ORIGINAL RESEARCH

Effect of WeChat-Based Medication Guidance on Symptoms and Serological Parameters in Children with Mycoplasma Pneumoniae

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ABSTRACT

Objective • The aim of this study was to assess the effect of microsoft-based medication guidance on the level of symptoms and serological indicators in children receiving budesonide nebulisation combined with terbutaline for the treatment of Mycoplasma pneumoniae pneumoniae (MPP). Methods • A total of 109 children with MPP treated in The First Affiliated Hospital of Ningbo University of China between October 2022 and April 2023 were divided into the conventional group (n=54, with medication)guidance by telephone follow-up) and the WeChat group (n=55, with medication guidance based on the WeChat platform) using a randomized number table. The time to resolution of symptoms, serological index levels, incidence of adverse drug events, medication adherence scores and satisfaction rate of family guidance were compared between the two groups.

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INTRODUCTION

Mycoplasma pneumoniae pneumonia (MPP) is a common form of community-acquired pneumonia in children,¹ accounting for approximately 14%-20% of community-acquired pneumonia, with a high incidence at 5-9 years of age.^{2,3} Pediatric MPP is an acute inflammatory disease of the lungs, characterized by intractable and severe cough caused by Mycoplasma pneumoniae (MP) infection. MP enters the body and directly damages the respiratory epithelium, increasing respiratory reactivity, promoting the accumulation of various inflammatory cells such as lymphocytes and releasing cytokines and inflammatory

Results • The disappearance time of symptoms such as wheezing and cough in the WeChat group was shorter than that in the conventional group (P < .05). After treatment, the C-reactive protein (CRP), interleukin-6 (IL-6) and calcitoninogen (PCT) levels and the incidence of adverse drug events were lower in the WeChat group than in the conventional group (P < .05). After treatment, the levels of forceful spirometry (FVC), 1st-second expiratory volume (FEV₁), peak expiratory flow rate (PEF), medication compliance score and family guidance satisfaction rate were higher in the WeChat group than in the conventional group (P < .05).

Conclusion • WeChat-based medication guidance can optimize the therapeutic effect of MPP, improve children's medication compliance and satisfaction rate of family guidance, and reduce the occurrence of adverse drug events. (*Altern Ther Health Med.* 2024;30(12):100-105).

response mediators, thus causing an inflammatory response in the respiratory tract.⁴ MPP also causes small airway lesions, which can lead to wheezing and irritating cough, and is associated with the development of asthma, affecting the health of the child.⁵ In the context of the increasing incidence of MPP in children and the decreasing age of onset, it is important to improve the effectiveness of treatment. Terbutaline and budesonide are commonly used in the clinical treatment of paediatric MPP. Terbutaline relaxes airway smooth muscle and enhances corticosteroid receptor excitability and endothelial cilia motility. Budesonide is a glucocorticoid with highly effective local anti-inflammatory effects. Nebulised inhalation allows rapid dispersion of the drug throughout the lungs, reduces the release of allergic transmitters such as histamine, inhibits the biology of various inflammatory cells and provides a significant antiinflammatory effect.⁶ Children treated with budesonide and terbutaline are mostly outpatients and require home medication after diagnosis in the hospital, and home medication is directly related to the outcome of treatment.

Related studies have shown that the rate of hospital visits for adverse drug events in children is as high as 4.3%, and

