

# The Effect of Nebulized Budesonide Inhalation in Treating Children with Asthma and its Influence on Immune Indexes

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**Abstract:** *Objective:* To explore and analyze the effect of nebulized budesonide inhalation on children with asthma and its influence on immune indexes. *Methods:* 300 children who were with asthma admitted to the Pediatric Respiratory Department of our hospital from January 2021 to January 2023 were selected as the research subjects. The patients were divided into a nebulization group ( $n = 150$ ) and a reference group ( $n = 150$ ) by drawing lots. The nebulization group received routine treatment along with budesonide nebulization inhalation therapy, while the reference group only received routine treatment. The treatment effect, the immune indicators, the time taken for the disappearance of symptoms, and the pulmonary function indicators of both groups were compared. *Results:* The total efficacy of treatment received in the nebulization group was significantly higher than that in the reference group ( $P < 0.05$ ). Before treatment, there was no statistically significant difference in the  $CD4^+$ ,  $CD8^+$ ,  $CD4^+/CD8^+$ , between the two groups ( $P > 0.05$ ); after treatment, the nebulization group's  $CD4^+$ ,  $CD8^+$ ,  $CD4^+/CD8^+$  and other immune indicators were significantly better than the reference group ( $P < 0.05$ ). The time taken for the disappearance of symptoms like wheezing, coughing, crackles, shortness of breath, and other symptoms in the nebulization group was significantly shorter than in the reference group ( $P < 0.05$ ). Before treatment, there was no statistically significant difference in the pulmonary function indexes such as FEV1, PEF, and FVC between the two groups ( $P > 0.05$ ); after treatment, the pulmonary function indexes of the patients in the nebulization group were significantly better than those in the reference group ( $P < 0.05$ ). *Conclusion:* Nebulized budesonide inhalation therapy has shown significant efficacy in the treatment of pediatric asthma, with notable improvements in immune indicators. Therefore, it is worthy of recommendation and further promotion

**Keywords:** Nebulized budesonide inhalation; Pediatric asthma; Immune index

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## 1. Introduction

Pediatric asthma is characterized as a chronic respiratory condition that tends to have its most severe attacks during the evening and early morning. These episodes are often accompanied by reversible limitations in expiratory airflow<sup>[1]</sup>. It is characterized by recurring symptoms influenced by various triggering factors. It has

a prolonged duration, and its pathogenesis is multifaceted. At this stage, it is believed that childhood asthma is associated with genetic, immune, environmental, neurological, and other factors [2,3]. The first step of treating pediatric asthma is to eliminate the infection to reduce the inflammatory response of the airway, followed by symptomatic treatment for clinical symptoms [4]. In recent years, atomized inhalation therapy has been widely used to treat respiratory diseases. Budesonide is a glucocorticoid that can be administered by nebulized inhalation. It plays an anti-allergic and anti-inflammatory role and humidifies the airway, thus reducing symptoms such as cough and sputum [5,6]. Therefore, the effect of nebulized budesonide inhalation on children with asthma and its influence on immune indexes was analyzed in this study.

## 2. General information and methods

### 2.1. General information

300 children who were with asthma admitted to the Pediatric Respiratory Department of our hospital from January 2021 to January 2023 were selected as the research subjects. The patients were divided into a nebulization group ( $n = 150$ ) and a reference group ( $n = 150$ ) by drawing lots. The nebulization group consisted of 80 males and 70 females, aged 3–10 years old, with an average age of  $6.21 \pm 1.25$  years; the course of disease was 1–5 years, with an average duration of  $3.02 \pm 0.42$  years. The control group consisted of 81 males and 69 females, aged 3–9 years old, with an average age of  $6.12 \pm 1.27$  years; the course of the disease was 1–4 years, with an average duration of  $3.12 \pm 0.37$  years. There was no statistically significant difference in baseline data between both groups ( $P > 0.05$ ).

Inclusion criteria: (1) Diagnosed with pediatric asthma, (2) those whose parents signed an informed consent.

Exclusion criteria: (1) Incomplete congenital development, (2) presence of coagulation abnormalities, (3) presence of blood diseases.

