Study on imaging changes, CRP, LDH levels, and glucocorticoid treatment efficacy of severe mycoplasma pneumonia

Heng Li

The second ward of Chengdu Children's Hospital, Chengdu, 610031, China

Introduction. To explore the imaging changes, C-reactive protein (CRP), lactate dehydrogenase (LDH) levels, and glucocorticoid treatment effects of severe mycoplasma pneumonia.

Method. (1) 92 patients with severe mycoplasma pneumonia from June 2021 to September 2023 were selected as the observation group, and 32 patients who underwent physical examination during this period were selected as the control group. All groups completed chest imaging examinations; Using a fully automated biochemical analyzer to measure LDH levels; Immunoturbidimetry was used to measure CRP levels; (2) The observation group was divided into two groups using a random number table method, with 46 cases in each group. The conventional dose group received 2mg/kg glucocorticoids, while the low-dose group received 1mg/kg glucocorticoids. The imaging changes, CRP, and LDH levels of the two groups were compared.

Result. The chest X-ray imaging changes in the observation group were clear before treatment, and the detection rate of various imaging signs in the patient's lesion site and lesion type was higher than that in the control group ($P<0.05$); The chest changes in the low-dose group and the conventional dose group were improved, and the detection rates of lesion location, large areas of consolidation, patchy or cloudy appearance, atelectasis, pleural effusion, and pleural thickening in the observation group were lower than before treatment ($P<0.05$); There was no statistical difference in the chest impact changes between the conventional dose group and the low dose group after treatment ($P>0.05$); Before treatment, the LDH and CRP levels in the observation group were higher than those in the control group ($P<0.05$); There was no statistically significant difference in LDH and CRP between the low-dose group and the

conventional dose group (P>0.05), and both were lower than before treatment in the observation group (P<0.05). The incidence of flushing, nausea and vomiting, occult blood in stools, abdominal pain, and rash allergies during the medication period in the low-dose group was lower than that in the conventional dose group (P<0.05).

Conclusion. Patients with severe mycoplasma pneumonia have significant chest imaging changes, accompanied by elevated levels of LDH and CRP; The use of low-dose glucocorticoid intervention can improve patient symptoms, reduce LDH and CRP levels, and has high drug safety, which is worthy of promotion and application.

Keywords. Severe Mycoplasma Pneumonia; Imaging changes; C-reactive protein; Lactate dehydrogenase; Glucocorticoids; treatment effect

INTRODUCTION

Mycoplasma pneumonia is a lower respiratory tract infection caused by Mycoplasma pneumoniae, which can be transmitted by droplets or direct contact. The clinical manifestations are mainly fever, cough and other symptoms [1]. However, patients with severe mycoplasma pneumonia are often accompanied by shortness of breath, increased lung texture and pleural effusion, etc. As the disease progresses, it can cause multiple organ involvement and affect the physical and mental health of patients [2-3]. In recent years, the cases of severe mycoplasma pneumonia have gradually increased, and timely detection and treatment can help to improve the prognosis of patients. However, the chest imaging manifestations are diverse and lack characteristics, which is easy to be misdiagnosed as viral pneumonia, affecting the formulation of subsequent treatment plans [4-5]. Zhao Baoxi et al. [6] showed that patients with severe mycoplasma pneumonia are in a state of inflammatory cascade reaction, which can cause organ function damage and coagulation dysfunction, and C-reactive protein (CRP) and lactate dehydrogenase (LDH) can promote the development of the disease. Intravenous administration of glucocorticoid methylprednisolone can play a good anti-inflammatory effect, and the drug does not pass through the liver to complete the transformation and metabolism in the human

body, with high drug safety and low risk of inducing sodium retention and adrenal pituitary axis inhibition. However, there are few studies on the effect of different drug doses in severe mycoplasma pneumonia [7-8]. This study mainly discusses the imaging changes of severe mycoplasma pneumonia, the levels of C-reactive protein (CRP) and lactate dehydrogenase (LDH), and the effect of glucocorticoid treatment, which is reported as follows.