20.3% to 66.7% of these are preventable.7 Shi SJ⁸ et al. found that 85% of children in China had home medication safety concerns, of which about 70% were preventable. It can be seen that when transitioning from hospital care to home medication, it is important to provide medication guidance to children on home medication to ensure that medication is used in accordance with the doctor's instructions and to reduce the incidence of adverse drug events, which can eliminate and reduce the potential risk of inappropriate use of medication, and can help to ensure that children take medication in accordance with the doctor's instructions at home. Follow-up is a key link between in-hospital and out-of-hospital drug therapy. Paediatric diseases are mostly respiratory, gastrointestinal and other internal diseases, and children often need to be treated at home after being discharged from the hospital. Due to the lack of medical advice and nurse supervision, safety issues are significantly more common in children at home than in the hospital, even in cases of death.9 Studies have shown that effective follow-up interventions can help children's guardians identify medication safety problems and help family caregivers make timely medication adjustments.¹⁰ In recent years, with the rapid development of the Internet, Internet of Things, cloud computing, big data and other new-generation information technologies, "Internet+medicine" has become an important part of the medical and preventive healthcare sector. "Internet+Medicine" mainly refers to the application of Internet technology in the field of disease treatment and prevention to improve the efficiency and quality of disease prevention and treatment.¹¹ A number of Internet-based medication guidance and monitoring practices have been developed: Cushing A et al.¹² designed a new mobile health management system for a specialist paediatric condition to monitor the child's medication directly and remotely; Hollenbach JP et al¹³ used the SensoryTreat mobile app to monitor the safe administration of medication by the child's guardian and received timely medication feedback while improving the child's medication adherence. The Sensory Treat mobile application was used to monitor the safe use of medication by the child's guardians, improving the child's medication adherence while receiving timely medication feedback. Xuzhou Children's Hospital, Jiangsu Province, China, used a mobile "microsugar" platform to monitor blood glucose, education, diet, exercise and medication in children followed by their endocrinology department, resulting in a significant reduction in adverse events.¹⁴ Yang Y et al.¹⁵ used the Internet to further extend the management of medication safety for children with asthma outside the hospital and to compensate for the lack of health education in the hospital, providing advice and personalised guidance on asthma disease knowledge, medication use and family management.

There has been no interventional research on the application of the "Internet+Healthcare" model to improve the safety of children's medication use at home, and there is a clear gap in research in this direction. The First Affiliated Hospital of Ningbo University has developed an innovative WeChat app that can provide medication guidance to



children. which has been used on a small scale with significant results, but the effect on children with MPP is unknown. Based on this, this study prospectively conducted a WeChatbased medication guidance for children with MPP treated with budesonide nebulisation in combination with terbutaline, focusing on the effects on the children's symptoms and serological index levels (CRP, IL-6, PCT), with the aim of providing valuable and informative opinions on the safety of medication use at home for children with MPP and even for children with other diseases.

METHODS

Experimental design

The 109 children with MPP who were treated in The First Affiliated Hospital of Ningbo University of China from October 2022 to April 2023 were enrolled in the study. They were divided into a conventional group (n=54, with telephone follow-up for medication guidance) and a WeChat group (n=55, with WeChat-based medication guidance) using a random number table, as shown in Figure 1. All guardians of the children signed an informed consent form.

Inclusion and exclusion criteria

Patients to be included in the study were required to meet the following criteria: confirmed diagnosis of paediatric MPP,¹⁶ age between 2 and 14 years, and no use of glucocorticoids within 2 weeks prior to the start of the study.

The following patients were excluded from the study: combined cardiac, pulmonary, hepatic and renal insufficiency, combined with other viral or bacterial infections, refractory or severe MMP.

Guidance methods

All children were treated with budesonide nebulisation in combination with terbutaline.

The children in the regular group received regular follow-up medication guidance during the home medication period, i.e., the physician made a fortnightly follow-up telephone call to enquire about the child's medication, affirm the child's medication compliance, point out and correct inappropriate medication behaviour, inform the child's family of the importance of helping the child to take medication as prescribed, and advise the child's family to come to the hospital promptly if the child became unwell during the medication period.