### 2.2. Methods

The reference group received conventional treatment, which included anti-inflammatory and anti-infection medications, cough suppressants, expectorants, antispasmodic drugs for asthma treatment, and other symptomatic treatments. The treatment was continued for 7 days.

The nebulization group received nebulized budesonide inhalation along with conventional treatment: (1) The conventional treatment is similar to the one received in the reference group; (2) 100–200ug of nebulized budesonide was inhaled twice daily. The treatment was continued for 7 days.

### 2.3. Observation indicators

- (1) The efficacy of the treatment received in both groups was compared. Markedly effective – normal breathing, no symptoms; effective – improvement of dyspnea symptoms, relief of symptoms; and ineffective – evident dyspnea, severe symptoms.
- (2) The immune indexes of the patients in both groups were compared, including  $CD4^+$  (T lymphocyte count),  $CD8^+$  (leukocyte differentiation antigen 8), and  $CD4^+/CD8^+$ .
- (3) The incidence of wheezing, coughing, crackles, and shortness of breath in both groups of patients were compared.
- (4) The pulmonary function indicators of both groups were compared, including forced expiratory volume in 1 second (FEV1), peak expiratory flow velocity (PEF), and forced vital capacity (FVC).

## 2.4. Statistical analysis

SPSS 21.0 was used to process and analyze the data. The count data were expressed by the number of cases ( $n$ ) and percentage (%) and analyzed using a  $\chi^2$ -test. The measurement data was expressed in mean  $\pm$  standard deviation and analyzed by a  $t$ -test, with  $P < 0.05$  indicating statistical significance.

## 3. Results

### 3.1. Efficacy of the treatment received

The total efficacy of the treatment received in the nebulization group was significantly higher than that in the reference group ( $P < 0.05$ ) as shown in **Table 1**.

**Table 1.** Comparison of the efficacy of the treatment received (  $n$  [%])

Group	Number of cases	Markedly effective	Effective	Ineffective	Total effective rate
Nebulization group	150	96 (64.00)	51 (34.00)	3 (2.00)	147 (98.00)
Reference group	150	75 (50.00)	64 (42.67)	11 (7.33)	139 (92.67)
$\chi^2$	-	-	-	-	4.7952
$P$	-	-	-	-	0.0285

### 3.2. Immune indicators

Before treatment, there was no statistically significant difference in the  $CD4^+$ ,  $CD8^+$ ,  $CD4^+/CD8^+$ , between the two groups ( $P > 0.05$ ); after treatment, the nebulization group's  $CD4^+$ ,  $CD8^+$ ,  $CD4^+/CD8^+$  and other immune indicators were significantly better than the reference group ( $P < 0.05$ ), as shown in **Table 2**.

**Table 2.** Comparison of immune indicators of the two groups ( $\bar{x} \pm s$ )

Group	Number of cases	$CD4^+$		$CD8^+$		$CD4^+/CD8^+$	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Nebulization group	150	35.25 $\pm$ 3.75	42.52 $\pm$ 3.25	31.52 $\pm$ 4.35	24.28 $\pm$ 3.62	1.15 $\pm$ 0.25	1.73 $\pm$ 0.26
Reference group	150	35.36 $\pm$ 3.49	39.57 $\pm$ 3.24	31.46 $\pm$ 4.26	27.85 $\pm$ 3.59	1.16 $\pm$ 0.53	1.42 $\pm$ 0.19
$t$	-	0.9324	7.8729	0.1206	8.5760	0.2089	11.7901
$P$	-	0.3519	0.0000	0.9040	0.0000	0.8346	0.0000

### 3.3. The time taken for the disappearance of symptoms

The time taken for the disappearance of symptoms like wheezing, coughing, crackles, shortness of breath, and other symptoms in the nebulization group was significantly shorter than in the reference group ( $P < 0.05$ ), as shown in **Table 3**.

