and the same rate was 11.76% in the experimental group. This shows that the combination of budesonide suspension and terbutaline aerosol for the treatment of respiratory tract infections is relatively safe and will not increase the risk of adverse reactions. Most of these adverse reactions are mild symptoms and do not require special treatment. They will resolve spontaneously after treatment and have no impact on the patient's treatment and recovery. It can be seen that the combined treatment is safe and reliable, well tolerated by patients, and is suitable for widespread clinical application.

Taken together, the combined use of budesonide suspension and terbutaline aerosol to treat respiratory tract infections can give full play to the synergistic effect of the two drugs. It can not only significantly improve the treatment effect, quickly relieve patients' cough, sputum, wheezing, and other uncomfortable symptoms, but also effectively improve the inflammatory response without increasing the risk of adverse reactions and is highly safe.

About the author

Lang Yingshu (1984.01); female; Han; Pingyu, Henan; undergraduate; attending physician; research direction: respiratory tract infection

Disclosure statement

The author declares no conflict of interest.

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