

Research Progress of Traditional Chinese Medicine Appropriate Techniques for Mycoplasma Pneumoniae Pneumonia in Children

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Abstract: *Mycoplasma pneumoniae pneumonia is more common in preschool and school-age children, and is mostly a benign and self-limiting disease. As the number of Mycoplasma pneumoniae infections in children continues to increase and the resistance of Mycoplasma pneumoniae to macrolide drugs increases, some children still show prolonged or recurrent symptoms after a certain course of anti-infection treatment, and even develop into severe Mycoplasma pneumoniae pneumonia, seriously affecting children's physical health and quality of life. In recent years, research has found that traditional Chinese medicine (TCM) is suitable as an auxiliary treatment method for Mycoplasma pneumoniae pneumonia in children, which has the effect of promoting symptom relief and improving prognosis. This article provides a review of the epidemiological characteristics, etiology and pathogenesis of Mycoplasma pneumoniae pneumonia in children, as well as relevant traditional Chinese medicine appropriate techniques, in order to provide scientific basis for the clinical treatment and in-depth research of pediatric MPP using traditional Chinese medicine appropriate techniques.*

Keywords: *Mycoplasma Pneumoniae Pneumonia; Pneumonia Wheeze; Appropriate Techniques for Traditional Chinese Medicine*

1. Introduction

Mycoplasma Pneumoniae Pneumonia (MPP) refers to acute pulmonary inflammation caused by infection with Mycoplasma pneumoniae (MP) [1]. The clinical manifestations are fever, cough, sputum production, some wheezing symptoms, and most of the disease is benign and self-limiting, affecting pre-school age and school-age children. At present, macrolide antibiotics are used as the first choice to control mycoplasma infection and prevent recurrence. With the increase of resistance of mycoplasma pneumoniae to macrolides and the long course of the disease, some children still show protracted disease or recurrent disease, and even develop severe mycoplasma pneumoniae pneumonia, despite sufficient amount and full course of antibiotic treatment. Seriously affect children's health and quality of life. Traditional Chinese medicine classifies MPP into the category of "pneumonia wheeze" and considers lung qi stagnation as its main pathological mechanism, and the treatment is mainly to open and close the lung and clear heat and eliminate phlegm [2]. In recent years, it has been found that as an auxiliary treatment for mycoplasma pneumoniae pneumonia in children, TCM suitable technology has the effect of promoting symptom relief and improving prognosis, and is favored by the majority of family members because of its simple operation, low price and few adverse reactions. This article reviews the epidemiological characteristics, etiology, pathogenesis and relevant TCM appropriate techniques of MPP in children, in order to provide scientific basis for the clinical treatment and in-depth study of TCM appropriate techniques in children MPP.

2. Epidemiological Characteristics of Mycoplasma Pneumoniae Pneumonia in Children

The incidence of MPP accounts for 10% to 40% of community-acquired pneumonia in children [3], with an average epidemic every 3 to 7 years and a duration of up to 2 years [4]. During the COVID-19 outbreak, strict protective measures have been implemented in schools and society, and the immune level of the population has decreased due to the lack of immune stimulation from pathogens, which has led to the current rising trend of MP infection. The epidemiological characteristics of MPP may vary

according to age, sex and geographical differences. The susceptible population is mainly early school age and school-age children, which can often cause small epidemics, which may be related to the wide range of activities of children in this age group and the dense school crowd, and the pathogen is easy to spread. The incidence of girls is higher than that of boys, which may be related to the sex difference in immune function of the body, or the fact that boys are more active than girls [5]. MPP can occur throughout the year, and there are obvious differences in the high incidence seasons in different regions. Winter is the main disease in northern regions, while summer and autumn are the main disease in southern regions. Wang Chunli et al. [6] investigated the MP infection in Ningxia and found that the MP infection rate of children in autumn and winter was higher than that in spring and summer. Wu Qian et al. [7] analyzed the epidemic characteristics of MP infection in Wuzhishan, Hainan, and found that summer and autumn were the high incidence periods of MPP, and high temperature and high rainfall were the main climatic factors promoting the epidemic of MP infection.

