Clinical Observation of Curative Effect of Qingfei Ditan Decoction Combined with Targeted Drug Penetration Therapy of Traditional Chinese Medicine on Severe Mycoplasma Pneumonia in Children

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Abstract [**Objectives**] This study was conducted to explore the curative effect of Qingfei Ditan decoction combined with targeted drug penetration therapy of traditional Chinese medicine on severe mycoplasma pneumonia in children. [**Methods**] Based on the retrospective study method, children with severe mycoplasma pneumonia admitted to the Children's Hospital of Soochow University from April 2023 to October 2023 were selected, and divided into a treatment group including 56 cases and a control group including 145 cases. The curative effect and adverse reactions of the two groups were compared. [**Results**] The total effective rate of the treatment group was higher than that of the control group, and the disappearance time of cough and lung rales was shorter than that of the control group, and the incidence of adverse reactions was lower, showing statistical significance ($P<0.05$). However, defervescence time and bronchoscope flushing rate showed no significant difference ($P>0.05$). [**Conclusions**] Qingfei Ditan Decoction combined with targeted drug penetration therapy of traditional Chinese medicine has a significant effect on severe mycoplasma pneumonia in children, and can reduce the side effects of drugs. It is a safe and efficient combination treatment scheme of traditional Chinese medicine.

Key words Qingfei Ditan Decoction, Severe mycoplasma pneumonia in children, Targeted drug penetration therapy of traditional Chinese medicine

1 Introduction

Mycoplasma pneumonia is a common respiratory disease in pediatrics. 2023 is a high incidence year of mycoplasma pneumonia in children, with following characteristics compared with previous years: high infection rate, high severe disease rate, and high resistance rate of azithromycin. Specifically, From the perspective of the high infection rate, it showed a large-scale epidemic performance first. As to the high severe disease rate, many children were accompanied by serious complications such as atelectasis, pulmonary consolidation, pleural effusion, coagulation disorders, *etc.* Many children needed bronchoscope flushing treatment, and some children suffered from sequelae or even life-threatening. In terms of high resistance rate to azithromycin, sometimes the symptoms could not be controlled after three cycles of standardized azithromycin treatment, which brought great difficulty to clinical treatment. Under this background, on the basis of standardized treatment of western medicine, we used self-made Qingfei Ditan Decoction combined with targeted drug penetration therapy of traditional Chinese medicine to treat severe mycoplasma pneumonia in children, and the results were encouraging.

2 Materials and methods

2.1 General materials Based on the retrospective study method, children with severe mycoplasma pneumonia admitted to the Children's Hospital of Soochow University from April 2023 to October 2023 were selected, and divided into a treatment group including 56 cases and a control group including 145 cases. The general information such as gender, age, and disease duration, as well as the severity indicators of serum D-dimer and lactate dehydrogenase (LDH), were compared between the two groups of children. The results showed that there was no statistical difference between the two groups ($P>0.05$), which were comparable, as shown in Table 1. This study was approved by the Hospital Medical Ethics Committee.

Table 1 Comparison of general situation and severity between the two groups of children

Variable		Control group ($n=145$)	Treatment group ($n=56$)
Gender	Male [n (%)]	69 (47.6)	29 (51.8)
	Female [n (%)]	76 (52.4)	27 (48.2)
Age ($\bar{x}\pm s$, month)		83.34 ± 28.69	83.00 ± 24.06
Disease duration ($\bar{x}\pm s$, d)		5.79 ± 1.12	5.86 ± 1.02
LDH ($\bar{x}\pm s$, U/L)		327.55 ± 109.68	327.28 ± 81.59
D-dimer ($\bar{x}\pm s$, mg/L)		682.76 ± 511.45	625.71 ± 427.69

2.2 Criteria for admission

2.2.1 Inclusion criteria. Patients met the diagnostic criteria of the 2023 edition of *Guidelines for Diagnosis and Treatment of Severe Mycoplasma Pneumoniae in Children*[2], aged 2 - 12 years.

2.2.2 Exclusion criteria. (i) Children with congenital diseases and immunodeficiency; (ii) children with pulmonary tuberculosis, hematological diseases and severe organ dysfunction.