Children in the WeChat group receive guidance on the use of medication based on the WeChat platform during home medication use. During the child's outpatient visit, the doctor introduces the child's family to the hospital's "Safe Medication for Children" WeChat app and guides them to use it. Firstly, the family is instructed to fill in the basic information and medication knowledge questionnaire in the "Basic Information" module so that the healthcare professionals can better understand the basic situation of the child. Secondly, the family members were instructed to enter the "Medication Reminder" module of the app, fill in the medication plan, add information on the medication and then turn on the reminder, scan the medication instruction sheet to view the medication instruction information, and teach the family members to familiarise themselves with the medication consultation pathway. Finally, families are encouraged to check the health information in the "Health Headlines" and "Videos" modules of the app, to learn about and actively participate in the activities in the "Activities" module, and to clock in daily in the "Monitoring" module. They are also encouraged to clock in the "Monitoring" module to record their child's medication, exercise and monitoring status. The doctor educates the child's family on the importance of safe medication use at home, advises them to follow the doctor's instructions to assist the child in taking medication, turns on the medication reminder function and follows the medication schedule on the WeChat app. If you have any questions about your child's medication, ask your doctor for advice through the "Medication Consultation" function. The doctor will see the child in the event of any abnormalities during the medication period. The doctor keeps in touch with the child's family through WeChat and informs the doctor when the child's symptoms have disappeared or when there are any adverse drug events.

Children in both groups were treated with medication for 7d.

Primary outcomes measures

Time to the disappearance of clinical symptoms: The time to the disappearance of clinical symptoms and signs, including wheezing, cough, fever and dry and wet rales in the lungs, was recorded for both groups of children.

Inflammatory factor levels: C-reactive protein (CRP), interleukin-6 (IL-6) and calcitoninogen (PCT) levels were measured before and after treatment using an enzyme-linked immunosorbent assay. Reagents were purchased from Hangzhou Haoxin Biotechnology Co of China,

Pulmonary function parameters: The child's pulmonary function parameters were measured before and after treatment using a Japanese CHEST AC-8800 spirometer, including forceful spirometry (FVC), first-second forceful expiratory volume (FEV₁), and peak expiratory flow rate (PEF).

Incidence of adverse drug events: The incidence of adverse drug events during medication administration was recorded for both groups of children, and the incidence was calculated.

Secondary outcome measures

Medication Adherence: The Morisky Medication Adherence Scale (MMAS) was used to assess the child's medication adherence after treatment and was completed by the child's family instead of the child based on the child's actual medication use. The scale is scored on a scale of 0 to 4. 0 is high adherence, where the patient follows medical advice and does not skip medication. 1-2 is moderate adherence, where the patient skips medication occasionally, perhaps because he or she forgets, feels better or is busy with other things. 3-4 is low adherence, where the patient skips medication frequently, perhaps because he or she forgets, feels better or is busy with other things. Patients skip medication frequently, perhaps because they forget, feel better, are busy with other things, or feel unwell. The lower the score, the higher the medication adherence.

Satisfaction with medication guidance: After treatment, the satisfaction of the child's family with the medication was assessed using our self-developed medication satisfaction scale, which was scored 0-100, with \leq 60 being dissatisfied, 61-80 being satisfied and >80 being very satisfied. Satisfaction rate = (number of very satisfied + number of satisfied)/ total*100%.

Statistical processing

The analysis software was SPSS 21.0, and the plotting software was GraphPad Prism 9.0. Count data were expressed as [n(%)] and compared using the chi-square test; measurement data were expressed as $(x \pm s)$ and compared using *t* test, ANOVA and LSD test. Differences were indicated as statistically significant at P < .05.

RESULTS

Demographics and Baseline Information

There were no differences in demographic and baseline information between the two groups (P > .05, Table 1).

Primary outcomes

Time to resolution of clinical symptoms. The disappearance of wheezing, cough, fever, and dry and wet rales in the lungs was shorter in the microsomal group than in the control group (P < .05, Figure 2).

Inflammatory factor levels

Before treatment, there was no difference in the levels of CRP, IL-6 and PCT between the two groups (P > .05). After treatment, the levels of the above indicators decreased in both groups, and were even lower in the microsomal group than in the conventional group (P < .05, Figure 3).

