Analysis of Inflammatory Factors and Therapeutic Effect of Azithromycin Combined with Budesonide in *Mycoplasma* Pneumonia

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We attempt to investigate and study the effect of azithromycin combined with budesonide treatment regimen on inflammatory factors and therapeutic effect in patients with *Mycoplasma* pneumonia. 100 patients with *Mycoplasma* pneumonia were selected in a hospital from January 2020 to December 2022 as the investigation subjects and divided them into two parts according to their admission time, control group consists of 50 patients whose treatment regimen was azithromycin orally combined with acetyl cysteine nebulization, and observation group consists of 50 patients whose treatment regimen was azithromycin orally combined with budesonide and acetyl cysteine nebulization. Detected the serum inflammatory factors and their related index values, the clinical efficacy and the occurrence of adverse reactions during the treatment period of the children with *Mycoplasma* pneumonia. The results showed that the serum inflammatory factor levels of the children in the observation group improved compared with those in the control group ($p<0.05$). Observation group possessed higher total clinical efficacy than control group ($p<0.05$). Observation group possessed lower incidence of adverse reactions than control group ($p<0.05$). The treatment regimen of azithromycin and budesonide combined with acetyl cysteine in patients with *Mycoplasma* pneumonia can achieve good clinical efficacy and good improvement in serum inflammatory factors, and there is no significant increase in adverse effects and high safety, which makes this treatment regimen suitable for promotion in patients with *Mycoplasma* pneumonia.

Key words: Azithromycin, budesonide, *Mycoplasma* pneumonia, inflammatory factors, efficacy

Pneumonia is a common disease in pediatrics and is one of the types of respiratory disease, of which *Mycoplasma* pneumonia is a common type. According to clinical statistics, *Mycoplasma* pneumonia is the type of infection that accounts for more than 10 % of the causative factors of pneumonia and has a high incidence and impact on the health of the child, so it needs to be given priority attention[1]. *Mycoplasma* is a microorganism that can survive independently of viruses and bacteria. *Mycoplasma* can be transmitted through the respiratory tract and once transmitted through the respiratory tract, it can spread rapidly and cause patients to sneeze, cough and other respiratory-related clinical symptoms, *Mycoplasma* pneumonia is the type of disease caused by *Mycoplasma*[2,3]. *Mycoplasma* pneumonia can occur in patients of any age, and the risk of *Mycoplasma* pneumonia is higher in children than in people of other ages because the respiratory system, especially the lungs, is not fully developed, according to clinical statistics, *Mycoplasma* pneumonia is detected in children at a rate of 15 % and above, and the detection rate is further increased in areas with poor air quality[4,5]. Currently, drug therapy is the main treatment for children with *Mycoplasma* pneumonia and has shown good therapeutic effects, but there were few clinical analysis on the inflammatory factors and efficacy of azithromycin combined with budesonide in children with *Mycoplasma* pneumonia, this study combines this current situation with research and analysis. We selected 100 patients with *Mycoplasma* pneumonia in a hospital from January 2020 to December 2022 as the investigation subjects and divided them into 2

