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Curative effect of CRRT in patients with septicopyemia and acute kidney injury and its influence on serum inflammatory factors.

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Abstract

Objective: This study attempts to analyse the curative effect of Continuous Renal Replacement Therapy (CRRT) on patients with septicopyemia and acute kidney injury and its influence on serum inflammatory factors.

Methods: A total of 96 cases with septicopyemia and acute kidney injury at our hospital from January 2014 to June 2016 were collected. These cases were then divided into the observation (n=48) and control groups (n=48) by the random number method. The control group was administered with conventional therapy, whereas the observation group was administered with CRRT therapy based on the conventional therapy. The curative effects on the two groups were then compared.

Results: The observation group exhibited a significantly better therapeutic effect than the control group (P<0.05). The two groups had no significant differences in their IL-1β, IL-6, TNF-α, PCT, and CRP levels before the treatment, which showed no statistical significance (P<0.05). The IL-1β, IL-6, TNF-α, PCT, and CRP levels of both groups then decreased sharply after the treatment (P<0.05). The IL-1β, IL-6, TNF-α, PCT, and CRP levels of the observation group were significantly lower than those of the control group (P<0.05).

Conclusions: CRRT can effectively decrease the levels of serum inflammatory factors of patients with septicopyemia and acute kidney injury, as well as improve the inflammatory reactions of patients. Thus, CRRT can be widely applied because of its promising clinical therapeutic effects.

Keywords: Septicopyemia, Acute kidney injury, CRRT, Serum inflammatory factors.

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Introduction

Septicopyemia, which is a systematic inflammatory response syndrome caused by infection, has serious complications and high morbidity and fatality rates [1]. It can significantly influence the safety and living quality of human beings. Septicopyemia can easily cause acute kidney injury, which prolongs the length of stay and increases the fatality rate of patients [2,3]. Continuous Renal Replacement Therapy (CRRT) can remove *in vivo* toxicants and metabolites of patients, as well as correct the disturbance of water and electrolytes effectively. CRRT is one of the known therapies for septicopyemia and acute kidney injury [4]. Therefore, the curative effect of CRRT in patients with septicopyemia and acute kidney injury was observed and discussed in this study to provide references for clinical treatment. Results are introduced in the following section.

Material and Methods

General information

A total of 96 cases with septicopyemia and acute kidney injury at our hospital from January 2014 to June 2016 were collected. All of these cases conformed to diagnosis standards of septicopyemia and acute kidney injury after careful examination. Patients who were less than 18 years old and had insufficient hepatorenal functions, serious cardiopulmonary diseases, and metal disorder were excluded. This study was approved by the Medical Ethics Committee of the hospital and patients. The patients signed the Informed Consent Form. All patients were divided into the observation (n=48) and control groups (n=48) by the random number method. The observation group had 25 males and 23 females aged 27 y old to 74 y old (average of 56.92 ± 11.35 y). The control group had 24 males and 24 females aged 29 y old to 76 y old (average of 57.33 ± 11.57 y). The two groups had no statistically significant differences in general information (e.g., gender and age) and were comparable (P<0.05).

Therapeutic methods

The control group was administered with conventional therapy, including anti-infection, body fluid supplementation, nutrition support, and adjuvant therapy with respirator. The observation group was administered with CRRT therapy based on the conventional therapy. A venous indwelling tube was offered to the observation group to establish vascular accesses and

washed by 1,000 ml of normal saline. Jinbao prismaflex CRRT was applied for the RRT. The filter utilized was an M100, and the treatment mode was CVCH. The blood flow rate, total replacing solution volume, and ultra-filtration time were set at 200 ml/min, 72 L, and less than 48 h, respectively. Each patient was treated twice in one week.

Observation indexes

The therapeutic effects of the two groups and levels of serum inflammatory factors (i.e., IL-1β, IL-6, TNF-α, PCT, and CRP) before and after the treatment were compared. Vein blood samples (5 ml) were collected from the patients in the morning under empty stomachs and then centrifuged for 10 min at a rate of 3,000 r/min. Serum samples were then extracted. IL-1β, IL-6, and TNF-α were tested by an enzyme linked immunosorbent assay, CRP was tested by immunoturbidimetry technique, and PCT was tested by the chemiluminiscence method. The clinical effects were divided into highly effective, effective, and ineffective. The total therapeutic effect was calculated as (highly effective+effective)/total cases × 100%.

Statistical analysis

The obtained data were processed by SPSS22.0. The measurement data were expressed by "$\bar{x} \pm S$," and t-test was implemented between the groups. The enumeration data were expressed by "%," and χ^2-test was implemented between the groups. P<0.05 means that the difference is statistically significant.

Results

Comparison of the clinical effects between the two groups

The total therapeutic effect of the observation group is 91.67%, whereas that of the control group is 75%, which shows a significant difference (P<0.05; Table 1).

Comparison of the levels of serum inflammatory factors before and after treatment of the two groups

The two groups had no significant difference in terms of the IL-1β, IL-6, TNF-α, PCT, and CRP levels (P<0.05) before the treatment. The IL-1β, IL-6, TNF-α, PCT, and CRP levels of both groups then decreased sharply (P<0.05) after the treatment. The IL-1β, IL-6, TNF-α, PCT, and CRP levels of the observation group were significantly lower than those of the control group (P<0.05; Table 2).

Comparison of the C3, C4, IgG, IgA, and IgM levels between the two groups

The two groups had no statistically significant difference in terms of IgG, IgA, IgM, C3, and C4 before and after the treatment (P>0.05) (Table 3).

