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Clinical Efficacy of Ambroxol Hydrochloride Injection and Cefotaxime Sodium Injection in the Treatment of Children with Bacterial Pneumonia

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Abstract

Objective: To compare the clinical efficacy of ambroxol hydrochloride injection and cefotaxime sodium injection in the treatment of children with bacterial pneumonia, and the changes of serum SIL-2R, CRP, and myocardial enzymes in children. **Methods:** A total of 136 cases of children with bacterial pneumonia treated in our hospital from January 2020 to December 2024 were selected, and randomly divided into a control group and research group, with 68 cases in each group. Children in the control group were treated with cefotaxime sodium injection, and children in the research group were treated with ambroxol hydrochloride injection. The time of clinical symptom disappearance, the incidence of adverse reactions, and the clinical efficacy of the two groups of children were compared, and the serum SIL-2R, CRP, and myocardial enzyme levels were determined by ELISA and compared and analyzed. **Results:** The time of cough relief, fever reduction, rales disappearance, and wheezing disappearance in the children of the research group were significantly shorter than those of the control group ($P < 0.05$). There was no significant difference in the levels of serum SIL-2R, CRP, and myocardial enzymes between the two groups of patients before treatment ($P > 0.05$). After treatment, the levels of serum SIL-2R, CRP, and myocardial enzymes in the patients of the research group were significantly lower than those of the control group ($P < 0.05$). The total effective rate of treatment in children of the research group was 98.53%, which was significantly higher than the total effective rate of treatment in children of the control group, 83.82% ($P < 0.05$). The incidence of adverse reactions in children of the research group was 2.94%, which was significantly lower than that in children of the control group, 11.77% ($P < 0.05$). **Conclusion:** The effect of ambroxol hydrochloride injection in the treatment of children with bacterial pneumonia is better than that of cefotaxime sodium injection. It can effectively improve the clinical symptoms of children, reduce the levels of serum SIL-2R, CRP, and myocardial enzymes, with fewer adverse reactions, be safe and reliable, and is worth promoting.

Keywords

Ambroxol hydrochloride injection; Cefotaxime sodium; Children with bacterial pneumonia; SIL-2R; CRP; Myocardial enzymes

Pediatric bacterial pneumonia is a relatively common respiratory system disease in children, generally caused by respiratory tract infection. Children, as a special group, have not yet fully developed their physical functions and have a weak immune function, making them prone to various diseases [1-3]. Relevant research shows that pediatric bacterial pneumonia is one of the important factors contributing to the death of children [4]. At present, with the increasingly frequent use of a large number of antibiotics in clinical medicine, drug-resistant strains are showing an upward trend, which also makes the treatment of pediatric bacterial pneumonia patients more demanding, not only prolonging the treatment time but also increasing the cost of treatment, bringing great pain and burden to children and their families [4]. Therefore, it is particularly important to find more convenient, safe, reliable, and economical treatment methods [5]. Ambroxol injection and cefotaxime sodium are commonly used clinical drugs for the treatment of pneumonia patients, and there are few reports on their effects on changes in serum SIL-2R, CRP, and myocardial enzymes in children. This article mainly compares and analyzes the clinical efficacy of ambroxol injection and cefotaxime sodium injection in the treatment of pediatric bacterial pneumonia patients, and compares their effects on changes in serum SIL-2R, CRP, and myocardial enzymes in children.

1. Data and Methods

1.1 General Data

Children with bacterial pneumonia admitted to our hospital from January 2020 to December 2024 were selected. A total of 136 children were included, all of whom were diagnosed with pneumonia after clinical examination. Among them, there were 75 males and 61 females; the average age was 7.07 ± 1.54 years old. Clinical manifestations included fever, cough, wheezing, rales, etc. They were randomly divided into a control group and a study group; each group had 68 cases, and there was no significant difference between the two groups of children in general data ($P > 0.05$), which was comparable.

Inclusion criteria: (1) The diagnosis was consistent with the diagnostic criteria for children with bacterial pneumonia in “Practical Pediatrics” [6], and all of them were diagnosed by chest X-ray; (2) Those who were not allergic to ambroxol injection and ceftriaxone sodium injection; (3) The children’s families voluntarily participated in this experiment and signed an informed consent form. This study was approved by the Ethics Committee of our hospital.

Exclusion criteria: (1) Those with major organ diseases such as the heart, liver, and kidney; (2) Those with malignant tumors; (3) Those with abnormal coagulation function.