1.MATERIALS AND METHODS

1.1 General Information

A total of 92 patients with severe mycoplasma pneumonia from June 2021 to September 2023 were selected as the observation group, including 51 males and 41 females, aged (5 months to 13) years, with an average age of (6.18±0.83) years. The course of disease was 3-14 days, with an average of 7.94±0.62 days. The clinical manifestations included fever (n = 43), cough (n = 51), shortness of breath (n = 21) and pleural effusion (n = 27). The observation group was randomly divided into conventional dose group and small dose group with 46 cases in each group. Thirty-two healthy controls were selected as the control group, including 19 males and 13 females, aged (6 months-12) years, with an average age of (6.31±0.87) years.

1.2 Inclusion and exclusion criteria

Inclusion criteria: (1) meet the diagnostic criteria of severe mycoplasma pneumonia [9], confirmed by MP-IgM titer >1:160 or throat swab nucleic acid test positive; (2) have complete imaging results and can cooperate with the determination of biochemical indicators; (3) All patients had no history of allergy and contraindications to glucocorticoids. Exclusion criteria: (1) combined with bronchial asthma, severe liver and kidney dysfunction; (2) pulmonary inflammation caused by blood system diseases or other reasons; (3) secondary immune diseases and recurrent respiratory tract infection.

1.3 Methods

(1) Detection of LDH and CRP. In the observation group (before and after

treatment), 3mL fasting venous blood was collected in the morning, and 3mL fasting venous blood was collected in the control group on the day of physical examination. LDH level was measured by automatic biochemical analyzer (model: AU480) (purchased from Olympus Corporation) [10]. The level of CRP was determined by immunoturbidimetry, and the kit of the instrument was used [11]. (2) Chest X-ray examination. Before the examination, the metal foreign body on the patient's body was removed, and the position of the X-ray machine was adjusted so that the projection direction of X-ray photography was parallel to the endplate and the body was located in the projection center [12]. (3) Treatment methods. The conventional dose group and the small dose group were treated with azithromycin dry suspension (Pfizer Pharmaceutical Co., LTD., Chinese Medicine approval number H10960112, 0.1g), once a day, 10mg/kg each time, oral administration for 3 days, stopping for 4 days and then taking for 3 days. The conventional dose group was treated with 2mg/kg glucocorticoid injection methylprednisolone sodium succinate (Tianjin Jinyao Pharmaceutical Co., LTD., Chinese Medicine approval number H20103047, specification: 40mg), and the small dose group was treated with 1mg/kg glucocorticoid for 4-5 days.

1.4 Indicators of observation

(1) Chest imaging changes; The chest imaging changes of the observation group (before treatment, low-dose group and conventional-dose group) and the control group were statistically analyzed, including: lesion location (left, right and bilateral), lesion type (large consolidation shadow, patchy or cloud, atelectasis, pleural effusion, pleural thickening) [13]. (2) LDH and CRP levels; The levels of LDH and CRP in the observation group (before treatment, low-dose group and conventional-dose group) and the control group were compared. (3) safety of glucocorticoid use. The incidences of facial flushing, nausea and vomiting, fecal occult blood, abdominal pain, and rash and allergy during treatment in the low-dose group and the conventional dose group were recorded.

1.5 Statistical Analysis

SPSS26.0 software was used to process the data. The enumeration data were analyzed by χ2 test, expressed by n (%), and the measurement data were analyzed by t test, expressed by（$\bar{x} \pm s$）, P<0.05 was statistically significant.

2 RESULTS

2.1 Comparison of chest effect changes between the observation group and the control group before treatment

The observation group was accompanied by obvious chest X-ray imaging changes before treatment, and the detection rate of each imaging sign in the lesion location and lesion type was higher than that in the control group (P<0.05), as shown in Table 1.

Table 1 Comparison of chest effect changes between the observation group and the control group before treatment [n（%）]

		Observation group (n=92)	Control group (n=32)	χ^2	P value
Location of the lesion	On the left On the left	20（21.74）	1（3.13）	20.112	0.000
	Right side	54（58.70）	3（9.38）	16.342	0.000
	Bilateral	28（30.43）	4（12.50）	8.445	0.021
Type of lesion	Massive consolidation	43（46.74）	0（0.00）	26.392	0.000
	Patchy or cloudy	14（15.22）	3（9.38）	7.734	0.037
	Atelectasis of lung	31（33.70）	0（0.00）	31.234	0.000
	Pleural effusion	46（60.00）	0（0.00）	50.491	0.000
	The pleura was thickened	9（9.78）	0（0.00）	5.456	0.041

The low-dose group and the conventional-dose group had improved chest changes, and the detection rates of lesion location, large consolidation shadow, patch

or cloud, atelectasis, pleural effusion and pleural thickening were lower than those before treatment in the observation group (P<0.05). There was no significant difference in chest effects between the conventional dose group and the low-dose group after treatment (P>0.05), as shown in Table 2.

