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Original Article

Nursing effect of continuous blood purification therapy in treatment of severe sepsis

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Abstract: Objective: To explore the nursing effect of continuous blood purification therapy in the treatment of severe sepsis patients. Methods: A total of 142 patients with severe sepsis in our hospital were divided into two groups, 70 patients in the experimental group who received an optimize nursing plan, while 72 patients in the control group were given routine nursing intervention. The SF-36 questionnaire, nursing satisfaction and serious adverse events and complications were collected. Results: The nursing intervention effect of the two groups after intervention were improved before intervention ($P<0.05$), and the patient's quality of life between the two groups (SF-36 questionnaire) in the experimental group was increased compared to that of the control group after nursing intervention. The nursing satisfaction scores of the experimental group were obviously improved after receiving optimize nursing intervention, and the scores in the experimental group were much higher than in the control group after receiving the intervention, namely ($P<0.05$). Moreover, the occurrence of serious adverse events and complications in the experimental group was decreased compared to that in the control group, especially the occurrence of acid base imbalance ($P<0.05$). Conclusion: The patients with severe sepsis who received continuous blood purification therapy and optimized nursing intervention had shortened ICU hospitalization time, reduced mortality and complication rates, and improved nursing satisfaction and quality of life.

Keywords: Continuous blood purification therapy, severe sepsis, nursing effect, the quality of life

Introduction

Sepsis is defined as purulent pathogens that invade the blood stream and multiply in the blood, causing multiple purulent lesions of tissues and organs [1, 2]. Severe sepsis and septic shock remain the leading cause of death in patients with critical illness, moreover, because of its high mortality, if the intervention is improper or not timely, it is easy to cause complications such as acute respiratory distress syndrome and multiple organ failure, which poses a serious threat to the safety of patients [3, 4]. Clinically, we should take active and effective treatment measures to prevent further deterioration of the disease.

Continuous blood purification (CBP) is the main way to treat severe sepsis. It can reduce the systemic inflammatory response, curb the progress of sepsis by eliminating inflammatory factors, improve capillary permeability and reduce pulmonary interstitial edema [5]. In the process of blood purification, nursing intervention is needed to keep the arteries and veins unblocked, observe the changes of patients' vital signs and maintain the stability of circulation, and ensure the safety of patients in the process of blood purification treatment [6, 7]. At present, most routine nursing care focuses on following the doctor's advice, where the subjective initiative of nursing staff is poor, and they pay less attention to reducing the complications of blood purification, so they do not always give patients high-quality nursing service [8]. Comprehensive nursing intervention is patient-centered, providing comprehensive and systematic nursing measures, which can help make nursing intervention complete and scientific [9]. In this study, we aimed to investigate optimized nursing effects on continuous blood puri-

fication therapy in treatment of severe sepsis patients.

Data and methods

Clinical data

A total of 142 severe sepsis patients in our hospital from January 2018 to December 2020 were randomized and allocated into two group: the experimental group (n=70 cases) and the control group (n=72 cases). The researchers systematically explained the role, purpose and process of the study to the patients and their families. The patients and their families voluntarily signed the informed consent form to participate in this study. This study followed Standard Operating Procedures ensuring compliance with the principles of Good Clinical Practice and the Declaration of Helsinki and any applicable regulatory requirements. This research was approved by the First Affiliated Hospital of Hainan Medical University Clinical Research Ethics Committee, which included nine members in this ethics committee.

Inclusion and exclusion standards

Inclusive criteria: Conformed to the diagnostic standard of severe sepsis [10], and continuous blood purification related operational indications [11]: 1) admission to ICU, 2) had severe sepsis within 3 days, 3) one or more organ types of dysfunction such as (AKI, an abrupt loss of kidney function developing within 7 days), acute respiratory distress syndrome (ARDS, a medical condition characterized by wide-spread inflammation in the lungs), acute liver dysfunction, circulatory dysfunction, or multiple organ dysfunction syndrome, 4) all the subjects were clear-minded, without hearing and mental retardation, they were able to read and understand the questionnaire, 5) age: ≥18 years, 6) no history of mental illness, 7) the subjects were willing to cooperate and implement the experiment.

