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Clinical study on acute renal failure treated with continuous blood purification

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ABSTRACT

Objective: To study the clinical effect of continuous blood purification on acute renal failure.

Methods: A total of 46 patients with acute renal failure treated with continuous renal replacement therapy in our hospital from April 2011 to December 2015 were retrospectively analyzed. Patients choosing continuous veno-venous hemofiltration (CVVH) mode were collected into CVVH group and patients choosing continuous venovenous hemodiafiltration (CVVHDF) mode were collected into CVVHDF group, and their general condition, hospitalization conditions and blood biochemical indexes were analyzed.

Results: Before and after treatment, the voided volumes and APACHE II scores of patients in CVVHDF group and CVVH group showed no differences. After treatment, the voided volumes of patients in the two groups were all higher than those before treatment and their APACHE II scores were all lower than those before treatment. The duration of continuous renal replacement therapy and the hospital stays in ICU of patients in CVVHDF group were all shorter than those in CVVH group. In CVVHDF group, the ratios of mechanical ventilation and death and the total hospitalization time had no significant differences with those in CVVH group. After treatment, the contents of blood urea nitrogen, serum creatinine, uric acid, β2 microglobulin, glutamic-pyruvic transaminase, aspartate transaminase, lactic dehydrogenase and creatine kinase isoenzyme of patients in CVVHDF group were all lower than those in CVVH group.

Conclusions: Continuous blood purification therapy possesses exact curative effect on acute renal failure. The cleanup effect of CVVHDF mode on solutes and its protective effect on heart and liver were all superior to those of CVVH mode.

1. Introduction

Acute renal failure (ARF) is common in the clinical critical disease characterized by sharp reduction of glomerular filtration rate, rapid accumulation of toxic metabolites in body and water-electrolyte and acid-base imbalance, which is mostly accompanied with multiple organ dysfunction and more likely to induce multiple organ dysfunction syndrome. These patients have a poor prognosis and show a higher mortality rate[1,2]. ARF has always been a difficulty in clinical treatment. Studies have reported that the mortality rate of ARF is more than 30%. It has become a heated research problem that how to correct the continuous renal function damage[3,4]. Severe trauma, massive blood loss and severe infection are all the common causes for ARF. The accumulation of toxic metabolites accompanied by renal function damage is the important part causing multiple organ function damage. Sweeping the toxic metabolites timely can improve the disease condition and prognosis[5,6]. Continuous renal replacement therapy (CRRT) is the important method in clinic to treat ARF, severe pancreatitis and multiple organ dysfunction and so on. The applied modes of our country are more likely to choose continuous veno-venous hemofiltration (CVVH), while continuous venovenous hemodiafiltration (CVVHDF) is popular in abroad[7–9].

At present, the research about the curative effect of the two CRRT modes (CVVH and CVVHDF) on ARF is insufficient. In

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the following research, we analyze the clinical effects of continuous blood purification on treating ARF.

2. Materials and methods

2.1. Clinical data

A total of 46 patients with ARF treated with CRRT in our hospital from April 2011 to December 2015 were retrospectively analyzed. Inclusion criteria for the cases are as follows: (1) all patients were consistent with the diagnosis of ARF that urine volume is less than 20 mL/h persisting for more than 6 h, diuretic treatment can't increase the urine output and serum creatinine (Scr) is more than 26.5 mmol/L for 2 or 2 times, or Scr elevates more than 50% in a short time; (2) the patients were treated with renal replacement therapy for the first time and the therapeutic regimen was CRRT, which included CVVH and CVVHDF; (3) the patients were not treated with hormones and immunosuppressant drug and so on; (4) patients accompanied with malignant tumors and autoimmune diseases were excluded.

2.2. Methods

2.2.1. Continuous blood purification therapy method

Femoral vein puncture maintained single-needle double-lumen catheters was conducted using Seldinger method which connected Prismaflex bedside blood purification system to perform treatment. The time for treatment persisted for 24 h and the replacement volume and blood flow volume were 80 mg/(kg·h) and 200 mL/min, respectively. The patients in CVVH group chose CVVH mode of which the blood filter was AN69-M1000 polypropylene eye film and displacement liquid was bicarbonate fluid replacement (5000 mL/bag). The patients in CVVHDF group chose CVVHDF mode of which the blood filter was AV600S polysulfone membrane and the displacement liquid was identical to that of CVVH group. The displacement liquid of the two groups was all generated online by hemofiltration apparatus with machine, which constituents were Na^+ (140 mmol/L), Cl^- (103 mmol/L), Ca^{2+} (1.5 mmol/L), Mg^{2+} (0.6 mmol/L), K^+ (3.5 mmol/L) and HCO_3^- (35 mmol/L).

