

# Comparative Study on the Effect of Different Modes of Administration of Ambroxol Hydrochloride in the Treatment of Pediatric Respiratory Diseases

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**Abstract:** *Objective:* To investigate the comparison of the effects of intravenous infusion of Ambroxol Hydrochloride and nebulized inhalation in the treatment of pediatric respiratory diseases. *Methods:* 188 children with respiratory diseases admitted to the pediatrics department of the hospital from September 2022 to March 2024 were selected as the study subjects, and were randomly divided into the control group ( $n = 41$ ) and the observation group ( $n = 41$ ) according to the random number table method. Both groups of patients were first treated with conventional treatment, and based on conventional treatment, the control group was treated with intravenous infusion of Ambroxol Hydrochloride, and the observation group was treated with nebulized inhalation of Ambroxol Hydrochloride. The general information, clinical symptom improvement time, oxygen therapy time, sputum aspiration frequency, hospitalization time, and the occurrence of adverse reactions were observed in the two groups. *Results:* The baseline data of the two groups of patients were not statistically significant ( $P > 0.05$ ); the disappearance time of clinical symptoms such as cough, lung rales, and shortness of breath in the observation group was shorter than that in the control group ( $t = 8.739$ ,  $t = 10.108$ ,  $t = 19.448$ ,  $P < 0.001$ ); the time of oxygen therapy, number of sputum aspirations, and hospital stay of the patients in the observation group were significantly shorter than that of the control group ( $t = 10.593$ ,  $t = 10.665$ ,  $t = 14.673$ , all  $P < 0.001$ ); the total incidence of adverse reactions in patients in the observation group (3/3.18%) was significantly lower than that in the control group (14/14.89%) ( $\chi^2 = 7.825$ ,  $P = 0.005 < 0.01$ ). *Conclusion:* In the treatment of pediatric respiratory diseases with Ambroxol Hydrochloride, nebulized inhalation has better efficacy than intravenous drip, and can better improve the clinical symptoms and reduce the side effects in children.

**Keywords:** Ambroxol Hydrochloride; Intravenous drip; Nebulized inhalation; Pediatrics; Respiratory disease

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## 1. Introduction

With the continuous development of modern medical technology, the treatment of respiratory diseases

has become increasingly available. However, for pediatric patients with respiratory diseases, ways to choose a treatment that is both safe and effective remains a challenge for the medical community <sup>[1]</sup>. Ambroxol Hydrochloride, as a commonly used drug for the treatment of respiratory diseases, has been widely used in clinical practice. This drug promotes the expulsion of sputum mainly by inhibiting the synthesis of acidic polysaccharide fibers in sputum, thereby reducing the viscosity of sputum. In addition, Ambroxol Hydrochloride has anti-inflammatory, antioxidant, and bronchial smooth muscle relaxation effects, which have significant effects on improving the symptoms of patients with respiratory diseases <sup>[2]</sup>. However, regarding the mode of administration of Ambroxol Hydrochloride in the treatment of pediatric respiratory diseases, there are currently two main clinical modalities: intravenous drip and nebulized inhalation. Although both modalities can achieve effective drug delivery, they may differ in terms of drug mechanism of action, therapeutic efficacy, and safety <sup>[3]</sup>. Therefore, this study aims to compare the effects of intravenous drip and nebulized inhalation of Ambroxol Hydrochloride in the treatment of pediatric respiratory diseases, to provide a more scientific and reasonable basis for the clinical use of drugs.

## **2. Information and methods**

### **2.1. General information**

188 cases of children with respiratory diseases admitted to the pediatrics department of the hospital from September 2022 to March 2024 were selected as the study subjects. They were randomly divided into the control group ( $n = 41$ ) and the observation group ( $n = 41$ ) according to the random number table method.

Inclusion criteria: (1) under 12 years of age; (2) clinically diagnosed with respiratory diseases; (3) complete clinical data; (4) the child's family members need to voluntarily sign an informed consent form and agree to participate in this study.

Exclusion criteria: (1) suffering from serious cardiovascular and cerebrovascular diseases and hepatic and renal dysfunction; (2) suffering from mental diseases and disorders of consciousness; (3) allergic to Ambroxol Hydrochloride; (4) low treatment adherence; (5) incomplete clinical data; (6) unwilling to sign the informed consent form or unable to cooperate with the relevant examinations and follow-up visits.

### **2.2. Methods**

Both groups of patients were first treated with conventional treatment for infection, asthma, and cough. Based on conventional treatment, the control group was treated with an intravenous drip of Ambroxol Hydrochloride. 7.5 mg of Ambroxol Hydrochloride was added to 50 ml of 5% dextrose injection for intravenous drip, 1 time/day. The observation group was treated with nebulized inhalation of Ambroxol Hydrochloride, 7.5 mg/dose, 2 times/day.