2.3 Treatment methods The treatment group and the control group were given standard treatment according to the guidelines, specifically: azithromycin 10 mg/(kg · d), intravenous drip once a day; methylprednisolone 1 mg/(kg · time), intravenous drip once every 12 h, reduced to once a day after 3 d; and intravenous drip of ambroxol hydrochloride, 7.5 mg/time for children < 6 years old, 15 mg/time for children > 6 years old, twice a day, and cephalosporin treatment for those complicated with bacterial infec-

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tion according to drug sensitivity. The treatment group was also given Qingfei Ditan Decoction combined with targeted drug penetration therapy of traditional Chinese medicine. Qingfei Ditan Decoction composed of Ephedrae Herba prepared with honey 5 g, boiled Armeniacae Semen Amarum 8 g, dried Houttuyniae Herba 5 g, Radix Rhizoma Glycyrrhizae 5 g, gypsum 20 g, Pericarpium Trichosanthis 10 g, Radix Scutellariae 12 g, scorched hawthorn fruit 12 g, Platycodonis Radix 10 g, Cortex Mori 8 g, bulb of Thunberg Fritillary 10 g, prepared lumbricus 6 g, and Descurainiae Semen 10 g, was decocted with water, and taken twice in the morning and evening, one dose per day for children > 6 years old, and half for children < 6 years old. Targeted drug penetration therapy of traditional Chinese medicine: Rhubarb and mirabilite were ground into powder, added with water and prepared into paste, which was smeared on patches, which were adhered to bilateral Feishu points, and the therapy was operated according to the standard procedure based on the tolerable strength of children, once a day, 20 min each time. Both groups were treated for one week.

2.4 Observation indicators (i) Clinical observation: Recovery: Chest shadow completely or basically disappeared (>90%), and body temperature was normal, and clinical symptoms and signs disappeared; remarkable effect: more than 50% but less than 90% of chest shadow disappeared, and body temperature was normal, and symptoms and signs basically disappeared; effective: more than 30% but less than 50% of chest shadow disappeared, and body temperature, symptoms and signs were obviously improved; and invalid: the above standards were not met or even the disease was aggravated[2]. (ii) The recovery time of body temperature, cough-relieving time, disappearance time of lung rales and bronchoscope flushing condition were recorded in the two groups. (iii) Adverse reactions such as rash, vomiting, abdominal pain, diarrhea, palpitation and headache were observed in the two groups.

2.5 Statistical methods Statistical analysis was completed by SPSS 26.0 software. Kolmogorov – Smirnov test was conducted to test the normality of the measurement data. Measurement data conforming to normal distribution were represented by mean ± standard deviation ($\bar{x} \pm s$), and the counting data were represented by the number of cases and compared for the differences between groups by Chi-square test, chi-square test with continuity correction or Fisher exact probability method. When the two groups of measurement data conformed to the normal distribution by K – S test, and the variances were equal, independent sample t test should be adopted, with $P < 0.05$ indicating a significant difference.

3 Results and Analysis

3.1 Comparison of clinical efficacy between two groups The clinical efficacy of the treatment group was better, and the difference between the two groups was statistically significant ($P < 0.05$), as shown in Table 2.

Table 2 Comparison of clinical efficacy between two groups

Group	n	Recovery	Remarkable effect	Effective	Invalid	Total effective rate//%
Control	145	9	18	80	38	73.79
Treatment	56	7	20	26	3	94.64*

NOTE Compared with the control group, $P < 0.05$.

3.2 Comparison on remission time of symptoms and signs between the two groups There was no significant difference in defervescence time between the two groups ($P > 0.05$). The disappearance time of cough and rales in the treatment group was shorter than that in the control group, and the differences were statistically significant ($P < 0.05$), as shown in Table 3.

Table 3 Comparison of remission time of symptoms and signs between the two groups ($\bar{x} \pm s$, d)

Variable	Control group (n = 145)	Treatment group (n = 56)
Defervescence time	1.36 ± 1.05	1.32 ± 0.74
Disappearance time of cough	4.32 ± 1.68	3.47 ± 1.49*
Disappearance time of rales	4.13 ± 2.94	2.26 ± 2.22*

NOTE Compared with the control group, $P < 0.05$.

3.3 Comparison on usage rate of bronchoscope between two groups There was no significant difference in the use of bronchoscope between the two groups ($P > 0.05$), as shown in Table 4.

3.4 Comparison of adverse reactions between the two groups During the treatment, one case of diarrhea occurred in the treatment group, the incidence rate was 1.78% (1/56). In the control group, there were 3 cases of rash, 5 cases of nausea and vomiting, 2 cases of dizziness and headache, 1 case of palpitation, 8 cases of abdominal pain and diarrhea, and the incidence rate was 13.10% (19/145). The difference between the two groups was statistically significant ($P < 0.05$).

Table 4 Comparison on usage of bronchoscope between two groups

Use of bronchoscope	n	Used//cases	Unused//cases	Usage rate//%
Control	145	37	108	25.52
Treatment	56	9	47	16.07