2.2.2. Clinical efficacy evaluation

Medical records of patients in the two groups were analyzed and information of CRRT duration time, number of mechanical ventilation, number of death, hospital stays in ICU and total hospitalization time and so on was collected. At the end of dialysis before and after treatments, the severity of patient's condition was evaluated by APACHE II score and 24-h urine volumes of the patients were record. At day 3 before and after treatment, serum was collected and the contents of blood urea nitrogen (BUN), Scr, uric acid (UA), β2 microglobulin (β2-MG), glutamic-pyruvic transaminase (ALT), aspartate transaminase (AST), lactic dehydrogenase (LDH) and creatine kinase isoenzyme (CK-MB) were detected by fully automatic biochemical analyser.

2.2.3. Statistical methods

SPSS19.0 version software was used to input and analyze the data. Measurement data were expressed as mean ± SD and analyzed by *t*-test. Enumeration data were expressed as frequencies and analyzed by *Chi*-square. $P < 0.05$ was the standard to judge the difference having statistical significance.

3. Results

3.1. General clinical data of patients in the two groups

In CVVHDF group, 19 cases included 11 males and 8 females with the mean age of (37.6 ± 7.9) years. Pathogens were the follows: 6 cases of severe pneumonia, 3 cases of abdominal trauma complicated with abdominal cavity infection, 4 cases of severe pancreatitis, 4 cases of craniocerebral trauma and 2 cases of chest trauma. In CVVH group, a total of 27 cases included 16 males and 11 females with the mean age of (39.1 ± 7.3) years. Pathogens were the follows: 9 cases of severe pneumonia, 4 cases of abdominal trauma complicated with abdominal cavity infection, 5 cases of severe pancreatitis, 5 cases of craniocerebral trauma and 4 cases of chest trauma. The gender, age and composition of pathogens of patients in the two groups had no significant difference (Table 1).

Table 1
General clinical data of patients in the two groups.

General clinical data	CVVHDF group (n = 19)	CVVH group (n = 27)	P
Gender (male/female)	11/8	16/11	> 0.05
Age	37.6 ± 7.9	39.1 ± 7.3	> 0.05
Pathogens			
Severe pneumonia	6	9	> 0.05
Abdominal trauma complicated with abdominal cavity infection	3	4	> 0.05
Severe pancreatitis	4	5	> 0.05
Craniocerebral trauma	4	5	> 0.05
Chest trauma	2	4	> 0.05

3.2. General condition of patients in the two groups before and after treatment

The urine output and APACHE II score of patients in the two groups before and after treatment were undifferentiated. The voided volumes of patients in the two groups after treatment was all more than those before treatment [CVVHDF group: (334.2 ± 54.9) *vs.* (1704.1 ± 254.8) mL/day and CVVH group: (328.4 ± 49.5) *vs.* (1693.4 ± 227.9) mL/day] and APACHE II scores was all lower than those before treatment [CVVHDF group: (18.95 ± 2.96) *vs.* (11.33 ± 2.14) and CVVH group: (18.32 ± 2.75) *vs.* (11.81 ± 2.35)] (Table 2).

Table 2
General condition of patients in the two groups before and after treatment.

General condition		CVVHDF group (n = 19)	CVVH group (n = 27)	P
Voided volume (mL/day)	Before treatment	334.2 ± 54.9	328.4 ± 49.5	> 0.05
	After treatment	1704.1 ± 254.8*	1693.4 ± 227.9*	> 0.05
APACHE II score	Before treatment	18.95 ± 2.96	18.32 ± 2.75	> 0.05
	After treatment	11.33 ± 2.14*	11.81 ± 2.35*	> 0.05

*: The comparisons between before treatment and after treatment had differences, $P < 0.05$.