3. Etiology and Pathogenesis of Mycoplasma Pneumoniae Pneumonia in Children

MPP belongs to the category of "pneumonia wheeze" in traditional Chinese medicine. The name of "pneumonia wheeze" first appeared in the *Ma Ke Living Book*, and the symptoms of pneumonia wheeze were initially described by "wheezing without nose and simultaneously with nose fanning". The causes are divided into internal causes and external causes, and the external causes are related to the invasion of the six sexual evils. The internal cause is related to the physiological characteristics of children, the physical structure and physiological function of children have not yet developed, the viscera are delicate, and the function of preventing the invasion of external pathogens is poor. *Warm heat Theory* pointed out that "Warmth pathogenic factors first invade the lungs", the six pathogenic factors of external factors can easily invade the body from the mouth, nose or skin, and the lungs are the first to be affected [8]. Pulmonary qi stagnation is the main pathogenesis of MPP. The internal and external evil attacks on the lung, the abnormal discharge and descending. When the lung qi is reversed, it is a cough or wheezing syndrome. The evil obstructs the lungs, causing the lungs to lose function, resulting in inadequate lung fluid, coagulation of body fluids, and the formation of phlegm; Phlegm, triggered by external pathogens, obstructs the airways and causes abnormal lung function, resulting in wheezing. *Pediatric medicine syndrome straight formula - pulse syndrome treatment* put forward that "lung main asthmatic, actually stuffy disorder asthmatic", and pointed out that phlegm and fluid obstructing lung is the cause of pneumonia wheeze. With the continuous deepening of research, scholars have put forward different views on the etiology and pathogenesis of pneumonia and wheezing. Wang Xuefeng [9] believes that pulmonary toxic heat is the pathogenesis of pediatric pneumonia. Toxic heat is trapped in the lungs, causing the lungs to lose ventilation, the lungs to be burned, and the lung function to be severely damaged. Shu Jing et al. [10] proposed that blood stasis is an important etiology and pathogenesis throughout the course of MPP in children. Blood stasis is both a pathological product and a pathogenic factor, forming a vicious cycle that aggravates or prolongates the disease and makes it difficult to cure. Guan Zhiwei et al. [11] believe that the etiology and pathogenesis of MPP in children are not entirely consistent with those of pneumonia wheeze. MPP has characteristics similar to warm diseases, such as sudden onset and easy transmission. The symptoms of MPP are all due to the urgent trend of warm pathogenic factors, the fastest heat transformation, the generation of toxic heat, and the subsequent generation of phlegm and blood stasis. Heat, toxin, phlegm, and blood stasis are intertwined and transformed, and "warm pathogenic factors lead to the fastest heat transformation" can more accurately explain the etiology and pathogenesis of MPP.

4. Appropriate Techniques of Chinese Medicine for Mycoplasma Pneumoniae Pneumonia in Children

4.1 Oral Administration of Chinese Medicine

The 2023 edition of the *Diagnosis and Treatment Plan of Integrated Chinese and Western Medicine for Mycoplasma pneumoniae Pneumonia in Children* divides MPP into acute stage: wind-heat blocking lung syndrome, phlegm-heat blocking lung syndrome, Xinyang deficiency and failure syndrome, evil depression and Jueyin syndrome, and recovery stage: positive deficiency and evil love syndrome and spleen-lung deficiency syndrome [3]. Under the guidance of the basic theory of traditional Chinese medicine and the principle of syndrome differentiation, the MPP was treated with traditional Chinese medicine, and the unique advantages of traditional Chinese medicine were given full play. On the basis of anti-infection treatment in Western medicine, Yao Bo [12] gave the children with phlegm-heat and