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parts according to their admission time, control group consists of 50 patients whose treatment regimen was azithromycin orally combined with acetyl cysteine nebulization and observation group consists of 50 patients whose treatment regimen was azithromycin orally combined with budesonide and acetyl cysteine nebulization. The average age of the children in the control group was (6.13±2.19) y, 24 boys and 26 girls and the average age of the children in the observation group was (6.06±2.28) y, 26 boys and 24 girls, and the families of the subjects were aware of the contents of the study and chose the appropriate treatment plan in the light of the actual condition of the children. All children met the diagnostic criteria for *Mycoplasma* pneumonia and were diagnosed with the relevant disease type after laboratory tests[6]. No children were found to have immunodeficiency diseases or congenital heart disease during the study and children with systemic infections requiring isolation during or before treatment were not included in the study. The clinician gives oral azithromycin at a dose of 10 mg/kg, four times daily and acetyl cysteine nebulization at a dose of half a dose for children younger than 3 y and one dose for children older than 3 y, twice daily. The medical staff adjusts the dose according to the child's condition, observes the child's adverse reactions in the process of treatment, stops the medication if the adverse reaction is serious and gives the corresponding nursing intervention plan for the adverse reaction[7]. After receiving the same treatment as control group, the clinician added budesonide. The children were given budesonide nebulized inhalation treatment, which was carried out according to the clinical procedure, with appropriate immobilization during the nebulized inhalation and appropriate encouragement to improve compliance with the nebulized inhalation[8]. In addition, the nurse takes care to set the oxygen flow rate for the nebulized inhalation treatment at 6 to 8 l/min, with each nebulized inhalation treatment lasting between 10-15 min, twice a day for 14 d. The nurses administered the usual treatments, including electrolyte homeostasis, to both groups of children with *Mycoplasma* infections according to the treatment protocol and the clinician's orders. The serum inflammatory indexes of children with *Mycoplasma* infection were tested and evaluated by the health care staff. 5 ml of fasting venous blood was collected from the children in the early morning and then centrifuged routinely; the supernatant was taken for testing of serum inflammatory factors and related index levels, including White Blood Cell (WBC) count, Neutrophil Ratio (NEUT-R), Neutrophil Count (NEUT), C-Reactive Protein (CRP) and Serum Amyloid A (SAA). The levels of these markers were counted and compared, and changes in inflammatory factor levels were compared between treatment regimens[9]. Physicians use the relevant criteria in the clinical pneumonia diagnosis and efficacy evaluation standards and *Mycoplasma* pneumonia diagnosis, and treatment guidelines to evaluate the effectiveness of treatment and clinical efficacy is classified as cured, improved, or ineffective according to the effect, cured means the clinical symptoms of children with *Mycoplasma* pneumonia, including fever, cough and wheezing, basically disappeared and there were no abnormalities in the imaging X-ray examination and chest percussion; improved means the clinical symptoms of children with *Mycoplasma* pneumonia improved significantly and the imaging and chest percussion results showed that the lesions were reduced by 50 % or more; ineffective means the children with *Mycoplasma* pneumonia whose clinical symptoms did not improve or even worsened after treatment and whose imaging and chest percussion results did not improve. The number of cured and effective children was used to calculate the total clinical efficacy value[10]. Medical and nursing staff conducted diagnosis and statistics of adverse reactions during treatment of children with *Mycoplasma* pneumonia, the main types of adverse reactions in this study and in children with *Mycoplasma* pneumonia during treatment were allergic rash, gastrointestinal symptoms, dizziness and headache, and the incidence of adverse reactions was calculated based on the number of cases of these reactions[11]. The data of this study were analyzed using statistical software and $p<0.05$ was considered as a difference. The results showed that the values of serum inflammatory factor-related indexes of observation group improved compared with control group ($p<0.05$) as shown in Table 1. The results showed that observation group possessed higher total effective rate values than the control group ($p<0.05$) as shown in Table 2. The results showed that observation group possessed lower

incidence of adverse reactions than control group ($p<0.05$) as shown in Table 3. *Mycoplasma* infection has been identified as an important factor in the development of pneumonia in children, *Mycoplasma* pneumonia can cause damage to the lung tissue on the one hand, and without active medication and intervention can even cause a systemic inflammatory response, which can have a significant impact on extra-pulmonary target organs and damage the child's health status. *Mycoplasma* pneumonia can lead to a number of complications in children, which can make treatment more difficult, so it is important to treat children with *Mycoplasma* pneumonia aggressively to prevent further exacerbation of the disease. Research has confirmed that Mycoplasma pneumonia has a certain degree of self-healing, that is, the patient will have a certain chance to heal on their own after the onset of the disease, but children's body organs are still in the developmental stage, especially the immune system is not fully developed, resulting in more serious clinical symptoms after the onset of the disease, and even without active intervention can lead to the further spread of pathogenic bacteria, leading to myocarditis, meningitis and other serious complications, further aggravating the child's condition. The results showed that the serum inflammatory factor-related index levels of the children in the observation group improved compared with those in the control group. Budesonide, as a highly effective glucocorticoid, can effectively reduce the activity of histamine hydrogen receptors, which is an important factor causing respiratory tract spasm in children and budesonide can play a better role in inhibiting it[12]. In addition, budesonide has significant efficacy in suppressing the inflammatory response of the body. Children with *Mycoplasma* pneumonia treated with budesonide have a good inhibitory effect on the immune response in the body, thus inhibiting the release of chemokine's and inflammatory factors in large quantities, and reducing the level of inflammatory factors in the body of children with *Mycoplasma* pneumonia has a significant effect on relieving the clinical symptoms of *Mycoplasma* pneumonia. Secondly, observation group possessed higher total clinical efficacy rate than control group. Acetyl cysteine, as a more effective mucolytic agent, can break more mucus protein disulfide bonds and significantly reduce the viscosity of the mucus plugs of the patients after nebulized inhalation treatment, thus providing more favorable conditions for the elimination of sputum in patients to a certain extent, which has a positive effect on the bronchial recirculation of the patients bodies. This has a positive effect on bronchial recuperation. In addition, acetyl cysteine is absorbed into the body and is rapidly converted into cysteine, which is needed by the body, so it is safe and does not cause damage to the patient's body. Finally, observation group possessed lower incidence of adverse reactions than control group. Azithromycin combined with budesonide has a high safety profile, even though children with *Mycoplasma* pneumonia did not experience any serious complications or adverse drug reactions after the combination, and the intravenous drip and nebulized inhalation can further improve the distribution of the above drugs in the respiratory tract of children, which not only can improve and increase the concentration of local drugs, but also can rapidly exert anti-inflammatory and cough suppressant effects, so this protocol is suitable for clinical application. In summary, patients with *Mycoplasma* pneumonia can obtain good clinical efficacy with azithromycin combined with budesonide treatment regimen and serum inflammatory factors improve well, and there is no significant increase in adverse reactions, and the safety is high, this treatment regimen is suitable for promoting the application in patients with *Mycoplasma* pneumonia.