Table 2 Comparison of changes in chest effects after glucocorticoid treatment in the observation group

[n（%）]

		Observation group before treatment (n=92)	Low-dose group (n=46)	Conventional dose group (n=46)	χ^2	P value
Location of the lesion	On the left	20（21.74）	1（2.17）#	3（6.52）#	20.112	0.000
	Right side	54（58.70）	5（10.87）#	6（13.04）#	16.342	0.000
	Bilateral	28（30.43）	4（8.70）#	3（6.52）#	8.445	0.021
Type of lesion	Massive consolidation	43（46.74）	6（13.04）#	5（10.87）#	26.392	0.000
	Patchy or cloudy	14（15.22）	5（10.87）#	4（8.70）#	7.734	0.037
	Atelectasis of lung	31（33.70）	5（10.87）#	6（13.04）#	31.234	0.000
	Pleural effusion	46（60.00）	6（13.04）#	5（10.87）#	50.491	0.000
	The pleura was thickened	9（9.78）	2（4.35）#	1（2.17）#	5.456	0.041

Compared with the observation group before treatment, #P<0.05;

2.2 Comparison of LDH and CRP between observation group and control group

LDH and CRP in the observation group were higher than those in the control group before treatment (P<0.05). There was no significant difference in LDH and CRP between the low-dose group and the conventional-dose group (P>0.05), and they were lower than those in the observation group before treatment (P<0.05), as shown in Table 3.

Table 3 Comparison of LDH and CRP between observation group and control group（$\bar{x} \pm s$）

Groups	Number of cases	LDH	CRP（mg/L）

Observation group	Before treatment	92	434.23±43.31#	48.67±3.53#
/	Low-dose group	46	231.69±25.49#*	11.13±1.42#*
/	Conventional dose group	46	233.43±25.54#*	11.15±1.45#*
Control group	/	32	100.51±14.23	4.31±0.36

Compared with the control group, #P<0.05; Compared with that before treatment, *P<0.05

2.3 The safety of glucocorticoid use was compared between the two groups

The incidences of facial flushing, nausea and vomiting, fecal occult blood, abdominal pain, and rash allergy in the low-dose group were lower than those in the conventional dose group (P<0.05), as shown in Table 4.

Table 4 Comparison of the safety of glucocorticoid use between the two groups [n（%）]

Groups	Number of cases	face flushed	Nausea and vomiting	Occult blood in the stool	Abdominal pain	Skin rash allergy	Incidence rate
Observation group	46	0（0.00）	1（0.65）	0（0.00）	1（0.65）	3（1.94）	5（3.23）
Control group	46	1（0.65）	2（1.29）	3（1.94）	3（1.94）	5（3.23）	14（9.03）
x^2	/						6.391
P	/						0.029

3 DISCUSSION

Severe mycoplasma pneumonia tends to occur in children. Most children have no obvious symptoms at the beginning of the disease, and may be accompanied by other extrapulmonary damage with the prolongation of the course of the disease, resulting in great difficulty in clinical diagnosis and treatment [14]. In recent years, the prevalence of severe mycoplasma pneumonia has increased year by year, and the drug resistance rate has also increased [15]. In this study, the observation group had obvious changes in chest X-ray images before treatment, and the detection rates of

