

Intervention Effect of Sequential Blood Purification on Early Morning Hypertension in Hemodialysis Patients

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Abstract: Objective: To investigate the effect of sequential blood purification on early morning hypertension in hemodialysis patients. **Methods:** A total of 76 hemodialysis patients who were admitted in the University of Chinese Academy of Sciences Shenzhen Hospital from June 2017 to August 2019 were selected and recruited in the present study. These patients were randomly divided into two groups, namely the control group and observation group. Each group consisted of 38 patients. The patients in the control group were treated with hemodialysis, while the patients in the observation group were treated with sequential blood purification. Early morning blood pressure was compared between the control group and observation group after 12 weeks of treatment. **Results:** There was no significant difference in blood pressure between the two groups of patients before treatment ($P>0.05$), whereas the blood pressure in the observation group was lower than that in the control group after the treatment, and the difference was statistically significant ($P<0.05$). **Conclusion:** The use of sequential blood purification treatment for hemodialysis patients can significantly reduce the blood pressure in the morning and is worthy of clinical use.

Keywords: Hemodialysis; Sequential blood purification; Early morning hypertension

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Hemodialysis is one of the renal replacement treatments for patients with acute and chronic renal failure. In the treatment, different hemodialysis programs corresponding to different treatment time

periods are referred to as sequential blood purification. Hypertension is a complication which is often associated with patients on hemodialysis. High blood pressure in the early morning is an important factor in triggering cardiovascular and cerebrovascular events. Early morning hypertension refers to blood pressure results measured at home that indicate hypertension within one hour after waking up in the morning and before taking any medication and breakfast. Alternatively, it refers to hypertension in dynamic blood pressure measurement which is taken two to six hours after waking up or early in the morning^[1-2]. The purpose of this study was to investigate the effect of sequential blood purification on early morning hypertension in hemodialysis patients. The research methodology and findings are reported as follows.

1 Materials and methods

1.1 General information and baseline characteristics

With the approval of the Medical Ethics Committee, 76 hemodialysis patients who were admitted to University of Chinese Academy of Sciences Shenzhen Hospital from June 2017 to August 2019 were selected and recruited. These patients were randomly divided into two groups, namely the control group and observation group. Each group consisted of 38 patients. In the control group, there were 21 male patients and 17 female patients who were aged 21 – 74 years, with an average age of 46.54 ± 12.38 years. On the other hand, there were 20 male patients and 18 female patients in the observation group who were aged 20 – 74 years, with an average age of 46.49 ± 12.33 years. The baseline characteristics between the control group and observation group were compared, and the difference was not statistically significant ($P>0.05$).

1.2 Selection criteria

(1) Inclusion criteria: Patients who were treated with hemodialysis and their clinical symptoms were stable; Patients with both systolic blood pressure and diastolic blood pressure were more than 140 mmHg and 90 mmHg respectively, and no antihypertensive drugs and other treatments were used during the treatment; Informed consent was obtained from patients and their family members.

(2) Exclusion criteria: Patients who were intolerant to this research method; Patients with mental illness; Patients with malignant tumors.

1.3 Methods

Hemodialysis was performed in patients of both control group and observation group using the hemodialysis machine from Chongqing Aokailong Medical Device Research Co., Ltd. SDL-2000H, high-throughput type: B-14H hollow fiber hemodialyzer from Bain Medical Equipment (Guangzhou) Co., Ltd., and extracorporeal blood circuit of PF-APF-BPF-C blood purification device from Pratt & Whitney Medical Co., Ltd.

1.3.1 Hemodialysis treatment in the control group

Blood was drained from the patient's body to the outside. After the dialyzer, blood and dialysate with similar body concentration are inside and outside the dialyzer, and material exchange is performed through the principles of dispersion, ultrafiltration, adsorption and convection. Metabolic waste was removed from patients, and electrolyte and acid-base balance were maintained. At the same time, excess water was removed from patients, and the purified blood was returned to patients. The hemodialysis treatment was performed for three times per week on each patient in the control group for a duration of 12 weeks.