Table 1. *Comparison of the clinical effects between the two groups.*

Groups	Highly effective	Effective	Ineffective	Total therapeutic effect
Observation group (48)	23 (47.92%)	21 (43.75%)	4 (8.33%)	44 (91.67%)
Control group (48)	13 (27.08%)	23 (47.92%)	12 (25%)	36 (75%)
χ^2				10.005
P				0.001

Table 2. *Comparison of the levels of serum inflammatory factors before and after treatment of the two groups.*

Groups	Time	IL-1β	IL-6	TNF-α	PCT	CRP
Observation group (48)	Before	102.14 ± 17.07	189.33 ± 18.56	11.69 ± 2.17	8.81 ± 2.77	67.99 ± 12.67
	After	19.09 ± 13.13*#	57.13 ± 17.65*#	16.51 ± 4.08*#	14.89 ± 3.76*#	22.09 ± 11.81*#
Control group (48)	Before	106.91 ± 17.18	191.74 ± 19.75	11.71 ± 3.31	8.91 ± 2.93	68.61 ± 13.64
	After	40.11 ± 12.09*	93.37 ± 21.33*	13.37 ± 3.36*	11.47 ± 3.33*	35.69 ± 11.13*

Note: *indicates the comparison with the samples before the treatment, P<0.05. #indicates the comparison with the control group, P<0.05.

Table 3. *Comparison of the C3, C4, IgG, IgA, and IgM levels between the two groups.*

Groups	Time	C3	C4	IgG	IgA	IgM

Observation group (48)	Before	77.93 ± 7.18	19.62 ± 4.53	938.83 ± 13.59	243.62 ± 12.43	89.76 ± 11.41
	After	79.53 ± 6.12	21.22 ± 4.13	978.56 ± 19.73	259.98 ± 12.99	92.77 ± 18.88
Control group (48)	Before	78.25 ± 7.27	19.88 ± 3.93	947.24 ± 14.88	246.92 ± 16.83	89.96 ± 13.31
	After	81.14 ± 5.53	21.62 ± 3.63	967.43 ± 16.62	258.32 ± 15.28	93.25 ± 11.31

Discussion

Septicopyemia, which is the systematic inflammatory response syndrome caused by infection, is characterized by acute onset and fast development. It can be caused by infection at any position and is common in meningitis, abscess, pneumonia, and peritonitis [5]. Its pathogenic microorganisms include bacteria, fungi, virus, and parasites. Septicopyemia often occurs in patients with inflammatory diseases, such as serious burns, surgical operations, and multiple injuries. Its clinical symptoms are mainly fever, chilling, thrombocytopenia, hypourocrinia, and accelerated breathing [6]. The metabolic changes in septicopyemia have more universal activation of inflammatory reactions and lack definite orientation focus in the local reaction compared with local infections. Pathogenic bacteria and products escape from the local defense and invade the circulatory system, which activates alexins and blood coagulation factors in the blood vessels [7]. Histamines released by the complete activation of mastocytes and 5-HT cause angiectasis and permeability growth. Abundant TNF and other proinflammatory signals can be released under serious local inflammation, which activates macrophage and neutrophile granulocytes in circulation, as well as far macrophage (i.e., alveolar macrophages and intrahepatic Kupffre cells) [8]. These factors further activate disseminative inflammatory cells. The inflammation activation in the entire body leads to complete angiectasis, accelerated blood flow (high haemodynamics state), and anasarca.

Current clinical measures, such as anti-infection and nutrition support, have certain therapeutic effects on septicopyemia and acute kidney injury, but they fail to accomplish a satisfying long-term therapeutic effect. CRRT is a blood purification treatment technique that eliminates water and solutes continuously and slowly through the extracorporeal circulation blood purification method to replace the renal functions [9]. Unlike common hematodialysis, CRRT prolongs the blood purification treatment and decreases the therapeutic efficiency per unit time, which weakens the effects of solute concentration in the blood and volume changes on the body to the lowest point. It also utilizes a high-permeability and high-biocompatibility filter, which provides extremely important homeostasis balance to treat patients with serious diseases [10]. CRRT can remove excessive water, metabolic wastes, and toxicants; correct water and electrolyte disturbance; guarantee nutrition support; promote renal functional recovery; and eliminate different cytokines and inflammatory media. It has been widely employed in the treatment of patients with emergency and severe diseases.

This study discusses the curative effect of CRRT in patients with septicopyemia and acute kidney injury and its influence on serum inflammatory factors. Results demonstrate that the observation group exhibits a significantly better curative effect than the control group ($P<0.05$). Two groups had no statistically significant difference in the IL-1β, IL-6, TNF-α, PCT, and CRP levels ($P<0.05$) before the treatment. The IL-1β, IL-6, TNF-α, PCT, and CRP levels of both groups then decreased sharply ($P<0.05$) after the treatment. The IL-1β, IL-6, TNF-α, PCT, and CRP levels of the observation group were significantly lower than those of the control group ($P<0.05$). These results show that CRRT can effectively cure septicopyemia and acute kidney injury. Given that CRRT can enhance the extracorporeal circulation of patients, relieve the fluctuation of blood volume, eliminate excessive electrolytes and inflammatory media in bodies, and maintain the electrolyte balance, it can prevent organ damage and control the inflammation development. Thus, CRRT can improve the stability of the internal environment and provide nutritional supplement and drug therapy for patients according to their practical requirements.

Conclusion

CRRT can effectively decrease the serum inflammatory factors in patients with septicopyemia and acute kidney injury, as well as improve their inflammatory reactions. CRRT can thus be extensively applied because of its promising clinical therapeutic effect.

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