lung-closing MPP children with Kaifei Xuanjiang Decoction by mouth, and the results showed that the total effective rate of TCM clinical syndrome after treatment was 96.67%, with safe efficacy and no toxic side effects. Hu Yong et al. [13] treated wind-heat and lung-closing MPP with the methods of clearing heat and supplementing qi and relieving asthma. On the basis of conventional anti-infection treatment, Ma Xing Yinqiao powder was added for continuous treatment for 7 days, and the results showed that the inflammatory indexes of interleukin-6, tumor necrosis factor- α and hypersensitive C-reactive protein were reduced. The levels of immune factors CD3⁺, CD4⁺, CD4⁺/CD8⁺ increased, indicating that the combination of Maxing Yinqiao powder and anti-infection treatment can alleviate the typical symptoms of children, inhibit the level of body inflammation, and enhance the immunity of children. The course of disease after MP infection is long, and the children often suffer from chronic cough. Gaochao [14] Self-prepared Qingfei Huatan decoction (Zhejiang Fritillaria, Sangbai, Huanglian, bitter almond, Scutellaria baicalensis, etc.) was used to treat chronic cough of phlegm-heat obstructive pulmonary type after MP infection, which has the effect of relieving cough and reducing phlegm, clearing lung heat, and improving the overall prognosis of the children. Oral administration of Chinese medicine has certain advantages over western medicine in the treatment of MPP in children. However, oral administration of Chinese medicine in the treatment of MPP in children also has certain limitations, such as poor taste of Chinese medicine leading to difficulties in drug administration in children, poor medication compliance and other problems affecting the efficacy of Chinese medicine. In the future, innovative dosage forms can be developed to make pediatric Chinese medicine preparations more convenient to take. It's easier for children and parents to accept.

4.2 TCM External Treatment

4.2.1 Moxibustion

Moxibustion is a treatment method that generates heat from burning moxa wool, which stimulates the local skin and specific acupoints of the human body to regulate physiological functions and achieve the goal of disease prevention and treatment. It has many advantages such as low cost, easy operation, and remarkable effects. Liu Kexin et al. [15] in the study, the control group was given oral administration of cough and phlegm reducing drugs and atomization inhalation for treatment of pneumonia wheeze caused by lung and spleen deficiency pneumonia in the convalescent period. The observation group explored the heat-sensitive point area along the bladder, spleen and lung channels on the basis of the control group, and selected the three most sensitive points each time for rotation, finch pecking, round-trip and mild moxibustion. The cure rate of the observation group was 90%, which was significantly higher than that of the control group 72.5%. Traditional Chinese medicine believes that antibiotics are mostly cold and cold, which can easily damage the yang qi. Cold qi can damage the spleen and stomach of children, leading to dereliction of transportation and transformation, and causing spleen and stomach symptoms such as abdominal pain, nausea, and vomiting [16]. Liu Yanling et al. [17] administered moxibustion at Shenque and Zhongwan acupoints to children, which can effectively alleviate gastrointestinal reactions such as diarrhea, nausea, and vomiting caused by intravenous infusion of azithromycin in children. Liu Yongtao et al. [18] found that sequential azithromycin therapy combined with moxibustion at Dazhui point, Tanzhong point, Pishu point, and Feishu point can promote the relief of lung rales, fever, and cough symptoms in children with MPP, and reduce serum inflammatory factors CRP, IL-6, and TNF- α Level, improve immune function, and the effect is better than using azithromycin alone, which may be related to the anti-inflammatory and bactericidal effects of moxibustion.

4.2.2 Cupping

Cupping is a treatment method that uses a jar as a tool, using heat or external force to create negative pressure inside the jar, adsorbing it onto the surface of acupoints or a specific area, causing skin congestion and stasis, achieving the therapeutic goals of unblocking meridians, promoting blood circulation and removing stasis, and treating internal organs. Li Yanwei's [19] study found that cupping at Dingchuan, Feishu, Pishu, and Ashi acupoints (areas with dense rales) and leaving the cupping for 10 to 15 minutes can effectively promote the absorption of rales in the lungs of children with pneumonia wheeze. Jiang Yuxiu [20] treated the control group of children with pneumonia wheeze with conventional Western medicine treatments such as anti-inflammatory, phlegm resolving, and asthma relieving. On the basis of conventional treatment, the treatment group of children used the technique of flash cupping to select Dazhui, Dingchuan, Feishu, Geshu, and lung base (Ashi acupoint) along the bladder meridian and Du pulse of the foot sun on the back of the child, and repeatedly aspirated and extracted them. After a slight redness of the local skin, the cupping was left at the main acupoint for 3-5 minutes before lifting. The results showed that the comprehensive effective rate of Western medicine combined with

meridian based flash cupping treatment for pediatric pneumonia and wheezing was 92%. The clinical application of cupping therapy for pneumonia wheeze often selects acupoints located on the Du pulse and bladder meridian. The Du pulse is the "sea of yang meridians", and the Foot Sun Bladder meridian is the "meeting of various yang". Applying cupping therapy on the Du pulse and bladder meridian can stimulate the body's positive qi, harmonize the qi of the camp and defense, and resist the invasion of external pathogens. But children's skin is delicate, and excessive negative pressure can easily form blisters. Insufficient negative pressure affects the effectiveness of cupping. During the cupping process, the negative pressure should be appropriate and the skin condition of the child should be closely observed.