Exclusion criteria: 1) cardiac disorders, 2) had a history of coronary heart disease, diabetes, cerebral infarction or hypertension, 3) had a history of coronary heart disease, diabetes, cerebral complications or were unwilling to participate in our research.

Methods

The control group (CG): The subjects received routine nursing intervention. Nursing staff closely monitored the vital signs of patients. Body temperature was measured every 1 hour, blood pressure and pulse were measured every 15 minutes. Ultrafiltration rate and blood flow were adjusted according to the patient's vital signs and blood gas analysis results. Psychological counseling, diet nursing, nutritional support and health education were given.

The experimental group (EG): The subjects received an optimized nursing plan. This consisted of the following content: ① The nursing staff evaluated the patients according to the disease and psychological state of each subject, so as to determine the direction and content of nursing. ② Close observation of vital signs. The patients with severe sepsis were treated with blood purification and ECG monitoring. The pulse and blood pressure were measured every 15 minutes, and the temperature was measured every hour. The blood flow and ultrafiltration rate were adjusted according to the changes of vital signs. If the blood pressure was too low, the dose of dopamine was increased, or albumin or plasma was infused. ③ Maintain circulation stability. During the treatment, severe sepsis patients may have high fever symptoms, and even lead to problems such as faster breathing, increased heart rate and increased hypoxia. Therefore, it is necessary to adjust the replacement fluid and reduce the blood temperature in combination with the actual situation of patients, so as to avoid the occurrence of adverse reactions. In addition, the blood circulation of patients' limbs should be observed, and the urine volume, urine color and shape should be strictly recorded. ④ Catheter care. In the process of treatment, we ensured that the catheter was unblocked, avoid bleeding or obstruction, reasonably adjust the patient's position, ensure the pipeline is unblocked, and regularly use 0.9% sodium chloride injection to clean the pipeline. ⑤ position, ensure the pipeline is unblocked, and regularly use 0.9% sodium chloride injection to clean the vascular access and blood filter should be closely observed to avoid coagulation problems. Anticoagulants were used immediately in case of blood color change, blood coagulation and other problems. Bleeding was closely

Table 1. Comparison of clinical data between the two groups

	Experimental group (n=70)	Control group (n=72)	t/χ^2	*P*
Age (years)	72.1±7.47	69.75±11.23	9.65	0.47
Sex			4.18	0.32
Male (n%)	42 (60%)	44 (61.1%)		
Female (n%)	28 (40%)	28 (38.9%)		
BMI	19.15±0.85	19.7±1.23	5.19	0.12
Original infection site			22.83	0.34
Severe pneumonia	15 (21.4%)	17 (23.6%)		
Blood stream infection	20 (28.6%)	19 (26.4%)		
Gastrointestinal and abdominal cavity infection	10 (14.3%)	8 (11.1%)		
Central nervous system infection	9 (12.9%)	11 (15.3%)		
Urinary system infection	6 (8.6%)	7 (9.7%)		
Osteomyelitis	4 (5.7%)	5 (6.9%)		
Other infections	6 (8.6%)	5 (6.9%)		
Complication			16.73	0.52
ARDS	11 (15.7%)	13 (18.1%)		
Gastrointestinal dysfunction	16 (22.9%)	19 (26.4%)		
Cardiac dysfunction	15 (21.4%)	14 (19.4%)		

Note: Compared with the control group, significant difference as P<0.05.

observed, and the dosage of anticoagulants was adjusted when needed. In the process of blood purification treatment, we paid close attention to whether the patient's stool was abnormal, carefully observed whether there was bleeding points on the patient's skin and mouth, and reported to the doctor immediately once bleeding was found. ⑥ Strengthen the observation of electrolyte changes. If the blood potassium concentration was too high, it was adjusted to 2.0 mmol/L with a potassium replacement solution, and the blood potassium concentration was detected regularly to avoid hypokalemia. ⑦ Strengthen nutrition support. During the treatment of continuous blood purification, we paid attention to heat and nutrition.

