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Clinical Effect of Combined Therapy with Triple Nebulization and Montelukast Sodium Orally Dissolving Films in the Treatment of Pediatric Asthmatic Bronchopneumonia

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Abstract: *Objective*: To evaluate the efficacy of montelukast sodium orally dissolving films combined with triple nebulization in the treatment of pediatric asthmatic bronchopneumonia. *Methods*: A total of 60 pediatric patients with asthmatic bronchopneumonia who visited the hospital from December 2021 to December 2024 were selected as samples and randomly divided into two groups. Group A received combined therapy with montelukast sodium orally dissolving films, while Group B received triple nebulization therapy. The time to symptom relief, serum inflammatory factors, and adverse reactions were compared between the two groups. *Results*: The duration of asthma, cough, and wheezing, as well as the length of hospital stay, were shorter in Group A than in Group B ($P < 0.05$). The levels of C-reactive protein (CRP), white blood cell count (WBC), and serum amyloid A (SAA) were lower in Group A than in Group B ($P < 0.05$). The incidence of adverse reactions was lower in Group A than in Group B ($P < 0.05$). *Conclusion*: The combination therapy of montelukast sodium orally dissolving films and triple nebulization for pediatric asthmatic bronchopneumonia can effectively inhibit inflammation, shorten the duration of symptoms, and is safe and efficient.

Keywords: Montelukast sodium orally dissolving films; Triple nebulization therapy; Pediatric asthmatic bronchopneumonia; Efficacy

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1. Introduction

Pediatric asthmatic bronchopneumonia is a common respiratory disease in infants and young children. It is associated with infection by viruses, *Mycoplasma pneumoniae*, or allergic factors, which can cause airway spasms and induce wheezing. The main symptoms include wheezing, cough, and shortness of breath. Clinically, asthmatic bronchopneumonia is often treated with medication, commonly using corticosteroids, antibiotics, and

bronchodilators. Through a comprehensive drug administration plan, the symptoms of bronchopneumonia can be alleviated. However, irrational drug use can increase the risk of side effects and affect prognosis. The triple nebulization inhalation therapy is a commonly used treatment strategy for asthmatic bronchopneumonia, which can alleviate bronchopneumonia-related symptoms. Montelukast sodium orally dissolving film can antagonize leukotriene receptors, inhibit airway inflammatory responses, and relieve bronchial mucosal edema, which is beneficial for enhancing the management effect of pediatric asthmatic bronchopneumonia [1]. Based on this, this article explores the treatment effect of montelukast sodium orally dissolving film combined with triple nebulization inhalation therapy using 60 pediatric asthmatic bronchopneumonia cases as samples from December 2021 to December 2024.

2. Materials and methods

2.1. Materials

A sample of 60 cases of pediatric asthmatic bronchopneumonia treated from December 2021 to December 2024 is selected and randomly divided into two groups, Group A and Group B. The data of asthmatic bronchopneumonia in Group A are compared with those in Group B, with $P > 0.05$, as shown in **Table 1**.

Table 1. Data analysis of children with asthmatic bronchopneumonia

Group	n	Gender (%)		Age (years)		Disease Duration (d)	
		Male	Female	Range	Mean ± SD	Range	Mean ± SD
Group A	30	19 (63.33)	11 (36.67)	1–7	4.09 ± 0.84	1–4	3.11 ± 0.49
Group B	30	20 (66.67)	10 (33.33)	1–8	4.11 ± 0.89	1–5	3.09 ± 0.51
X^2/t	-	0.0733		0.0895		0.1549	
P	-	0.7866		0.9290		0.8774	

2.2. Inclusion and exclusion criteria

2.2.1. Inclusion criteria

(1) Compatible with asthmatic bronchopneumonia in Zhu Futang's Practical Pediatrics [2]

(2) Parents signed the informed consent

(3) Not taking bronchodilators or immunosuppressants

2.2.2. Exclusion criteria

(1) Children with critical pneumonia requiring surgical intervention

(2) Accompanied by organ lesions

(3) Abnormal liver function

2.3. Treatment methods

Group A is treated with montelukast sodium orally dissolving membranes (Qilu Pharmaceutical Co., Ltd.). For children ≤ 5 years old, the single dose is 4mg; for children > 5 years old, the single dose is 5mg. Take an appropriate amount of medication and place it in the mouth. The active ingredients dissolve and are absorbed by the body. The medication is administered for 3 weeks.