### **2.3. Observation indexes**

The observation indexes include general information such as gender, average age, and number of bronchopneumonia/capillary bronchopneumonia/acute bronchitis.

The improvement time of clinical symptoms includes the time of disappearance of cough, time of disappearance of lung rales, and time of disappearance of shortness of breath.

The observation indexes also include the duration of oxygen therapy, the number of sputum aspirations, and the length of hospitalization.

The occurrence of adverse reactions observed include vomiting, loss of appetite, and nausea.

## 2.4. Statistical methods

Statistical processing was performed with SPSS 20.0, and the measurement data were expressed using (mean  $\pm$  SD), and the two-sample *t*-test and  $\chi^2$  test were used for comparison between groups, with  $P < 0.05$  as the difference being statistically significant.

## 3. Results

### 3.1. Comparison of general information of patients in the two groups

As shown in **Table 1**, the baseline information of the two groups of patients was not statistically significant ( $P > 0.05$ ).

**Table 1.** Comparison of general information of patients in two groups

| Groups                     | Sex (male/female) | Average age     | Bronchopneumonia/capillary bronchopneumonia/acute bronchitis |
|----------------------------|-------------------|-----------------|--|
| Control group (n = 94)     | 50/44             | 2.52 $\pm$ 0.56 | 35/30/29   |
| Observation group (n = 94) | 48/46             | 2.53 $\pm$ 0.58 | 38/33/23   |
| $\chi^2/t$                 | 0.085             | 0.120           | 0.959  |
| <i>P</i>                   | 0.770             | 0.904           | 0.619  |

### 3.2. Comparison of clinical symptom improvement time between the two groups of patients

As shown in **Table 2**, the disappearance time of clinical symptoms such as cough, lung rales, and shortness of breath of patients in the observation group was shorter than that of the control group ( $t = 8.739$ ,  $t = 10.108$ ,  $t = 19.448$ ,  $P_{\text{all}} < 0.001$ ).

**Table 2.** Comparison of clinical symptom improvement time between the two groups of patients

| Groups                     | Cough disappearance time | Lung rale disappearance time | Shortness of breath disappearance time |
|----------------------------|--------------------------|------------------------------|--|
| Control group (n = 94)     | 6.12 $\pm$ 1.38          | 6.25 $\pm$ 1.35              | 6.87 $\pm$ 1.26                        |
| Observation group (n = 94) | 4.38 $\pm$ 1.35          | 4.36 $\pm$ 1.21              | 3.58 $\pm$ 1.05                        |
| <i>t</i>                   | 8.739                    | 10.108                       | 19.448                                 |
| <i>P</i>                   | 0.000                    | 0.000                        | 0.000                                  |

### 3.3. Comparison of oxygen therapy time, number of sputum aspirations, and hospitalization time between the two groups of patients

As shown in **Table 3**, the oxygen therapy time, the number of sputum aspirations, and the hospitalization time of the patients in the observation group were significantly less than those in the control group ( $t = 10.593$ ,  $t = 10.665$ ,  $t = 14.673$ ,  $P_{\text{all}} < 0.001$ ).

**Table 3.** Comparison of oxygen therapy time, number of sputum aspirations, and hospitalization time between the two groups of patients

| Groups                             | Duration of oxygen therapy | Number of sputum aspirations | Length of hospitalization |
|------------------------------------|----------------------------|------------------------------|---------------------------|
| Control group ( <i>n</i> = 94)     | 1.92 ± 0.53                | 4.21 ± 1.12                  | 9.87 ± 1.53               |
| Observation group ( <i>n</i> = 94) | 1.22 ± 0.36                | 2.78 ± 0.66                  | 7.25 ± 0.81               |
| <i>t</i>                           | 10.593                     | 10.665                       | 14.673                    |
| <i>P</i>                           | 0.000                      | 0.000                        | 0.000                     |

### 3.4. Comparison of the occurrence of adverse reactions between the two groups of patients

As shown in **Table 4**, the total incidence of adverse reactions in patients in the observation group (3/3.18%) was significantly lower than that in the control group (14/14.89%) ( $\chi^2 = 7.825$ ,  $P = 0.005 < 0.01$ ).