1.2 Methods

1.2.1 Treatment Methods

All children were treated with antipyretics, atomization (inhaled budesonide suspension, 2ml:1mg/vial, HealthYuan Pharmaceutical Group Co., Ltd., Product batch number: 24081549; terbutaline sulfate atomization inhalation solution, 2ml:5mg/vial, Hebei Renhe Yikang Pharmaceutical Co., Ltd., Product batch number: 0282406303; ipratropium bromide inhalation solution, 2ml:250ug/vial, Shandong Jingwei Pharmaceutical Co., Ltd., Product batch number: 24033214), and expectorants, etc., symptomatic and supportive treatment based on their condition.

The control group children were treated with cefotaxime sodium injection (Hunan Kelong Pharmaceutical Co., Ltd., Product batch number: E2310001;) by intravenous drip, 60mg/kg, once a day, continuously dripped, continuously treated for 1 week.

The study group children were treated with ambroxol hydrochloride injection (2ml:15mg/vial, Hubei Kelong Pharmaceutical Co., Ltd., Product batch number: F240524C) by intravenous drip, 2ml/day, once a day, continuously dripped for 7 days, then stopped medication for 3 days, and continuously treated for 1 week.

1.2.2 Criteria for Evaluating Therapeutic Efficacy

(1) Observe the time it takes for clinical symptoms such as fever, cough, rales, and wheezing to disappear in children of both groups. (2) Compare the levels of serum SIL-2R, CRP, and cardiac enzymes in children of both groups before and after treatment. Cardiac enzyme indicators include: lactate dehydrogenase (LDH), creatine kinase (CK), creatine kinase isoenzyme (CK-MB), and aspartate aminotransferase (AST). The levels of serum SIL-2R, CRP, and cardiac enzymes were measured using ELISA. All relevant kits were purchased from Shanghai Yuan Ye Biotechnology Co., Ltd., and the operations were performed strictly according to the operation manuals of the kits. (3) Compare the clinical efficacy of the two groups of children [7]: (a) Marked effect: The clinical symptoms and signs of the children disappeared completely after treatment, and the body temperature returned to normal; (b) Effective: The clinical symptoms and signs of the patients were improved to some extent after treatment, and the body temperature decreased; (c) Ineffective: There was no significant change in all clinical symptoms and signs of the patients before and after treatment, and the condition after treatment even worsened. (4) Observe the incidence of adverse reactions in children of both groups.

1.3 Statistical Methods

Statistical analysis was performed using SPSS 20.0. For normal distribution of measurement data, " $\bar{x} \pm s$" was used to express, and a t-test was used for comparison between the two groups; for normal distribution of enumeration data, the rate was used to express, and a x^2 test was used for comparison between the two groups, and $P < 0.05$ was considered statistically significant.

2. Results

2.1 Comparison of the Time of Clinical Symptom Disappearance in Children between the Two Groups

The time of symptom disappearance, such as cough, fever, rales disappearance, and wheezing in the study group, was significantly shorter than that in the control group ($P < 0.05$), as shown in Table 1.

Table 1. Comparison of the time of clinical symptom disappearance in two groups of children (d)

Group	n	Coughing stop time	Fever subsided time	Rales disappearance time	Wheezing disappearance time
Control group	68	5.83±1.31	3.87±1.43	6.95±3.18	7.95±2.12
Research group	68	3.95±0.53[a]	2.36±1.12[a]	4.22±2.41[a]	5.64±1.67[a]

Note. [a]$P < 0.05$, compared with the control group post-treatment.

2.2 Comparison of Serum SIL-2R, CRP, and Cardiac Enzyme Levels in Children Before and After Treatment

Before treatment, there was no statistically significant difference in the levels of serum SIL-2R, CRP, and cardiac enzymes between the two groups of patients ($P > 0.05$); after treatment, the levels of serum SIL-2R, CRP, and cardiac enzymes in the study group were significantly lower than those in the control group ($P < 0.05$), as shown in Table 2.

Table 2. Comparison of serum SIL-2R, CRP, and myocardial enzyme levels before and after treatment in 2 groups ($\bar{x} \pm s$)

Group	n	SIL-2R (U/L)		CRP (mg/L)		Myocardial enzyme levels(U/L)							
						LDH		CK		CK-MB		AST	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Control group	68	512.86±24.72	414.62±22.08[a]	21.32±1.04	10.12±1.45[a]	409.12±17.64	326.43±12.14[a]	872.22±34.93	652.38±17.55[a]	127.43±6.32	80.32±5.54[a]	51.43±4.87	46.32±3.26[a]
Research group	68	513.22±22.54	356.93±23.08[ab]	22.06±1.13	7.43±1.55[ab]	410.43±18.55	278.72±11.03[ab]	873.16±37.08	538.21±15.54[ab]	128.16±6.84	65.17±4.42[ab]	52.05±4.96	42.62±2.74[ab]

Notes. [a]$P < 0.05$, compared with the same group pre-treatment; [b]$P < 0.05$, compared with the control group post-treatment.