Table 1. Demographics and	baseline information
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	WeChat Group(n=55)	Conventional Group (n=54)	χ^2 or t	P value
Age(years)	9.14±1.24	9.23±1.21	0.383	.702
Female/Male(n)	25/30	26/28	0.079	.778

Figure 2. Comparison of the time for clinical symptoms to disappear in the two groups. A) Comparison of time for breathlessness to disappear. B) Comparison of time for cough to disappear. C) Comparison of time for fever to disappear. D) Comparison of time for dry and wet rales in the lungs to disappear.



Figure 3. Comparison of inflammatory factor levels between the two groups. A) Comparison of CRP. B) Comparison of IL-6. C) Comparison of PCT.



 ${}^{\mathrm{b}}P < .05$ compared with conventional group

Figure 4. Comparison of pulmonary function indicators between the two groups. A) FVC comparison. B) FEV_1 comparison. C) PEF comparison.



 ${}^{\mathrm{b}}P < .05$ compared with conventional group

Table 2. Occurrence of adverse drug events [n (%)]

	WeChat Group (n=55)	Conventional Group (n=54)	χ^2	P value
Deficiencies in pharmaceutical standards	0(0.00)	0(0.00)	-	-
Drug quality issues	0(0.00)	0(0.00)	-	-
Adverse drug reactions	0(0.00)	0(0.00)	-	-
Drug errors	1(1.82)	4 (7.41)	-	-
Drug abuse	0(0.00)	2(3.70)	-	-
Total	1(1.82)	6 (11.11)	3.916	.048

Lung function indicators

Before treatment, there was no difference in FVC, FEV₁ and PEF between the two groups (P > .05). After treatment, the levels of the above indices increased in both groups, with the microsomal group being higher than the conventional group (P < .05, Figure 4).

Incidence of adverse drug events

The incidence of adverse drug events was lower in the microsoft group than in the conventional group (P < .05, Table 2).





*P < .05 compared with conventional group.

Table 3. Guidance satisfaction rate

	WeChat Group(n=55)	Conventional Group (n=54)	χ^2	P alue
Very satisfied	30 (54.55)	23 (42.59)	-	-
Satisfied	22 (40.00)	18 (33.33)	-	-
Dissatisfied	3 (5.45)	13 (24.07)	-	-
Very satisfied+satisfied	52 (94.55)	41 (75.93)	7.543	.006

Secondary outcomes

Medication adherence scores were lower in the Microsoft group than in the conventional group (P < .05, Figure 5).

Guidance satisfaction rate

Satisfaction with guidance was higher in the Microsoft group than in the conventional group (P < .05, Table 3).

DISCUSSION

This study investigated the role of WeChat-based medication guidance in children with MPP treated with budesonide nebulisation in combination with terbutaline. The results showed that the WeChat-based medication guidance played an important role in the treatment of children with MPP with budesonide nebulised in combination with terbutaline, including optimising treatment effects, reducing adverse drug events and improving medication adherence. On the one hand, the use of medication in children with MPP has certain specificities. The administration of budesonide by nebulised inhalation is different from that of traditional oral medication and is administered through a nebuliser. Therefore, children and their families need to know how to use the nebuliser and to ensure that the medication is administered smoothly. Therefore, it is important to reduce the contact between the medication and the skin during use to avoid skin absorption. Long-term use of budesonide can lead to rupture of the nasal mucosa and nasal bleeding. It may also cause erosion of the nasal septum or perforation of the nasal septum, so it is important to follow medical advice and avoid singing between medications to obtain better results. In addition, if the child has an acute infection in the oropharynx with significant pain, pus or bleeding, budesonide based preparations should

not be used for nebulised treatment as this may lead to the spread of infection. These are all precautions to be taken when nebulising budesonide in children with MPP, which are unique to other oral medications and require special attention when administered at home. On the other hand, children with MPP are young and have poor cognitive ability, so they cannot fully understand the effects of budesonide, terbutaline and other drugs and how to use them. The family's knowledge of the disease and medication is directly related to the child's medication status. Suppose the child's family has a low level of knowledge of the disease and the importance of following medical advice. In that case, effective medication assistance may not be implemented, which may affect the child's medication compliance and thus reduce the overall treatment outcome.¹⁷