1.3.2 Sequential blood purification treatment in the observation group

Hemofiltration was performed with Fresenius F80X dialyzer from Germany, and HA130 hemoperfusion device was used for hemoperfusion. Both the dialyzer and the perfusion device are disposable. The first week

of hemodialysis treatment is the same as that of the control group where hemodialysis was performed two times per week, and another hemofiltration treatment was also performed. The specific procedure is described in the following: during the blood purification process, a certain amount of replacement fluid is continuously added, mixed with the blood, and then the ultrafiltration was performed at the same rate. Excess water and toxins were removed from the body by filtration once a week.

Hemodialysis was performed two times in the second week, and another hemodialysis coupled with hemoperfusion was performed. The specific procedure of hemoperfusion is described in the following: the patient's blood was introduced into a perfusion device with a solid adsorbent, and the exogenous or endogenous toxins, drugs or metabolic waste were removed from the blood through adsorption in the dialysis. Sequential treatment was performed for 12 weeks.

1.4 Evaluation Index

(1) Blood pressure (systolic and diastolic blood pressure) was measured and compared between two groups of patients before and after 12 weeks of treatment.

1.5 Statistical analysis

Statistical Package for Social Sciences (SPSS), version 18.0, was used for data processing. Quantitative data were expressed in $\bar{x} \pm s$, and the data between groups were analyzed using independent samples *t* test, and paired sample *t* test was used for comparison within groups. $P < 0.05$ was considered statistically significant.

2 Results

There was no significant difference in blood pressure between the patients of control group and observation group before treatment ($P > 0.05$). Blood pressure in the observation group was lower than that in the control group after treatment, and the difference was statistically significant ($P < 0.05$) (Table 1).

Table 1. Comparison of early morning blood pressure between the control group and observation group ($\bar{x} \pm s$, mmHg)

Time	Group	Systolic blood pressure	Diastolic blood pressure
Before the treatment	Control group(n=38)	164.38±14.54	96.67±4.33
	Observation group(n=38)	164.41±14.49	96.71±4.31
	<i>t</i>	0.009	0.040
	<i>P</i>	0.993	0.968

Continued table 1

Time	Group	Systolic blood pressure	Diastolic blood pressure
After the treatment	Control group(n=38)	163.54±11.39	95.48±3.27
	Observation group(n=38)	135.26±8.76 ^a	81.05±2.34 ^a
	<i>t</i>	12.132	22.122
	<i>P</i>	0.000	0.000

Note: Compared with the same group before treatment, ^a $P < 0.05$

3 Discussion

During the period when the dialysis patient has just using hemodialysis (induction period), a high osmotic pressure will be resulted because the patient has accumulated a lot of metabolites in the body for a long time. Hemodialysis can only remove the metabolites in the blood vessels, but it cannot cross blood-brain barrier. Water will cause acute cerebral edema through the blood-brain barrier under the action of osmotic pressure. Therefore, the dialysis treatment usually begins with a short treatment time and then the treatment time will be increased so that the patients can go through the induction phase smoothly^[3-4].

The results of the present study showed that the blood pressure in the observation group after treatment was lower than that in the control group, indicating that the use of sequential blood purification treatment for hemodialysis patients can significantly reduce the blood pressure in the morning. Sequential blood purification is to apply blood purification in series or in series in different ways to make up for the shortcomings of their respective treatments and to enhance the ability of patients to remove poisons from the blood and support the function of corresponding organs^[5-6]. Compared with hemodialysis, hemodiafiltration has the advantages of small impact on hemodynamics and high clearance of intermediate molecular substances, and is a commonly used method for the treatment of dialysis with hypertension^[7]. Hemoperfusion is mainly used to rescue drugs and poisoning. It can also be used in combination with hemodialysis to remove macromolecular toxins from patients with chronic renal failure on dialysis, which is beneficial to remove blood pressure-related hormones. Therefore, sequential blood purification dialysis, hemofiltration, and hemoperfusion are used in series to reduce the patient's blood pressure more efficiently^[8-9].

In summary, the use of sequential blood purification treatment for hemodialysis patients can significantly reduce the early morning blood pressure of patients, which is worthy of clinical use.

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