each imaging sign in the lesion location and lesion type were higher than those in the control group (P<0.05). The detection rates of lesion location, large consolidation shadow, patch or cloud flocculence, atelectasis, pleural effusion and pleural thickening in the low-dose group and the conventionaldose group were lower than those before treatment in the observation group (P<0.05). According to the results, the changes of chest imaging in patients with severe mycoplasma pneumonia were obvious, and the levels of LDH and CRP in patients were increased. Analysis of reasons: chest imaging is a common method for the diagnosis and treatment of severe mycoplasma pneumonia, which can determine the location of the lesion, and the patient is accompanied by imaging changes. However, the imaging findings of most patients lack characteristics, resulting in a high misdiagnosis rate. CRP is an acute phase protein that can reflect the immune defense of the body, which can be used for the diagnosis of diseases, the dynamic evaluation and observation of the condition, and can provide the basis for the formulation of clinical treatment plans [16]. According to the study of Tu Lili et al. [17], CRP belongs to the acute-phase protein, and its expression level increases significantly in the early stage of infection and decreases with the stable stage of the disease. LDH widely exists in the cytoplasm of human tissue cells. As a glycolytic enzyme, after infection of patients, tissue cells are destroyed, resulting in a large amount of LDH released into the blood, causing its level to increase, which can determine and evaluate the patient's condition [18]. Therefore, strengthening the imaging, LDH and CRP examination of patients with severe mycoplasma pneumonia can assist clinical diagnosis and lay the foundation for the subsequent treatment plan.

Glucocorticoid is a common intervention method for patients with severe mycoplasma pneumonia, which can play a strong anti-inflammatory effect and enter the body without liver metabolism [19]. Drugs can down-regulate the immune hyperfunction caused by mycoplasma infection, help to reduce inflammatory response, relieve respiratory edema, inhibit the synthesis of local secretions, promote airway patency, and ensure pulmonary ventilation to the maximum extent [20]. In this study,

there was no significant difference in chest effects between the conventional dose group and the low-dose group after treatment (P>0.05). LDH and CRP in the observation group were higher than those in the control group before treatment (P<0.05). There was no significant difference in LDH and CRP between the low-dose group and the conventional-dose group (P>0.05), and they were lower than those in the observation group before treatment (P<0.05). The incidence of facial flushing, nausea and vomiting, fecal occult blood, abdominal pain and rash allergy in the low-dose group was lower than that in the conventional dose group (P<0.05). The results showed that different doses of glucocorticoids used in patients with severe mycoplasma pneumonia were helpful to improve the imaging performance of patients, reduce the levels of LDH and CRP, but low-dose glucocorticoids were safer. It can improve the treatment tolerance and compliance of patients.

In conclusion, the chest imaging changes of patients with severe mycoplasma pneumonia are obvious, accompanied by increased LDH and CRP levels. Low-dose glucocorticoid intervention can improve the symptoms of patients, reduce the levels of LDH and CRP, and has high drug safety, which is worthy of promotion and application.

REFERENCES

[1] Gao Shiyue, Cao Yamin. Serum levels of FIB and TSP-1 in children with severe pneumonia caused by Mycoplasma pneumoniae and their correlation with prognosis[J]. Medical Clinical Research, 2022, 39(6): 909-912.

[2] Yang Huirong, Zhang Yingqian, Huang Kunling, et al. Clinical study on the treatment of refractory Mycoplasma pneumoniae pneumonia with Qingre Jiedu Qutan Fang adjuvant bronchoscopy[J]. Hebei Journal of Traditional Chinese Medicine, 2022, 37(1): 13-16, 31.

[3] Tamiya S, Yoshikawa E, Ogura M, et al. Vaccination using inactivated Mycoplasma pneumoniae induces detrimental infiltration of neutrophils after subsequent infection in mice[J]. Vaccine, 2020, 38(32): 4979-4987.

[4] Lou Mengying, Gu Shenfeng, Dong Xiaoyan. Correlation analysis of serum PDCD5 levels in

children with Mycoplasma pneumoniae pneumonia and myocardial injury[J]. Journal of Clinical Pulmonary Medicine, 2023, 28(1): 58-62.

[5] Hu Caiyun, Jiang Jiali, Xu Weihua, et al. Effect of methylprednisolone combined with alveolar lavage on Mycoplasma pneumoniae pneumonia and its influence on lactate dehydrogenase and high-sensitivity C-reactive protein levels in children[J]. China Medicine, 2021, 16(5): 680-683.