4.2.3 Gua Sha

Gua Sha is guided by the theory of meridians and acupoints of traditional Chinese medicine. Different tools are used to stimulate meridians and acupoints by scraping to achieve the purpose of relieving sweat and dredging meridians. Li Runhua et al. [21] selected 76 children with MPP with phlegm-heat blocking lung type and divided them into two groups, 38 cases in each group. The control group received conventional treatment. On the basis of conventional treatment, the intervention group, with the spine as the center, opened 5cm to both sides, used silicone tanks to scrape from Fengchi to Pishu, and focused on scraping Fengchi, Fengmen, Pishu, Feishu and Du pulse. Scrape from the wrist to the elbow, withdraw the six organs; Form a straight line from Yin pool to elbow, scrape from elbow to wrist with silicone pot, treating symptoms of solid heat; Once every 3 days, twice as a course of treatment, the overall effective rate was 94.74%. The duration of fever, cough, wheezing and pulmonary riles was shorter than that of conventional treatment. After 3 months of follow-up, the recurrence of fever and cough in the intervention group was less than that in the control group. Research by Zhang Ningning et al. [22] has shown that Gua Sha along the bladder meridian has a good sustained antipyretic effect on children with pneumonia, reducing the levels of endogenous heat sources IL-1 β and TNF- α , thereby reducing the temperature regulation point and playing a role in lowering body temperature, it can reduce the frequency of use of antipyretic western medicine, shortening the time of complete antipyretic, and improving the rate of complete antipyretic. Considering the delicate characteristics characteristics of children's skin and their tolerance to pain, the scraping area should not be too large, and the force should be moderate. The force should not be forcefully applied, and the child's skin should be flushed or have patchy scraping spots. After scraping, avoid wind and cold.

4.2.4 Massage

Pediatric massage is a method of treating diseases and promoting health, guided by the theory of internal organs and meridians, by stimulating specific acupoints and meridians through manual stimulation, improving body function, regulating internal organs, and promoting blood circulation. Li Wen et al. [23] believe that the pathogenesis of cough after MP infection is deficiency of the lungs and spleen, as well as deficiency and evil love. They used the pediatric massage method of regulating the lungs and spleen, which mainly restores the healthy circulation of the spleen and promotes the function of the lungs, to treat chronic cough after MP infection in children with phlegm dampness accumulation in the lungs. The results showed that after treatment, the cough score and total score of traditional Chinese medicine syndromes in children with MP infection were significantly lower than those treated with Western medicine alone, with a total effective rate of 94.29% in clinical efficacy. Wan Xin [24] implemented sequential therapy with azithromycin combined with pediatric massage on 43 children with MPP. The massage regimen was as follows: clearing the Tianhe River, clearing the lung meridian, promoting the internal Eight Trigrams, removing the Six Organs, kneading the Tiantu, kneading the Ru Gen acupoint, kneading the Ru Bian acupoint, kneading the Fei Shu, pushing the Shan Zhong acupoint, and pushing the Fei Shu acupoint 50 times each; If accompanied by symptoms of wind cold, press the Fengchi acupoint and push the three levels 50 times each; If the patient is accompanied by wind and heat symptoms, 50 times each of clearing the large intestine meridian, clearing the heart meridian, opening the Tianmen, and pushing Yongquan should be added. Treatment should be given once a day for 5 days as a course of treatment. The results show that this method can reduce the levels of CRP and IL-6 in the patient, shorten the time for disappearance of rales, cough improvement, and hospitalization. Azithromycin treatment and pediatric massage can have a synergistic effect. Fu Ouli [25] used the Shanghai style pediatric massage techniques: kneading the Sun, opening the Heavenly Gate, kneading the Welcoming Fragrance, and pushing the Kan Palace 50 times each. He also used the Eight Trigrams, Clearing the Lung Meridian, and kneading the Small Horizontal Patterns 150 times each. He also used 200 times each to clear the Heavenly River and expel the Six Organs (when the body temperature is high). He also used 50 times each to open the Xuanji and divide the pushing of the Tanzhong,