**Table 4.** Comparison of the occurrence of adverse reactions between the two groups of patients

| Groups                             | Vomiting  | Loss of appetite | Nausea    | Total incidence |
|------------------------------------|-----------|------------------|-----------|-----------------|
| Control group ( <i>n</i> = 94)     | 5 (5.32%) | 3 (3.19%)        | 6 (6.38%) | 14 (14.89%)     |
| Observation group ( <i>n</i> = 94) | 1 (1.06%) | 0                | 2 (2.12%) | 3 (3.18%)       |
| $\chi^2$                           |           |                  |           | 7.825           |
| <i>P</i>                           |           |                  |           | 0.005           |

## 4. Discussion

Pediatric respiratory diseases refer to a wide range of disorders that occur in the respiratory system of children, including the upper respiratory tract, such as the nose and throat, and the lower respiratory tract, such as trachea, bronchus, and lungs. Pediatric respiratory diseases cover a wide range of conditions including some common infections such as acute upper respiratory tract infections, laryngitis, tonsillitis, rhinitis, bronchitis, and pneumonia, as well as some other chronic conditions such as asthma, allergic rhinitis, and chronic cough [4-5]. Symptoms of these diseases may include coughing, coughing up sputum, dyspnoea, wheezing, chest tightness, chest pain, and fever [6]. The occurrence of pediatric respiratory diseases may be related to the fact that children's immune system is not fully developed, frequent exposure to external pathogenic substances, and environmental factors. Therefore, it is very important to prevent the occurrence of pediatric respiratory diseases.

For the treatment of pediatric respiratory diseases, commonly used methods such as antibiotic therapy, antiviral therapy, and inhaled glucocorticosteroids, are likely to lead to an increase in drug resistance and are likely to have an impact on the balance of intestinal flora in children [7-8]. Thus, the advantages of Ambroxol Hydrochloride treatment came to the fore. Ambroxol Hydrochloride is an expectorant mainly used for the treatment of acute and chronic respiratory diseases accompanied by abnormal sputum secretion and poor sputum elimination. It promotes the elimination of viscous secretions from the respiratory tract and reduces the retention of mucus, thus significantly facilitating phlegm expectoration and improving respiratory conditions. Ambroxol Hydrochloride can be administered in a variety of ways, of which intravenous drip and nebulized inhalation are the two most common ways of administering the drug, which have their advantages and disadvantages.

In this study, it was noted that the disappearance time of clinical symptoms such as cough, lung rales, and shortness of breath in the observation group was shorter than that in the control group ( $t = 8.739$ ,  $t = 10.108$ ,



$t = 19.448$ ,  $P_{\text{all}} < 0.001$ ), and the duration of oxygen therapy, the number of sputum suctioning and the length of hospital stay in the observation group were significantly less than that in the control group ( $t = 10.593$ ,  $t = 10.665$ ,  $t = 14.673$ ,  $P_{\text{all}} < 0.0011$ ). This indicates that in the treatment of pediatric respiratory diseases with Ambroxol Hydrochloride, nebulized inhalation is more effective and improves the clinical symptoms of the children compared to an intravenous drip. This is mainly due to the following reasons. Firstly, through nebulized inhalation, the drug can be directly applied to the mucous membrane of the respiratory tract, and fully make contact with the lesion, to exert the therapeutic effect more quickly, while intravenous drip requires the drug to reach the lesion through the blood circulation, which is a relatively slower process. Secondly, through nebulized inhalation, the drug can form a higher concentration of the drug in the respiratory tract, which can exert the therapeutic effect more effectively. When administered by intravenous drip, the concentration of the drug in the blood is relatively low, and it takes a longer time to achieve the therapeutic effect. In addition, when administered by nebulized inhalation, the drug can moisten the mucous membrane of the respiratory tract, promote the dilution and discharge of sputum, and thus improve the respiratory symptoms, which is particularly important for alleviating the coughing and sputum symptoms of the children<sup>[9-10]</sup>.

This study also pointed out that the total incidence of adverse reactions in patients in the observation group (3/3.18%) was significantly lower than that in the control group (14/14.89%) ( $\chi^2 = 7.825$ ,  $P = 0.005 < 0.01$ ), which indicates that in the treatment of pediatric respiratory disorders with aminobromine hydrochloride, nebulized inhalation therapy is more able to reduce the adverse reactions of the patients, compared with intravenous drip<sup>[11]</sup>. The main reasons are as follows. Firstly, when nebulized inhalation is performed, the drug acts directly on the respiratory tract, the local drug concentration is high, and the amount of drug entering the blood circulation is relatively small, so there are fewer systemic side effects, which can reduce the potential damage of the drug to the patient's other organs, such as the liver and kidneys. Secondly, by administering drugs through nebulized inhalation, the drugs can avoid being broken down and destroyed in the gastrointestinal tract, thus maintaining a high level of drug activity, which can improve the therapeutic effect of the drugs and reduce the side effects caused by the breakdown of the drugs in the gastrointestinal tract. At the same time, when nebulized inhalation therapy is used, the dose of the drug is relatively small and can be directly applied to the lesion site, thus reducing the frequency and total amount of the drug, which can help to reduce the overall burden of the drug on the patient and reduce the occurrence of adverse reactions. In addition, nebulized inhalation therapy is easier to administer than intravenous drip, and patients do not need to remain in a fixed position for long periods of time, resulting in a higher level of comfort, which helps to reduce patient discomfort and anxiety caused by the treatment process itself.