Group B received triple nebulization therapy. The dosage is determined based on the child's weight. For children < 20kg, nebulized terbutaline sulfate solution (1ml) + budesonide suspension (2ml) + ipratropium bromide solution for inhalation (0.5ml) are administered. For children > 20kg, the dosages are adjusted to 2ml, 2ml, and 0.5ml, respectively. Nebulization is performed 3 times a day for 3 weeks.

2.4. Observation indicators

(1) Symptom relief time: Record the time of wheezing, coughing, dry rales, and length of hospital stay.

(2) Serum inflammatory factor indicators: CRP and SAA are detected by immunoturbidimetry, and WBC is detected by a blood analyzer.

(3) Adverse reactions: Record dizziness, abdominal pain, and nausea.

2.5. Statistical analysis

The data are processed using SPSS 23.0 software. The chi-square test is used for counting data (% recorded), and the t-test is used for measurement data (±s recorded). Statistical differences are considered significant at $P < 0.05$.

3. Results

3.1. Symptom relief time

The time of wheezing, coughing, dry rales, and hospital stay in Group A were shorter than those in Group B, with $P < 0.05$, as shown in **Table 2**.

Table 2. Comparison of symptom relief time in children with asthmatic bronchopneumonia (d, $\bar{X}$±s)

Group	Wheezing disappearance time (days)	Cough disappearance time (days)	Dry rales disappearance time (days)	Hospitalization duration (days)
Group A (*n*=30)	4.01 ± 0.61	3.28 ± 0.36	2.48 ± 0.26	3.81 ± 1.12
Group B (*n*=30)	5.94 ± 0.79	5.68 ± 0.81	4.32 ± 0.31	5.36 ± 1.36
t	10.5912	14.8301	24.9089	4.8187
P	< 0.0001	< 0.0001	< 0.0001	< 0.0001

3.2. Serum inflammatory factor indicators

After treatment, the levels of CRP, SAA, and WBC in Group A were lower than those in Group B, with $P < 0.05$. Details are shown in **Table 3**.

Table 3. Comparison of serum inflammatory factors in asthmatic bronchopneumonia ($\bar{X}$±s)

Group	CRP (mg/L)		SAA (mg/L)		WBC (×10⁹/L)	
	Pre- treatment	Post- treatment	Pre- treatment	Post- treatment	Pre- treatment	Post- treatment
Group A (*n*=30)	81.29 ± 4.19	12.52 ± 1.26	22.14 ± 2.14	10.14 ± 1.81	14.22 ± 1.81	5.61 ± 1.06
Group B (*n*=30)	81.31 ± 4.21	37.51 ± 1.94	22.17 ± 2.16	16.36 ± 1.79	14.21 ± 1.79	8.72 ± 1.45
t	0.0184	59.1700	0.0540	13.3831	0.0215	9.4838
P	0.9853	0.0000	0.9571	0.0000	0.9829	0.0000

3.3. Adverse reaction indicators

The adverse reaction rate in Group A was lower than that in Group B, with $P < 0.05$, as shown in **Table 4**.

Table 4. Comparison of adverse reactions in asthmatic bronchopneumonia (n,%)

Group	Dizziness	Abdominal pain	Nausea	Overall incidence
Group A (n=30)	1 (3.33%)	0 (0.00%)	0 (0.00%)	1 (3.33%)
Group B (n=30)	3 (10.00%)	2 (6.67%)	1 (3.33%)	6 (20.00%)
X^2	-	-	-	4.0431
P	-	-	-	0.0444

4. Discussion

Wheezing bronchopneumonia is prevalent in infants and young children, often with acute onset. It is associated with infectious pathogens or allergic factors, leading to edema and congestion of bronchial mucosa, as well as increased mucus secretion in the respiratory tract. Additionally, it is related to airway spasms and inflammatory reactions, resulting in narrowing of the airways and inducing wheezing symptoms [3]. Common symptoms of wheezing bronchopneumonia include cough, wheezing, and dyspnea. A few children may experience fever > 38°C after 2–3 days of infection, accompanied by irritability, diarrhea, vomiting, and loss of appetite [4]. Currently, clinical treatment for wheezing bronchopneumonia in children often involves medication, with the principles of relieving asthma, eliminating phlegm, stopping cough, and reducing fever.