massaging the abdomen for 3 minutes, and kneading the Fenglong 100 times; Take a prone position again, pinch the spine 5 times, focus on stimulating the lung, stomach, and kidney, and hold the shoulder well 5 times. The results showed that the combination of azithromycin and Haipai pediatric massage had better and faster effects in relieving cough, resolving phlegm, and improving lung signs. From this, it can be seen that massage assisted treatment for MPP can improve the symptoms of children, but the frequency, duration, acupoint selection, and techniques of massage vary. Existing research lacks observation of changes in the condition during the massage process.

4.2.5 Acupoint Application

Acupoint application is to grind Chinese medicine into powder, with honey, water, oil and other paste, applied to the human skin and specific acupoints, the drug acts on the whole body or directly absorbed by the skin, regulate physiological functions, to achieve the purpose of disease prevention and treatment. For respiratory diseases, it can regulate immune cells, immune proteins and immune factors in the immune system and improve the immune function of patients [26]. Sun Yingxue et al. [27] observed acupoint application of TCM syndrome differentiation to assist the treatment of MPP, and found that it could promote the improvement of cough and fever symptoms in children, reduce the absorption of lung rura and the absorption time of X-ray lung lesions, and reduce the level of serum inflammatory factors, with a total effective rate of 97.78%. Tan Chunfeng et al. [28] also found that acupoint application therapy for MPP can not only improve clinical symptoms in children, but also effectively reduce serum levels of inflammatory factors (TNF- α , CRP, IL-6, IL-8, IL-10), elevation of immune cells (CD3⁺, CD4⁺, CD4⁺/CD8⁺) and immunoglobulin levels (IgA, IgG). Yu Lingya et al. [16] applied homemade Penang Muxiang ointment (such as *Alpinia officinalis*, Betel nut, Agarwood, Muxiang, etc.) to the Zhongwan and Shenque acupoints of patients 1 hour before administering azithromycin, which can effectively improve the gastrointestinal reactions caused by drugs. Acupoint application therapy is painless, less irritating, and easy for children to accept; In addition, the thin chest wall of children allows for faster absorption of drug properties through the skin, effectively avoiding the first pass elimination effect of the liver and fully exerting the therapeutic effect of drugs.

4.2.6 Ear Point Pressure Bean

Traditional Chinese medicine believes that the ear is closely related to the viscera and meridians. Ear acupoint pressing beans is a method of preventing and treating diseases by applying pill like substances such as Wangbuliuxing seeds to the acupoints or reaction points on the auricle, stimulating the acupoints to unblock meridians and adjust organ functions. Wang Lixia [29] divided 100 children with MPP into a control group and an observation group, with 50 cases in each group. The control group received routine Western medicine treatment, while the observation group added ear acupoint pressing beans on the basis of routine treatment. A total of 7 acupoints on one ear, including the trachea, lung, spleen, sympathetic, kidney, Shenmen, and subcortical, were taken and pressed tightly against Wangbuliuxing seeds, 3-5 times a day for 1-2 minutes each time; Change the ear patch pressure every 3 days, with a 5-day interval for the second course of treatment. The results showed that ear acupoint pressure assisted therapy has good therapeutic effects on children with MPP, such as fever relief, cough, and lung rales.

