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Effects of glucocorticoid combined with antibiotics on serum infection indexes, acute phase proteins and stress hormones in patients with severe pneumonia

Yang Yu, Jie Fan✉

Department of Western Medicine, Affiliated Hospital of Jianghan University in Hubei Province, Wuhan City, Hubei Province, 4300145, China

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ABSTRACT

Objective: To study the effects of glucocorticoid combined with antibiotics on serum infection indexes, acute phase proteins and stress hormones in patients with severe pneumonia. **Methods:** a total of 80 patients with severe pneumonia who were hospitalized between August 2014 and January 2017 were retrospectively analyzed and divided into the routine treatment group (n=46) who received conventional antibiotic therapy and the combined treatment group (n=34) who received glucocorticoid combined with antibiotic therapy, and the differences in infection indexes, acute proteins and stress hormones were compared between the two groups of patients before and after treatment. **Results:** The differences in serum levels of infection indexes, acute phase proteins and stress hormones were not statistically significant between the two groups before treatment. After 1 week of treatment, serum infection indexes CRP and PCT levels of observation group were lower than those of control group; serum acute phase proteins α 1-AT, α 1-AG and CER levels were lower than those of control group; serum stress hormones Cor, Ang Ⅰ and Ang Ⅱ levels were lower than those of control group. **Conclusion:** Glucocorticoid combined with antibiotics can effectively inhibit systemic infection and stress and optimize the illness in patients with severe pneumonia.

1. Introduction

Severe pneumonia is one of the most common clinical acute diseases that cause the death of patients. Early controlling inflammation in the lungs and optimizing the systemic state is the key to improve the therapeutic effect[1,2]. Using broad-spectrum antibiotics to inhibit bacteria proliferation and toxin secretion in early severe pneumonia therapy can effectively inhibit the disease progression, but some patients are still characterized by shock as well as heart, liver kidney and other important organ dysfunction, which are associated with severe cascade reaction. Glucocorticoid is an effective drug for treatment of various serious infectious diseases and exerts both immunomodulatory and anti-inflammatory effects[3−5], and many scholars have currently recommended it for auxiliary treatment of patients with severe pneumonia. In this study, patients with severe pneumonia hospitalized between August 2014 and January 2017 were retrospectively analyzed, they received conventional antibiotic therapy and glucocorticoid combined with antibiotic therapy respectively, and the changes of illness were compared between the patients with different treatments to provide a reference for selecting the therapy for subsequent similar diseases.

2. Information and methods

2.1 Diagnostic criteria for severe pneumonia

(1) With intratulmonary inflammation which occurred before admission or within 48 h after admission and was confirmed by pulmonary CT; (2) requiring mechanical ventilation support; (3) systolic pressure<90 mmHg, and/or diastolic pressure <60 mmHg; (4) oliguria (< 400 mL/d) or acute renal failure.

2.2 Case information

The treatment process and results of 80 cases patients with severe pneumonia were retrospectively analyzed, and they were divided into the routine treatment group (n=46) who received conventional

✉Corresponding author: Jie Fan, Department of Western Medicine, Affiliated Hospital of Jianghan University in Hubei Province, Wuhan City, Hubei Province, 4300145, China.

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antibiotic therapy and the combined treatment group (n=34) who received glucocorticoid with combined antibiotic therapy. Control group: 24 male cases and 22 female cases that were 41-75 years old; observation group: 25 male cases and 21 female cases that were 43-74 years old. The baseline data of the two groups were found to be comparable.

2.3 Inclusion and exclusion criteria

Inclusion criteria: (1) clearly diagnosed with severe pneumonia; (2) no history of severe pneumonia; (3) no independent treatment outside the hospital. Exclusion criteria: (1) withdrawing from the study in mid-stream; (2) dead during treatment; (3) long-term glucocorticoid application outside the hospital.

2.4 Therapy

Control group received routine antibiotic therapy, broad-spectrum antibiotics were taken and the sputum samples were collected for bacterial culture in early stage, and sensitive antibiotics were adopted in later stage according to the culture results.