A commonly used treatment is the triple nebulization inhalation regimen. Among them, terbutaline sulfate nebulization inhalation solution can activate β2 adrenergic receptors, increase intracellular cyclic adenosine monophosphate content in children, relax bronchial smooth muscles, and relieve bronchial spasms. The medication takes effect within 5–10 minutes, reducing airway resistance and alleviating dyspnea. Budesonide is a glucocorticoid drug that binds to corticosteroid receptors, inhibiting airway inflammation and blocking excessive glandular secretion. When administered via nebulization inhalation, the medicinal components deposit heavily in the lungs, favoring prolonged duration of the medicinal effects. Ipratropium bromide for inhalation can block M cholinergic receptors in airway smooth muscles, inhibit receptor contraction, suppress glandular mucus secretion in children, and accelerate sputum excretion [5, 6]. The triple nebulization inhalation regimen exerts medicinal effects through different targets, expanding the bronchi and reducing nocturnal wheezing symptoms [7].

However, the improvement in lung function achieved by nebulization inhalation alone is limited, necessitating the exploration of efficient combination therapy regimens. Montelukast sodium orally dissolving films represent a modern therapeutic approach. They can antagonize leukotriene receptors, inhibit airway inflammation, alleviate bronchial mucosal edema, block mucus secretion from bronchial mucosa, and suppress smooth muscle spasms. They are suitable for the treatment of pediatric asthmatic diseases [8]. However, it should be noted that children with wheezing bronchopneumonia are often young and have limited awareness of their own disease, sometimes even resisting medication [9]. Therefore, in this paper, montelukast sodium orally dissolving films were selected as an adjuvant therapy. These films are directly absorbed through the oral mucosa, effectively avoiding the first-pass effect and degradation by gastric acid. They do not require water for administration, chewing, or swallowing, which can improve children's cooperation with medication intake.

Based on the data analysis in this article, Group A had shorter durations of wheezing, coughing, and dry

rales, as well as a shorter hospital stay compared to Group B, with $P < 0.05$. The reason for this is that the triple nebulization inhalation therapy targets multiple points, inhibiting inflammation progression in the children through the active ingredients of budesonide suspension, and dilating their airways through terbutaline sulfate nebulization inhalation solution and ipratropium bromide inhalation solution, which can rapidly relieve wheezing symptoms [10]. On this basis, the combination of montelukast sodium orally dissolving films can inhibit airway hyperresponsiveness through antagonism of leukotrienes, prevent inflammatory factors from infiltrating the airways, and avoid difficulty in swallowing medication with water as the medication is placed in the child's mouth to dissolve, resulting in rapid relief of various symptoms [11]. Another set of data shows that Group A had lower levels of CRP, SAA, and WBC compared to Group B, with $P < 0.05$. The reason for this is that combination therapy with montelukast sodium orally dissolving films stimulates eosinophil deactivation, blocks the release of mediators such as histamine and leukotrienes, inhibits airway hyperresponsiveness, and indirectly reduces the release of inflammatory mediators, resulting in lower serum indicators [13].

Additionally, montelukast sodium orally dissolving films can block the release of mucus and reduce airway edema, which is beneficial for further reducing serum factors [14]. Finally, another set of data indicates that Group A had a lower adverse reaction rate compared to Group B, with $P < 0.05$. Nebulization inhalation therapy, a commonly used treatment for pediatric diseases, can reduce the drug dosage and minimize the adverse effects of active ingredients on children's bodies. The nebulized medication directly exerts its effect at the site of the disease, relieving airway discomfort and reducing side effects associated with oral administration [15]. Furthermore, the use of montelukast sodium orally dissolving films as adjunctive therapy improves medication compliance as they do not require water for administration, and the films are safer as they do not carry risks of osteoporosis or oral and pharyngeal candidiasis. However, the small sample size of children with asthmatic bronchopneumonia in this study may introduce deviations in the evaluation of the control effects of montelukast sodium orally dissolving films combined with triple nebulization inhalation therapy. Future studies should include a larger sample size of children with asthmatic bronchopneumonia to explore the control effects of this combination therapy through multicenter investigations.

5. Conclusion

In summary, the combination of montelukast sodium orally dissolving films and triple nebulization inhalation therapy for the treatment of pediatric asthmatic bronchopneumonia can shorten the duration of symptoms, reduce inflammatory responses, and decrease adverse reactions, making it a promising approach for widespread use.

Disclosure statement

The author declares no conflict of interest.

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