4.2.7 TCM Enema

The theory of treating pediatric pulmonary diseases from the perspective of the large intestine is based on the theory that the lungs and large intestine are interrelated. As early as the Han Dynasty, there were records of traditional Chinese medicine enemas. Chinese medicine decoctions were infused from the anus into the rectum or colon, absorbed by the intestinal mucosa, and then transported to the lungs through the meridians. Through the promoting effect of the lungs, they were distributed throughout the body to achieve the goal of treating diseases. Wang Yalei et al. [30] used Western medicine for symptomatic treatment combined with Huagai powder decoction enema to treat children with wind cold closed lung pneumonia and wheezing, with a treatment effectiveness rate of 95.56%. A meta-analysis involving 14 studies showed [31] that traditional Chinese medicine enema treatment for pediatric pneumonia has good clinical effects in reducing fever, relieving cough, relieving asthma, and promoting lung disease absorption. Traditional Chinese medicine enema highlights the advantages of traditional Chinese medicine through syndrome differentiation and treatment. Compared with oral medication, it can not only avoid the influence of digestive enzymes on drugs, but also reduce the liver and kidney burden caused by drug metabolism, making it more suitable for children with medication difficulties.

4.2.8 TCM Appropriate Technology Combination

The combination of TCM appropriate technologies refers to the combined use of two or more technologies, which can play a synergistic role in the treatment of diseases. Zhai Xiaohui et al.^[32] applied moxibustion combined with acupoint application on the basis of conventional azithromycin intravenous infusion to 60 children with wind-cold MPP. Moxibustion was performed for 10 to 15 minutes before acupoint application, and the heat generated by moxibustion was used to promote drug absorption. The results showed that the clinical effective rate of combined treatment was higher than that of conventional treatment, and the time for cough relief and disappearance was significantly shortened. Fu Yan^[33] randomly divided 60 cases of children into control group and observation group, both groups received conventional Western medicine treatment, the control group was given meridian massage therapy, and the observation group was given meridian massage combined with Ma Xing Yinqiao powder add or subtract. The results showed that after treatment, the scores of fever, cough, sputum, asthma and pulmonary moist rale in the observation group were significantly lower than those in the control group.

5. Summary and Prospect

Wu Shiji, a doctor in the Qing Dynasty, put forward in *The theory of external treatment* that "the principle of external treatment is the principle of internal treatment; The medicine of external treatment is the medicine of internal treatment, and the difference lies in the method of treatment ", which explains that the administration methods and ways of external treatment and internal treatment of traditional Chinese medicine are different, but they follow the same theory of traditional Chinese medicine and the theory of drug properties. The treatment of MPP with appropriate techniques of Chinese medicine can significantly shorten the recovery time of childhood diseases, reduce the gastrointestinal reaction caused by the use of macrolide antibiotics, and avoid the increase of pathogen resistance caused by excessive use of antibiotics. Compared with Western medicine treatment, it has advantages of safety, economy, convenience and so on, and deserves to be widely promoted.

Although the appropriate technology of TCM has made great development in this field, there are still some shortcomings: (1) The quality of existing literature is not high, the sample size of clinical studies is small, the outcome indicators are mostly clinical effect observation, and there is a lack of objective laboratory indicators. In the next step, large sample size and multi-center research should be conducted to increase the observation of objective indicators to improve the credibility of research results. (2) At present, the appropriate techniques of TCM applied to children's MPP lack standardized operation procedures, the intervention time and frequency of the same type of studies are different, and there is a lack of observation of changes in the condition of children in the operation process. It is suggested to form corresponding operating standards for various appropriate techniques of TCM, standardize the operation procedures, and strengthen the training of professionals in operation techniques in medical institutions and TCM colleges. (3) In clinical studies, the treatment of MPP is mostly combined with the use of pairwise techniques on the basis of antibiotic therapy, and some study designs lack rigor, so the difference between the effect of combined application and single application is vague and biased greatly. It is suggested that the application effect of different types of TCM appropriate techniques on MPP can be verified through high-level evidence such as randomized controlled trials in the future. (4) There is a lack of mechanism studies, most of which are only effect observation and lack of in-depth study of MPP action mechanism by appropriate techniques of traditional Chinese medicine. Basic studies can be carried out to clarify the targets and ways of relevant intervention, so as to make the mechanism of action more clear. (5) Traditional Chinese medicine pays attention to syndrome differentiation in MPP treatment, while most of the appropriate techniques of TCM in clinical practice are performed by nurses, and the ability of TCM syndrome differentiation of nursing staff is relatively weak. It is necessary to strengthen the training of TCM theory and syndrome differentiation ability of nursing staff, promote the rapid development of TCM appropriate techniques, and improve the application effect of TCM appropriate techniques in pediatric diseases.

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