4 Discussion

Mycoplasma pneumonia is caused by mycoplasma pneumoniae infection, with fever and cough as the main clinical manifestations, and severe cases may be accompanied by wheezing, shortness of breath, chest tightness, chest pain and other diseases with high clinical incidence. Commonly used therapeutic drugs are macrolide antibiotics, such as azithromycin and erythromycin, but they need to be used in sufficient amount for a full course of treatment, otherwise the disease condition may recur and side effects may be significant[3]. Studies have shown that in Asian countries, the resistance rate of mycoplasma pneumoniae to macrolides is significantly higher than that in Europe, the United States and other parts of the world, especially in China. A report in 2022 showed that the resistance rate of children in China to mycoplasma pneumoniae was as high as 90% – 100%, while this data was still 83% from 2005 to 2008[4]. In addition, after novel coronavirus infection, children's immune system is generally disordered, and their disease resistance is reduced. Therefore, the situation of mycoplasma

pneumoniae infection in children in 2023 was more serious than before, and the number of children with severe mycoplasma pneumonia was significantly higher than before, which brought great difficulties to our clinical treatment. Although national guidelines for diagnosis and treatment clearly put forward alternative second-line drugs, in clinical application, family members and doctors are still worried about their potential side effects, so they tend to seek Chinese medicine treatment.

The results of this study showed that the total effective rate of the treatment group with self-made Qingfei Ditan Decoction combined with targeted drug penetration therapy of traditional Chinese medicine was higher than that of the control group. Specifically, the cough-relieving time and the disappearance time of lung rales were shorter than those of the control group, and the incidence of adverse reactions was low. It shows that Qingfei Ditan Decoction combined with targeted drug penetration therapy of traditional Chinese medicine can obviously improve the clinical efficacy and reduce the side effects of western medicine. There was no significant difference in the defervescence time between the two groups, which might be related to the use of hormones. As we all know, hormones can inhibit prostaglandin synthesis and inflammatory reaction, thus playing a role in rapidly reducing fever. The usage condition of bronchoscope flushing is related to family members' wishes, family's economic strength, doctors' control of indications, doctors' recognition and enthusiasm for bronchoscope flushing, and there are many influencing factors, so it is necessary to expand the sample for research.

In traditional Chinese medicine, mycoplasma pneumonia belongs to the category of "pneumonia wheezing and cough disease", and its basic pathogenesis is lung qi stagnation, which is characterized by heat, depression and phlegm in the early stage and blood stasis in the later stage[5-6]. Therefore, in the early stage of pediatric infection, the treatment mainly focuses on clearing heat, removing pulmonary obstruction, resolving phlegm, and relieving asthma. Qingfei Ditan Decoction used in this study is based on this theory. It is a summary of years of experience in our department and specifically designed to treat severe mycoplasma pneumonia in children with a disease course of less than one week (early stage of infection). In the prescription, Ephedrae Herba prepared with honey is pungent and warm in nature, and has the effects of relieving exterior syndrome, dispersing lung qi and relieving asthma; Armeniacae Semen Amarum has the effects of depressing qi and relieving cough and asthma, and gypsum has the effects of clearing away heat and purging pathogenic fire, relieving vexation and quenching thirst, and when combined with Houttuyniae Herb, Radix Scutellariae, Pericarpium Trichosanthis, Cortex Mori, bulb of Thunberg Fritillary, prepared lumbricus and Descurainiae Semen, the effects of clearing heat, purging lung, resolving sputum and relieving asthma could be achieved; Platycodonis Radix has the effects of dispersing lung qi, relieving sore throat, eliminating phlegm and discharging pus, and introducing medicine into the lung; and scorched hawthorn fruit has the effects of strengthening the spleen, helping digestion and harmonizing the stomach, which means that it can tonify the spleen and stomach (soil) to enhance lung qi (gold), thereby improving human immunity and achieving the purpose of preventing and treating diseases, and combined with Radix Rhizoma Glycyrrhizae, various medicines are harmonized to achieve their effects.

Studies have shown that the components contained in Ephedrae Herba prepared with honey can inhibit the increase of eosinophils, neutrophils and leukocytes and regulate IL-4, IL-13 and IFN-γ, and it has good anti-inflammatory, antiasthmatic and immune-regulating effects[7]. Armeniacae Semen Amarum has the effects of relieving cough and asthma, resisting inflammation, relieving pain, resisting fibrosis and regulating immunity[8-10]. Gypsum has antipyretic and anti-inflammatory effects, and can improve the phagocytosis of macrophages and enhance the immune function of the body. The ethanol extract and water extract of Houttuyniae Herba, prepared lumbricus and Cortex Mori all have inhibitory effects on the growth of mycoplasma *in vitro*, and the compound group has the strongest antibacterial effect *in vitro*[11]. It can be seen that the curative effect of Qingfei Ditan Decoction has a clear scientific basis. The targeted drug penetration therapy of traditional Chinese medicine used rhubarb and mirabilite to clear away heat and toxic materials, promote blood circulation and dissipate stagnation, which can promote drug absorption, accelerate inflammation dissipation and improve curative effect. To sum up, Qingfei Ditan Decoction combined with targeted drug penetration therapy of traditional Chinese medicine has a significant effect in treating severe mycoplasma pneumonia in children, and can reduce the side effects of western medicine. Therefore, it is worthy of clinical promotion.

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