2.3 Comparison of Clinical Efficacy of Pneumonia in Children between the Two Groups

The total effective rate of treatment in children of the study group was 98.53%, which was significantly higher than the total effective rate of treatment in children of the control group, 83.82% ($P < 0.05$) (see Table 3).

Table 3. Comparison of the clinical efficacy of pneumonia in two groups of children (cases)

Group	n	Significant effect	Effective	Ineffective	Total effective rate of treatment (%)
Control group	68	18	39	11	83.82
Research group	68	35	32	1	98.53[a]

Note. [a]$P < 0.05$, compared with the control group post-treatment.

2.4 Comparison of the Incidence of Adverse Reactions in Children with Pneumonia between the Two Groups

The incidence of adverse reactions in children with pneumonia in the study group was 2.94%, which was significantly lower than that in the control group (11.77%) ($P < 0.05$), as shown in Table 4.

Table 4. Comparison of the incidence of adverse reactions in children with pneumonia between the two groups (cases)

Group	n	Rash	Vomiting Nausea	Gastrointestinal Discomfort	Incidence of Adverse Reactions (%)
Control group	68	3	2	3	11.77
Research group	68	1	1	0	2.94[a]

Note. [a]$P < 0.05$, compared with the control group post-treatment

3. Discussion

In the treatment of children with bacterial pneumonia, the key is to effectively inhibit the growth of bacteria in children and continuously eliminate the bacteria through the rational use of antibiotics [8]. Children with bacterial pneumonia is a disease caused by bacteria such as Pseudomonas aeruginosa and Streptococcus. In order to reduce the pain suffered by children, clinicians often choose ambroxol injection to effectively inhibit the bacteria in children [9]. Ambroxol injection, as a macrolide antibiotic, is a broad-spectrum antibacterial drug that has an effective bactericidal effect on many bacteria, which is also the reason why it is widely used in the treatment of children with bacterial pneumonia [10, 11]. Clinical use of ambroxol injection to treat children with bacterial pneumonia is generally sequential treatment, that is, antibiotics are injected intravenously for a period of time during treatment, and then changed to oral administration [4]. The premise of using sequential treatment is that it must be guaranteed that children can absorb and that the bioavailability and utilization of oral preparations are both ideal, so that the advantages of sequential treatment can be brought into play. In the process of sequential treatment of children with bacterial pneumonia with ambroxol injection, when the child is in the early stage of onset, and the condition is more serious, intravenous administration can quickly reach the drug concentration needed to inhibit and kill the bacteria in children, so that the symptoms of children can be effectively relieved. When the child's condition is relieved in the later stage, the child is given oral administration to maintain the blood drug concentration, so that the bacteria in the body can be completely killed [12, 13]. Ceftriaxone sodium is also a drug with a strong bactericidal effect, but its bactericidal effect is obviously insufficient compared to ambroxol injection [14, 15]. This study shows that the time of disappearance of clinical symptoms in the study group children is significantly less than that in the control group, the incidence of adverse reactions is significantly lower than that in the control group, and the clinical efficacy is significantly higher than that in the control group ($P < 0.05$). It shows that the effect of ambroxol injection in the treatment of children with bacterial pneumonia is better than that of ceftriaxone sodium injection.

SIL-2R can be used to reflect the disease condition and the immune regulation in the organism, and it can also be used to reflect the condition of pneumonia patients [16]. CRP can be used to reflect the inflammatory condition of pneumonia patients and the stress condition of the human body [17]. The increase in the level of myocardial enzyme indicators can reflect the damage to the children's myocardium by children's bacterial pneumonia, and it is positively correlated with the degree of damage [18]. This study shows that before treatment, there was no statistically significant difference in the levels of serum SIL-2R, CRP, and myocardial enzymes between the two groups of patients ($P > 0.05$). After treatment, the levels of serum SIL-2R, CRP, and myocardial enzymes in the research group were significantly lower than those in the control group ($P < 0.05$). It shows that ambroxol hydrochloride injection can effectively reduce the levels of serum SIL-2R, CRP, and myocardial enzymes in children, which may be its pathophysiological basis for the treatment of children with bacterial pneumonia.

In conclusion, ambroxol hydrochloride injection is more effective than ceftriaxone sodium injection in the treatment of children with bacterial pneumonia, can effectively improve the clinical symptoms of children, reduce the levels of serum SIL-2R, CRP, and myocardial enzymes, and has a low incidence of adverse reactions. It is safe and reliable, and is worth promoting.

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