**Table 3.** The comparison of the time taken for the disappearance of symptoms of the two groups (mean  $\pm$  standard deviation)

Group	Number of cases	Wheezing	Coughing	Crackles	Shortness of breath
Nebulization group	150	3.48 $\pm$ 0.66	3.04 $\pm$ 0.35	1.75 $\pm$ 0.26	2.87 $\pm$ 0.36
Reference group	150	4.85 $\pm$ 0.58	3.86 $\pm$ 0.38	2.69 $\pm$ 0.42	3.85 $\pm$ 0.45
$t$	-	19.0966	19.4395	23.3065	20.8275
$P$	-	0.0000	0.0000	0.0000	0.0000

### 3.4. Pulmonary function indicators

Before treatment, there was no statistically significant difference in the pulmonary function indexes such as FEV1, PEF, and FVC between the two groups ( $P > 0.05$ ); after treatment, the pulmonary function indexes of the patients in the nebulization group were significantly better than those in the reference group ( $P < 0.05$ ).

**Table 4.** Comparison of pulmonary function indicators between the two groups (mean  $\pm$  standard deviation)

Group	Number of cases	FEV1		PEF		FVC	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Nebulization group	150	0.76 $\pm$ 0.09	1.78 $\pm$ 0.42	1.68 $\pm$ 0.38	3.42 $\pm$ 0.45	1.14 $\pm$ 0.42	1.31 $\pm$ 0.12
Reference group	150	0.77 $\pm$ 0.10	1.28 $\pm$ 0.46	1.69 $\pm$ 0.35	2.54 $\pm$ 0.52	1.16 $\pm$ 0.44	1.19 $\pm$ 0.09
<i>t</i>	–	0.9103	9.8310	0.2370	15.6726	0.4026	9.7979
<i>P</i>	–	0.3634	0.0000	0.8128	0.0000	0.6875	0.0000

## 4. Discussion

Bronchial asthma is a common disease among children. The disease progresses slowly, and has different stages, often lasting for an extended period [7]. Acute asthma attacks are more severe, and there is a possibility of exacerbation. On the other hand, chronic asthma involves occasional attacks. During the clinical remission stage, there will be no symptoms, the lung function returns to normal, and there will be no attacks for 12 weeks [8]. The main symptoms of pediatric asthma are cough, shortness of breath, and wheezing. Studies have shown that the disease has a particular relationship with the immune system [9]. Following the disease onset, bronchospasm-induced airway constriction can lead to symptoms like dyspnea, coughing, and asphyxiation in children. Additionally, there is a risk of severe complications, including respiratory failure and shock [10,11].

Budesonide is a commonly used inhalant that produces an anti-inflammatory effect. This medication does not disrupt regular physiological processes during its breakdown and action. It is used in managing asthma in children. This medication serves a dual purpose: mitigating the inflammatory response and alleviating symptoms while also modulating the immune system [12]. Budesonide is administered in the form of aerosol inhalation. The drug can directly act on the airway, instantly react with the lesion, inhibit inflammatory factors, relax the smooth muscle in the bronchi, improve spasm, maintain endothelial cell stability, and hinder the synthesis and release of allergic mediators [13]. The drug can bind to the corresponding receptors, stimulate steroid hormone receptors, reduce the synthesis of antibodies, and reduce the levels of immune indicators such as T lymphocytes and eosinophils [14,15].

Budesonide exhibits a rapid onset of action, leading to swift improvement in children's symptoms. It effectively controls capillary permeability, enhances hyperreactivity characteristics, suppresses the release of allergic mediators, reduces immune cell responses, and exerts anti-inflammatory effects. Consequently, the drug aids in airway humidification, mucus thinning in the respiratory tract, bronchial dilation, and the restoration of lung function.

## 5. Conclusion

In summary, nebulized budesonide inhalation is highly effective in treating children with asthma and improving immune indicators. Therefore, this treatment method should be popularized.

## Disclosure statement

The author declares no conflict of interest.