Conventional medication guidance is carried out through telephone follow-up visits, which have a long lead time and a single method of guidance (only correcting wrong medication behaviour). The rapid development of mobile internet applications, with a new generation of smartphones as terminals and the WeChat platform as a representative, provides a new opportunity for medical services.¹⁸ Families of children with MPP can set up medication reminders on the platform under the guidance of their doctors to avoid wrong or missing medication; they can enter medication instructions and check the child's medication precautions online at any time; they can record the child's medication and exercise, etc. to keep track of the overall medication status and the overall medication intake. When there is a medication problem, you can consult the doctor online to get the correct information on medication and correct inappropriate medication behaviour. By making full use of the WeChat platform's medication guidance function, families of children with MPP can, to a large extent, encourage children with MPP to comply with medical advice and ensure the accuracy of medication dosage, duration and course of treatment so as to reap the best treatment results. This effect is reflected in the disappearance of symptoms and the transformation of serology in the children. The results of this study showed that the disappearance time of all the symptoms of the children in the WeChat group was shorter than that of the children in the conventional group, and the serum inflammatory factor indexes and lung function indexes of the former group were better than those of the latter group, confirming that WeChatbased medication guidance may be helpful in promoting the correct use of medication for children, giving full play to the optimal effect of medication, facilitating the rapid alleviation of symptoms, reducing inflammatory response, improving the ventilation and oxygenation capacity of the respiratory tract, and improving the lung function, which significantly improved clinical outcomes. The clinical efficacy was significantly improved, all of which reflect that the WeChat platform-based medication guidance may bring good benefits to children with MPP. The results also showed that the incidence of adverse drug events in the WeChat group was lower than that in the conventional group, suggesting that

WeChat-based medication guidance may be able to improve the safety of medication for children with MPP, which is of great significance for children who are still in the stage of growth and development.

This study shows that the satisfaction rate of families of children with MPP with the WeChat-based medication guidance is higher than that of conventional medication guidance, considering the following reasons: WeChat-based medication guidance can effectively reduce the burden of family care for their children with MPP. The WeChat platform-based medication guidance can provide comprehensive and personalized information and guidance on medication guidance and health education through the WeChat platform so that children's families can receive timely answers to their questions and consolidate their knowledge of MPP. The family's knowledge of the MPP has enabled them to meet the needs of the child's family in a timely and effective manner. At the same time, the children's family members teach the children the concepts of correct medication and following the doctor's instructions, which is conducive to the formation of a good concept of medication, and strengthens their medication compliance, which improves the children's quality of life in the process of treatment as a whole. Medication adherence is a concept that will not only benefit the child from MPP treatment but will also be useful for other health education and treatment in the future in order to reduce resistance to treatment and optimise treatment outcomes.

Limitations

Firstly, the small number of study participants included in this study may lead to statistical calculation chance and reduce the credibility of the findings to some extent. Secondly, children with MPP were treated with budesonide and terbutaline for a relatively short period of time, and the short period of time for medication guidance to take effect could affect the reliability of the conclusions. Thirdly, the study did not assess changes in the psychological aspects of the children and their families to understand the changes in their psychological state before and after medication guidance. All of these limitations will be addressed in future in-depth studies. Future research directions should focus on conducting larger studies to confirm the effectiveness of WeChat-based medication guidance in children with MMP.

CONCLUSION

WeChat-based medication guidance can promote rapid relief of clinical symptoms in children with MPP, reduce the inflammatory response and optimize lung function, improve the child's medication compliance and the satisfaction rate of the child's family with the guidance, and reduce the occurrence of adverse drug events, which is safe and effective and has some value for clinical application. At the same time, the findings from this study can inform medical interventions or policies to improve medication adherence and patient outcomes in the paediatric population.

CONFLICTS OF INTEREST

The authors report no conflict of interest

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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