TABLE 1: COMPARISON OF SERUM INFLAMMATORY FACTOR LEVELS BETWEEN BOTH GROUPS

Group	Cases	WBC (×10⁹/l)	NEUT-R (%)	NEUT (×10⁹/l)	CRP (mg/l)	SAA (mg/l)
Control	50	8.59±4.44	62.31±11.60	5.50±3.89	25.16±24.21	307.29±265.75
Observation	50	8.82±4.24	68.24±52.10	5.54±3.40	22.74±22.22	292.19±242.31
t		2.895	2.389	4.351	3.138	2.776
p		<0.05	<0.05	<0.05	<0.05	<0.05

TABLE 2: COMPARISON OF THE CLINICAL EFFICACY BETWEEN BOTH GROUPS [n (%)]

Group	Cases	Cured	Improved	Ineffective	Total clinical effectiveness
Control	50	23 (46.00)	18 (36.00)	9 (18.00)	41 (82.00)
Observation	50	28 (56.00)	20 (40.00)	2 (4.00)	48 (96.00)
χ^2			23.174		
p			<0.05		

TABLE 3: COMPARISON OF ADVERSE REACTIONS BETWEEN BOTH GROUPS [n (%)]

Group	Cases	Allergic skin rash	Digestive tract symptoms	Dizziness and headache	Incidence of adverse reactions
Control	50	2 (4.00)	2 (4.00)	3 (6.00)	7 (14.00)
Observation	50	1 (2.00)	0 (0.00)	2 (4.00)	3 (6.00)
χ^2			19.382		
p			<0.05		

Conflict of interests:

The authors declared no conflict of interests.

REFERENCES

1. Yang JH, Han X. Efficacy of budesonide ipratropium bromide nebulized inhalation in the treatment of pediatric *Mycoplasma* pneumonia. Guizhou Med J 2022;46(7):1063-4.
2. Xing YM, Wang FJ, Zhang J. Effect of budesonide combined with compound ipratropium bromide aerosol on TNF-α MMP-9 PCT in children with *Mycoplasma* pneumonia. Hebei Med 2021;27(4):682-6.
3. Li CJ. Efficacy of budesonide nebulized inhalation treatment for pediatric *Mycoplasma* pneumonia and observation of changes in chest CT performance. Chin J CT MRI 2021;19(4):54-6.
4. Pang WH, Li JW, Zong GS. Effect of azithromycin combined with budesonide on cytokines, co-stimulatory molecules and immune function in children with *Mycoplasma* pneumonia. Hebei Med 2020;42(3):362-5.
5. Pang WH, Li JW, Chen S. Effect of azithromycin combined with budesonide on immune stress indicators and quality of life in children with *Mycoplasma* pneumonia. Hebei Med 2020;42(17):2661-4.
6. Cao F, Fang SJ, Hua S. Clinical effects of electronic fiberoptic bronchoscopy with preserved perfusion of acetylcysteine and budesonide in the treatment of refractory *Mycoplasma* pneumonia in children. Chin J Med 2020;15(3):369-73.
7. Han CL, Dang YY, Tian QL. Clinical evaluation of budesonide combined with azithromycin in sequential treatment of pediatric migratory *Mycoplasma* pneumonia. Chin Pharm J 2020;29(10):142-4.
8. Wang ZF, He LW, Zhu JY. Effect of montelukast and budesonide in combination with azithromycin on the efficacy of pediatric patients with *Mycoplasma pneumoniae* pneumonia. Chin J Clin Pharmacol 2022;38(16):1851-4.
9. Lou YP. Efficacy of budesonide combined with methylprednisolone in the treatment of pediatric refractory *Mycoplasma* pneumonia and the effect on immune function of children. Mater Child Health Care China 2021;36(3):607-9.
10. Zhao Q, Yuan HL, Li SS. The efficacy of combining azithromycin with Ma Heng Shi Gan Tang in the treatment of pediatric *Mycoplasma* pneumonia and the effects on the cellular immune response, serum Fbg and G-CSF levels. Mod J Integr Tradit Chin Western Med 2022;31(10):1399-402.
11. Gao SY, Zhu BW. Clinical efficacy and adverse effects of sequential treatment of *Mycoplasma pneumoniae* pneumonia in pediatric patients with erythromycin and azithromycin. Guizhou Med J 2022;46(9):1393-4.
12. Wang SL, Yang LR, Xia Y. Efficacy of ultrashort wave combined with azithromycin in the treatment of pediatric *Mycoplasma* pneumonia and the effect on inflammatory factors and immune function. J North Sichuan Med Coll 2022;37(4):513-6.

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