Based on routine antibiotic therapy, observation group received glucocorticoid treatment as follows: methylprednisolone (Pfizer Pharmaceuticals, approved by H20170197) 40 mg in 250 mL saline, intravenous drip, 1 time/d, for continuous 1 week of treatment.

2.5 Observation indexes

Before treatment and after 1 week of treatment, the radioimmunoassay kit was used to determine the serum contents of infection indexes C-reactive protein (CRP) and procalcitonin (PCT); enzyme-linked immunosobent assay kit was used to detect the serum levels of acute phase proteins α 1 antitrypsin (α 1-AT), 1 acid glycoprotein (α 1-AG) and ceruloplasmin (CER); chemiluminescence kits was used to detect the serum contents of stress hormones cortisol (Cor), angiotensin Ⅰ (Ang Ⅰ) and angiotensin Ⅱ (Ang Ⅱ). Serum specimens were obtained are as follows: morning fasting cubital venous blood was joined by sodium citrate for anticoagulation and centrifuged at 4 ℃ to get upper serum.

2.6 Statistical processing

Infection indexes, acute phase proteins and stress hormones belonged to measurement data and were in terms of (Mean ± SD), and comparison within group and between groups was both by t test. SPSS 19.0 software was used for data processing and P<0.05 was the standard of statistical significance in differences.

3. Results

3.1 Infection indexes

Comparison of serum infection indexes CRP and PCT levels between the two groups of patients was as follows: before treatment, the differences in serum CRP and PCT levels were not significant between the two groups of patients (P>0.05); after 1 week of treatment, serum CRP and PCT levels of both groups were lower than those before treatment, and the decrease in serum levels of above indexes of observation group was higher than that of control group (P<0.05), shown in Table 1.

3.2 Acute phase proteins

Comparison of serum acute phase proteins α 1-AT (g/L), α 1-AG (mg/dL) and CER (mg/L) levels between the two groups of patients was as follows: before treatment, the differences in serum α 1-AT, α 1-AG and CER levels were not significant between the two groups of patients (P>0.05); after 1 week of treatment, serum α 1-AT, α 1-AG and CER levels of both groups were lower than those before treatment, and the decrease in serum levels of above indexes of observation group was higher than that of control group (P<0.05), shown in Table 2.

3.3 Stress hormones

Comparison of serum stress hormones Cor (ng/mL), Ang Ⅰ (ng/mL) and Ang Ⅱ (ng/L) levels between the two groups of patients was as follows: before treatment, the differences in serum Cor, Ang Ⅰ

Table 1.

Serum infection index levels (mg/L).

Groups	n	CRP		PCT	
		Before treatment	After 1 week of treatment	Before treatment	After 1 week of treatment
Control group	46	38.29±4.52	20.74±2.86*	1.83±0.21	1.17±0.15*
Observation group	34	38.65±4.17	11.89±1.73*	1.85±0.22	0.73±0.08*
t		0.219	13.284	0.073	8.512
P		＞0.05	＜0.05	＞0.05	＜0.05

Note: compared with same group before treatment, *P＜0.05.

Table 2.

Serum acute phase protein levels.

Groups	*n*	1-AT		1-AG		CER	
		Before treatment	After 1 week of treatment	Before treatment	After 1 week of treatment	Before treatment	After 1 week of treatment
Control group	46	3.74±0.41	1.88±0.25*	158.29±17.32	113.63±14.27*	592.17±65.88	418.66±45.72*
Observation group	34	3.69±0.38	1.15±0.17*	157.85±16.99	92.54±10.62*	590.35±62.43	309.42±35.84*
t		0.173	7.923	0.284	11.651	0.362	15.387
P		>0.05	<0.05	>0.05	<0.05	>0.05	<0.05

Note: compared with same group before treatment, *$P<0.05$.

Table 3.

Serum stress hormone levels.