## References

- [1] Zhao X, 2023, Comparison of Clinical Effect and Safety of Nebulized Inhalation of Budesonide Suspension in Different Doses in the Treatment of Acute Asthma Attack in Children. *Clinical Rational Drug Use*, 16(11): 27–30.
- [2] Liu C, 2022, The curative effect of Ventolin Combined with Pulmicort Oxygen Nebulization Inhalation in Treating Children with Asthma and its Influence on Adverse Reactions and Pulmonary Function. *Chinese Medicine Guide*, 20(34): 97–99.
- [3] Chen W, Chen X, 2022, Clinical Efficacy of Nebulized Inhalation of Montelukast Sodium Combined with Budesonide in Treating Asthma and its Influence on Pulmonary Function and Inflammatory Factors in Children. *Journal of Clinical Rational Drug Use*, 15(32): 130–132.
- [4] Zhang L, Huang J, 2022, Efficacy of Budesonide Combined with Salbutamol in Treating Children with Asthma Complicated by Respiratory Virus Infection and Its Impact on Lung Function. *Chinese Practical Medicine*, 17(18): 15–19.
- [5] Cun Y, Li Q, Wang J, 2022, The Clinical Effect of Ipratropium Bromide Combined with Budesonide Atomized Inhalation in the Treatment of Children with Asthma and its Influence on the Pulmonary Function of Children. *Clinical Medicine Research and Practice*, 7(12): 32–35.
- [6] Song Y, Zhang L, Guo Z, 2022, Analysis of the Clinical Efficacy of Montelukast Combined with Budesonide-Assisted Aerosol Inhalation in Treating Children with Asthma Complicated by Respiratory Virus Infection and the Influence on Serum Indicators. *Journal of Mathematics and Medicine*, 35(04): 554–556.
- [7] Zhang X, 2022, Clinical Efficacy of Inhalation of Cetirizine Combined with Budesonide in the Treatment of Children with Acute Exacerbation of Asthma and its Effect on Immune Function. *Journal of Clinical Rational Drug Use*, 15(09): 150–152.
- [8] Zuo Z, Li N, 2022, The Clinical Effect of Oral Cetirizine Combined with Inhalation of Budesonide In Treating Children with Acute Asthma Attacks and its Influence On The Level of Inflammatory Factors in Children. *Clinical Medicine Research and Practice*, 7(09): 94–97.
- [9] Yi L, Che E, 2022, The Clinical Efficacy of Nebulized Albuterol Inhalation Combined with Montelukast in Treating Children with Acute Asthma Attacks and its Influence on Lung Function and T Lymphocyte Subsets in Children. *Jilin Medicine*, 43(03): 719–720.
- [10] Feng X, Qiu J, Yan D, 2021, The Effectiveness of Montelukast Combined with Budesonide in Treating Airway Response and Asthma Attack in Children with Asthma in Remission Period. *Journal of Clinical Rational Drug Use*, 14(20): 36–38.
- [11] Feng Z, 2021, Efficacy of Montelukast Sodium Combined with Budesonide Nebulizer in Treating Children with Asthma and Its Effect on Serum CRP, TNF- $\alpha$ , IL-6. *Chinese Modern Drug Application*, 15(10): 17–20.
- [12] Yuan J, Huang W, Guo S, 2021, Efficacy of Budesonide Suspension Inhaled by Oxygen Drive Nebulization in Treatment of Acute Attack of Infantile Asthma and Its Effect on Pulmonary Function. *Chinese Prescription Drugs*, 19(05): 116–118.
- [13] Shao J, Wang X, 2021, The Clinical Curative Effect of Montelukast Combined with Salmeterol-Timezone Powder Inhalation in Treating Children with Asthma and its Influence on Inflammatory Factors. *Journal of Clinical Rational Drug Use*, 14(09): 18–20.
- [14] Wang L, 2021, Singulair Combined with Budesonide Nebulized Inhalation's Effect in Treating Children with Asthma and the Analysis of its Impact on Immune Indicators and Pro-Inflammatory Factors. *Chinese Modern Drug*

Application, 15(04): 172–174.

- [15] Zhou R, Zhang W, Chen B, et al., 2020, Clinical Efficacy of Montelukast Sodium Combined with Pulmicort Reswell in Treating Children with an Acute Asthma Attack and its Effect on Serum IL-17, TNF- $\alpha$ , hs-CRP. *Laboratory Medicine and Clinic*, 17(23): 3515–3517.

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