Evaluation standards of clinical therapeutic effects

① SF-36 questionnaire [12, 13]: It was developed by the American Medical Outcomes Research Group in 1992. The scale includes eight dimensions: physiological function, psychological function, physical pain, emotional function, social function, and mental health. According to the different weights of each item in the scale, the sum of the scores of each item in the subscale was calculated and converted into the standard score of 0-100. The higher the score, the higher the quality of life. ② Nursing satisfaction: Nursing satisfaction = (number of very satisfied cases + number of satisfied cases)/total cases × 100%. ③ Serious adverse events and complications: Serious adverse events were observed during the study.

Statistical analysis

All data were analyzed by SPSS 22.0. The statistical results are expressed by mean ± standard deviation ($\bar{x}$±sd), the data comparison was conducted by t-test and the correlation analysis was conducted by person linear phase, P<0.05 was the difference with statistical significance. Analyses were performed using Graph Pad Prism 7 Software (Graph Pad Prism, San Diego, CA).

Results

Clinical data

As shown in the **Table 1**. During the study, a total of 142 patients were included, this involved 70 patients in the experimental group, with a mean age of (72.1±7.47) years, while in the control group, there was a mean age of (69.75±11.23) years. The BMI in the experimental group was (19.15±0.85) kg/m^2, and in the control group was (19.7±1.23) kg/m^2, there was no statistical significance between two

Table 2. Comparison of SF-36 questionnaire between the two groups after intervention (points, $\bar{x}\pm sd$)

	time	Experimental group (n=70)	Control group (n=72)	t	*P*
Physiological function	Before intervention	74.48±4.19	71.24±4.53	7.89	0.069
	After intervention	92.27±4.44	83.36±3.95	14.83	0.021
	t	22.19	18.58	-	-
	P	0.001	0.004	-	-
Psychological function	Before intervention	72.31±6.58	73.32±4.86	3.54	0.27
	After intervention	90.15±5.42	79.93±5.47	26.12	0.001
	t	19.21	8.25	-	-
	P	0.002	0.025	-	-
Physical pain	Before intervention	74.54±4.53	75.53±3.09	2.14	0.17
	After intervention	94.28±3.89	84.55±4.92	10.32	0.027
	t	26.11	17.55	-	-
	P	0.004	0.009	-	-
Emotional function	Before intervention	76.34±6.37	75.31±6.19	3.24	0.42
	After intervention	94.31±5.89	80.28±6.42	16.22	0.019
	t	16.91	12.45	-	-
	P	0.0001	0.0001	-	-
Social function	Before intervention	72.21±6.37	70.31±4.09	4.14	0.31
	After intervention	93.15±6.89	85.39±2.32	9.92	0.025
	t	22.91	7.15	-	-
	P	0.002	0.041	-	-
Mental health	Before intervention	70.67±4.37	69.31±8.09	2.54	0.27
	After intervention	91.11±5.19	79.29±4.32	16.32	0.001
	t	29.91	17.15	-	-
	P	0.002	0.004	-	-

Note: Compared with the control group, significant difference as P<0.05.

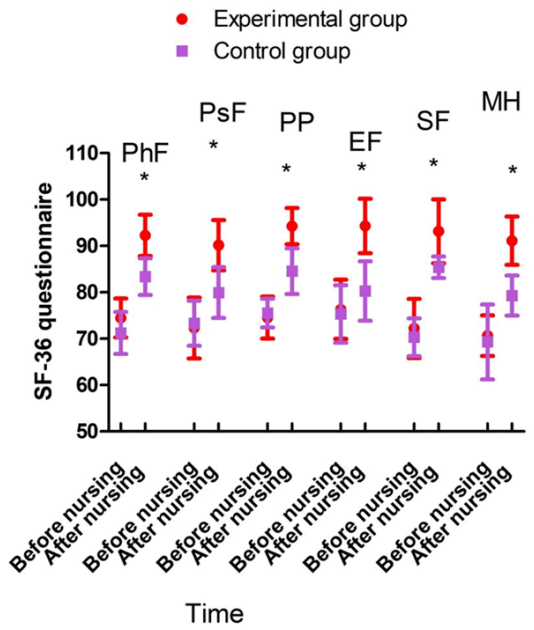

Figure 1. Comparison of SF-36 questionnaire between the two groups before and after intervention. Note: Compared with control group, **P<0.05.*