In the treatment of pediatric respiratory diseases, the following points need to be noted when using Ambroxol Hydrochloride for nebulized inhalation therapy. Firstly, it is necessary to ensure that nebulizing equipment and masks suitable for children are used to ensure that the drug can be effectively inhaled into the respiratory tract. Secondly, the appropriate dose and concentration of the drug should be determined according to the child's age, body weight, and medical condition to avoid overdosage or underdosing. Thirdly, during nebulization, the children should be kept in an appropriate position, such as sitting up straight or lying on their backs, and make sure that they can breathe normally so that the medication can enter the respiratory tract adequately. Fourthly, the appropriate duration and frequency of nebulization should be determined according to the doctor's advice. Excessive nebulization time or frequency may increase the risk of adverse effects. Fifth, children should be closely observed during nebulization, and if adverse effects such as shortness of breath, increased wheezing, or coughing occur, nebulization should be stopped immediately and medical attention should be sought. Sixth, if children are concurrently using other medications, especially those related to

respiratory diseases, a doctor should be consulted to ensure that drug-drug interactions do not occur. Seventh, during treatment, children should be given a light, easily digestible diet and encouraged to drink plenty of water. At the same time, children should be given enough rest and avoid over-exertion.

In conclusion, in the treatment of pediatric respiratory diseases with Ambroxol Hydrochloride, nebulized inhalation has better efficacy than intravenous drip, which can better improve clinical symptoms and reduce the side effects in children.

## Disclosure statement

The authors declare no conflict of interest.

## References

- [1] Xia J, 2016, Analysis of the Efficacy of Budesonide Combined with Ambroxol Hydrochloride Nebulized Inhalation in the Treatment of Pediatric Bronchopneumonia. *Modern Diagnosis and Treatment*, 27(21): 4068–4069.
- [2] Tao J, 2019, Observation on the Application Effect of Ambroxol Hydrochloride Injection in the Treatment of Pediatric Respiratory Diseases. *Journal of Clinical Rational Use of Drugs*, 12(29): 75–76.
- [3] Zhang RH, Chen D, 2018, Application Value of Ambroxol Hydrochloride Injection in the Treatment of Pediatric Respiratory Diseases. *China Medicine Guide*, 16(02): 47.
- [4] Chen N, Li XH, Liu P, et al., 2016, Clinical Pharmacokinetics and Pharmacodynamics of Ambroxol Hydrochloride by Nebulized Inhalation Versus Intravenous Injection. *Journal of Medical Research*, 45(01): 113–116.
- [5] Chen XM, Tang L, Zhao JY, 2016, Efficacy of Budesonide Combined with Ambroxol Hydrochloride Nebulized Inhalation in the Treatment of Pediatric Capillary Bronchiolitis. *Chinese and Foreign Medical Treatment*, 35(31): 121–123.
- [6] Wei YW, 2016, Comparative Analysis of the Effect of Different Administration Modes of Ambroxol Hydrochloride Applied in the Treatment Process of Pediatric Respiratory Diseases. *Chinese and Foreign Women's Health Research*, 2016(16): 214 + 224.
- [7] Zhou CY, Su XL, Zou Y, et al., 2019, Comparative Study on the Effect of Different Administration Modes of Ambroxol Hydrochloride in the Treatment of Pediatric Respiratory Diseases. *Chinese and Foreign Medicine Research*, 17(10): 125–126.
- [8] Wei YW, 2016, Comparative Analysis of the Effects of Different Administration Modes of Ambroxol Hydrochloride Applied in the Treatment Process of Pediatric Respiratory Diseases. *Chinese and Foreign Women's Health Research*, 2016(16): 214 + 224.
- [9] Liu QH, Tian ML, 2017, Comparative Analysis of the Effect of Different Administration Modes of Ambroxol Hydrochloride Applied in the Treatment Process of Pediatric Respiratory Diseases. *Chinese Community Physician*, 33(17): 48 + 50.
- [10] Wang F, 2019, Exploring the Effect of Different Administration Modes of Ambroxol Hydrochloride in the Treatment of Pediatric Respiratory Diseases. *World Digest of Latest Medical Information*, 19(75): 139–140.
- [11] Zheng M, 2014, Discussion on the Efficacy of Ambroxol Hydrochloride Injection in the Treatment of Pediatric Respiratory Diseases. *Chinese and Foreign Medical Treatment*, 33(15): 57–58 + 60.

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