[6] Zhao Baoxi, Xu Jun, Feng Xumin. Expression levels and significance of high mobility group box protein B1 in peripheral blood of children with refractory Mycoplasma pneumoniae pneumonia[J]. Chinese Maternal and Child Health Care, 2021, 36(22): 5212-5215.

[7] He Baoping, Duo Hongying, Song Dongmei, et al. Clinical study on changes of vitamin A and humoral immune protein levels in children with Mycoplasma pneumoniae pneumonia[J]. Journal of Inner Mongolia Medical University, 2021, 43(5): 492-494, 499.

[8] Terasaki Y, Suzuki T, Tonaki K, et al. Molecular hydrogen attenuates gefitinib-induced exacerbation of naphthalene-evoked acute lung injury through a reduction in oxidative stress and inflammation[J]. Laboratory Investigation, 2019, 99(1): 793-806.

[9] Zhang Yukun, Huang Chunhua, Xu Xintan, et al. Changes of D-D, CRP, LDH in children with severe Mycoplasma pneumoniae pneumonia and their diagnostic value for the condition[J]. Clinical Misdiagnosis & Mistreatment, 2022, 35(5): 78-81.

[10] Wang Yongjun, Li Wanyi, Wang Wenyuan, et al. Clinical analysis of necrotizing pneumonia associated with Mycoplasma infection in children[J]. Chinese Journal of Medicine Guide, 2022, 24(4): 384-388.

[11] Xu W, Yang H, Liu H, et al. Bronchoalveolar lavage T cell cytokine profiles and their association with lung function in children with Mycoplasma pneumoniae-associated bronchiolitis obliterans[J]. Pediatric Pulmonology, 2020, 18(8): 55-62.

[12] Hu Caiyu, Song Lei, Zhang Weiyan. Comparative study on clinical characteristics and routine coagulation of children with Mycoplasma pneumoniae pneumonia with different imaging manifestations[J]. Chinese Medical Equipment Journal, 2022, 19(2): 68-71.

[13] Wang Xue, Gao Mimi, Yin Li, et al. Risk factors for children with Mycoplasma pneumoniae pneumonia complicated by lobar pneumonia[J]. Chinese Journal of Nosocomiology, 2021, 31(2): 277-280.

[14] Mu Nan, Jiang Yazhou, Zhuo Lie, et al. Clinical significance of lung ultrasound score combined with blood CRP and LDH levels in evaluating the extent of lesions in children with Mycoplasma pneumoniae pneumonia[J]. Chinese Journal of Ultrasonography, 2021, 37(9): 993-997.

[15] Nick L M, Nedel A S, Alonso M F, et al. Relationship between meteorological variables and pneumonia in children in the Metropolitan Region of Porto Alegre, Brazil[J]. International Journal of Biometeorology, 2022, 21(66): 2301-2308.

[16] He Xinru, Ji Xunchao. Study on the correlation between "Heat-Toxin Blood Stasis" and Mycoplasma pneumoniae pneumonia in children[J]. Journal of Guangzhou University of Traditional Chinese Medicine, 2022, 39(12): 2762-2767.

[17] Tu Lili, Zhang Manman, Pan Yanan, et al. Clinical characteristics and risk factors analysis of children with Mycoplasma pneumoniae pneumonia combined with adenovirus infection[J]. Medical Journal of Chinese People's Health, 2022, 51(9): 149-153.

[18] Yun K W, Wallihan R, Desai A, et al. Clinical Characteristics and Etiology of Community-acquired Pneumonia in US Children, 2015–2018[J]. The Pediatric Infectious Disease Journal, 2022, 41(5): 381-387.

[19] Tian Xiaoyin, Zhang Guangli, Wang Chongjie, et al. Clinical features and risk factors analysis of children with plastic bronchitis[J]. Chinese Journal of Contemporary Pediatrics, 2023, 25(6): 626-632.

[20] Du Chunyan, Zhang Nini, Jiang Xun. Clinical efficacy and safety observation of low-dose and conventional-dose glucocorticoids in the treatment of children with refractory Mycoplasma pneumoniae pneumonia complicated with extrapulmonary complications[J]. Guizhou Medicine, 2021, 45(7): 1097-1098.

Corresponding Author:

Heng Li

The second ward of Chengdu Children's Hospital, Chengdu, 610031, China

E-mail：16291181@qq.com