groups (P=0.12). Organ infections, was the basic cause leading to severe sepsis in 142 cases, there were severe pneumonia cases (n=32), blood stream infections (n=39), central nervous system infections (n=20), gastrointestinal and abdominal cavity infections (n=18), urinary system infections (n=13, osteomyelitis (n=9), and other infections (n=11). The ratio of severe pneumonia was 21.4% in experimental group, which was lower than that in control group (23.6%, P>0.05). The complications for the 142 patients with severe sepsis included ARDS (n=24), gastrointestinal dysfunction (n=35), and circulatory dysfunction (n=29). The ratio of complications was not different between two groups (P>0.05).

Assessment of the patient's quality of life between the two groups (SF-36 questionnaire)

As shown in **Table 2** and **Figure 1**, the score of physiological function before nursing in the experimental group was (74.48±4.19) points, and

Table 3. Comparison of nursing satisfaction between the two groups

Group	Number of cases	Basically Satisfaction	Satisfaction	Very Satisfaction	Satisfaction Rate
Experimental group	70	24 (34.3%)	28 (40%)	15 (21.4%)	67 (95.7%)
Control group	72	19 (26.4%)	24 (33.3%)	11 (15.3%)	54 (75%)
T	-	6.32	2.92	3.29	5.47
P	-	0.043	0.64	0.23	0.032

Note: Compared with the control group, significant difference as P<0.05.

Table 4. Comparison of serious adverse events between the two groups after intervention ($\bar{x}$±sd)

group	Number of cases	Bleeding at the puncture site	Electrolyte disorder	Acid base imbalance
Experimental group	70	9 (12.9%)	20 (28.6%)	6 (8.6%)
Control group	72	17 (23.6%)	26 (36.1%)	14 (19.4%)
t	-	7.82	3.67	9.27
P	-	0.046	0.19	0.012

Note: Compared with the control group, significant difference as P<0.05.

that after nursing was (92.27±4.44) points, while the score of physiological function before nursing in the control group was (71.24±4.53) points, and that after nursing was (83.36±3.95) points. The score of psychological function before nursing had no significant difference between the two groups ((72.31±6.58) VS. (73.32±4.86), P=0.27>0.05), while there was an obvious difference between two groups after nursing ((90.15±5.42) VS. (79.93±5.47), P<0.05). The physical pain in the experimental group before and after nursing was respectively (74.54±4.53) points and (94.28±3.89) points, while that in the control group was respectively (75.53±3.09) points and (84.55±4.92) points. The score of emotional function before nursing had no significant difference between two groups ((76.34±6.37) VS. (75.31±6.19), P = 0.42>0.05); while there was a difference between the two groups after nursing ((94.31±5.89) VS. (80.28±6.42), P<0.05). The score of social function before nursing had no significant difference between two groups ((72.21±6.37) VS. (70.31±4.09), P=0.31), while there was an obvious difference between the two groups after nursing ((93.15±6.89) VS. (85.39±2.32), P<0.05). The score of mental health in the experimental group before and after nursing were respectively (70.67±4.37) points and (91.11±5.19), and that in the control group were respectively (69.31±8.09) points and (79.29±4.32) points. The SF-36 questionnaire of patients (physiological function, psychological function, physical pain, emotional function, social function, and mental health) in the experimental group improved more significantly compared with the control group, and the difference was statistically significant.