Groups	*n*	Cor (ng/mL)		Ang Ⅰ (ng/mL)		Ang Ⅱ (ng/L)	
		Before treatment	After 1 week of treatment	Before treatment	After 1 week of treatment	Before treatment	After 1 week of treatment
Control group	46	284.36±33.51	215.38±24.61*	15.38±2.11	11.47±1.53*	68.39±7.11	54.27±6.19*
Observation group	34	282.49±32.64	180.62±22.17*	15.29±2.07	8.09±0.95*	68.54±7.09	43.16±5.22*
t		0.184	17.283	0.264	6.374	0.195	10.948
P		>0.05	<0.05	>0.05	<0.05	>0.05	<0.05

Note: compared with same group before treatment, *$P<0.05$.

and Ang Ⅱ levels were not significant between the two groups of patients ($P>0.05$); after 1 week of treatment, serum Cor, Ang Ⅰ and Ang Ⅱ levels of both groups were lower than those before treatment, and the decrease in serum levels of above indexes of observation group was higher than that of control group ($P<0.05$), shown in Table 3.

4. Discussion

It has been proven that glucocorticoid can optimize the condition of patients with sepsis and acute severe pancreatitis[3,6], and play a positive role in inhibiting inflammatory response, maintaining circulation stability and other aspects. The core mechanism of severe pneumonia aggravation is the inflammatory cascade and the resulting lung and other important tissue organ damage, glucocorticoid is combined with related receptors and further connected to the glucocorticoid response element of target genes to affect the transcription of nuclear factor κ B (NF-κ B), activated protein-1 (AP-1) and other important inflammatory mediators, and finally suppress the inflammatory response[4,7]. In this study, glucocorticoid was added in clinical treatment of patients with severe pneumonia, and the effect of adding the drug on the infection status and disease severity was explored to provide reference for subsequent treatment of similar diseases.

The toxins secreted by pathogenic bacteria and the systemic infection state caused by inflammatory mediator secretion are the typical signs of severe pneumonia, and the severity of the infection state can objectively reflect the severity of severe pneumonia. CRP is an early warning indicator of infectious disease, CRP can be massively secreted early after the pathogen invasion and its content is positively correlated with the degree of infection[8,9]. PCT is a new infection-related index, its expression increases after severe infection, but the content of PCT is basically stable in patients with mild bacterial infection or viral infection[10,11]. It was found in this study that compared with those before treatment, serum CRP and PCT levels of both groups decreased after treatment; further compared with those of conventional treatment group, serum CRP and PCT levels of observation group were lower after treatment, confirming that adjuvant glucocorticoid therapy on the basis of conventional antibiotics treatment can more effectively control the systemic infection state.

In addition to infection indicators, the changes in the expression of various acute proteins can quantitatively reflect the outcome of patients with severe pneumonia[12]. α 1-AT is a typical acute phase protein, which can enter the tissue fluid through the capillaries after the inflammation occurs; the characteristics of α 1-AG are similar to those of α 1-AT, and it is highly expressed in infection, trauma and malignant tumor; CER is synthesized by liver, and its content increases rapidly after severe infection[13,14]. It was found in the study that serum α 1-AT, α 1-AG and CER levels of both groups decreased after treatment, and the decrease in serum levels of these indexes of joint treatment group was more significant, confirming that adjuvant glucocorticoid therapy can more effectively reduce the acute phase protein generation, and this is a direct sign of it to control patients′ condition.

Systemic inflammatory response can directly stimulate the body's stress response, make the central nervous system stimulate massive stress hormone secretion, accelerate the catabolism of the body, lower protein levels and prevent disease recovery[15]. The degree of stress response is directly related to the condition of patients with severe pneumonia, and the detection of relevant stress hormone levels is another reliable means to determine the severity of the condition and evaluate the therapeutic effect[16]. Cor, Ang Ⅰ and Ang Ⅱ are typical stress indexes, and it was found in the study that serum Cor, Ang Ⅰ and Ang Ⅱ levels of both groups decreased after

treatment, and the decrease in serum levels of these indexes of joint treatment group was more significant, confirming that adjuvant glucocorticoid therapy can more effectively inhibit the systemic stress reaction in patients with severe pneumonia.

It is thus clear that glucocorticoid combined with antibiotics therapy can be more effective in inhibiting the systemic infection and stress response of patients with severe pneumonia, which can help control the final condition. The therapy is more effective than conventional antibiotics therapy and is worth promoting in future clinical practice.

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