Nursing satisfaction

The patients who were basically satisfied with nursing in the experimental group was 24 cases, and that in the control group was 19 cases, there was an obvious difference between two groups (P<0.05). The patients who were satisfied and very satisfied with nursing in the experimental group was 28 cases and 15 cases, and that in the control group it was 11 cases and 54 cases. The rate of satisfaction in the experimental group was 95.7% (67/70), and that in the control group was 75% (54/72), there was an obvious difference between the two groups (P<0.05), which indicated that an optimized nursing plan can improve the satisfaction rate and the relationship between doctors and patients (**Table 3**).

Serious adverse events

The occurrence of bleeding at the puncture site was significantly lower in the experimental group than in the control group (12.9% vs. 23.6%, P<0.05). Among the total 142 patients, there were 46 patients who developed electrolyte disorders (hyponatremia, hypernatronemia, hypokalemia, etc.), which included 20 patients in experimental group and 26 patients in control group (P>0.05). There was a significant difference in the occurrence of acid base imbalance between both groups (8.6% vs. 19.4%, P<0.05) (**Table 4**).

Table 5. Comparison of outcome between the two groups after intervention ($\bar{x}\pm sd$)

Group	Number of cases	Mortality	Survive
Experimental group	70	19 (27.1%)	51 (72.9%)
Control group	72	22 (30.6%)	50 (69.4%)
T	-	1.281	2.176
P	-	0.226	0.169

Note: Compared with the control group, significant difference as P<0.05.

Outcome

The overall mortality rate of the study population was 28.9%. The mortality in the experimental group (19/70) which was less than that in the control group (22/72), but there was no significant difference in mortality between the two groups (P=0.226) (**Table 5**).

Discussion

Sepsis is a severe systemic inflammatory reaction caused by infection or trauma. Continuous blood purification therapy introduces blood into the purification device to remove inflammatory substances, and then transfuses the purified blood back into the body. Because blood purification treatment requires long-time catheterization, the risk of complications is high [14]. It is very important to carry out comprehensive nursing measures to improve and consolidate the prognosis and curative effect of patients with sepsis.

Optimized nursing intervention is a patient-centered, providing comprehensive and systematic nursing measures, which make nursing intervention complete and scientific. As shown in our study, the patient's quality of life (SF-36 questionnaire) and the incidence of complications in the experimental group were improved compared to those in the control group, suggesting that optimized nursing intervention can improve the health status of patients with severe sepsis treated by continuous blood purification and reduce the incidence of complications. Furthermore, optimized nursing intervention could increase the satisfaction rate and the relationship between doctors and patients.

Optimized nursing intervention can effectively reduce the occurrence of adverse events such as blood coagulation and blockage, improve the quality of blood purification, shorten the catheterization time, ensure the smooth progress of blood purification, improve the physiological health of patients, purify the operation procedures of instruments and pipelines, and ensure the normal operation of instruments and pipelines [15-17]. Secondly, nursing staff pay close attention to the vital signs of patients, they ensure the normal clinical indicators and smooth blood operations, improve the treatment effect and promote good prognosis of the disease. Moreover, nurses pay attention in order to understand the blood coagulation of patients, and give appropriate anticoagulant drugs, so as to effectively prevent thrombosis, reduce the occurrence of related complications, improve the quality of blood purification, and promote the rehabilitation of patients [18, 19]. Moreover, Nurses strengthen the disinfection work in nursing work, in order to reduce nursing errors, and reduce the infection rate of treatment [20]. Last but not least, the optimized nursing model can improve the relationship between nurses and patients, improve patient satisfaction, and improve the medical environment.

Inevitably, our research had some weakness. Firstly, our current study is a small sampled single center trial. Particularly, the number of critically sepsis patients was limited with a strict selection criteria. Secondly, although our results are promising, but the explanation is inadequate by lack of research on the mechanism. Thirdly, we could not avoid the influence of selection bias on this research. In our study, we only included serious sepsis patients, other population who are in need of receiving continuous blood purification therapy should be included.

In conclusion, patients with severe sepsis who received continuous blood purification therapy and optimized nursing intervention have shortened ICU hospitalization time, reduced mortality and complication rates, as well as improved nursing satisfaction and quality of life.

Disclosure of conflict of interest

None.

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