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Review Article

Study on the effects of high-quality nursing combined with micro-pump injection of norepinephrine on hemodynamics and complications in patients with septic shock

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Abstract: High-quality nursing combined with micro-pump injection of norepinephrine can improve hemodynamics and reduce complications in patients with septic shock. From February 2017 to September 2019, a total of 74 septic shock patients who were treated in our hospital were selected and randomly divided into two groups according to different nursing methods. In the control group (CG), patients were treated with routine nursing methods (31 cases) during the course of micro-pump injection of norepinephrine therapy, while patients in the intervention group (IG) were treated with high-quality nursing methods (43 cases). After treatment, the indexes of hemodynamics and inflammatory factors were observed. The adverse reactions of patients were observed in the two groups during the nursing. Chronic Health (APACHE II) Score and Sequential Organ Failure Assessment (SOFA) were used to evaluate the patients' condition. A self-made nursing satisfaction questionnaire was used to evaluate the nursing satisfaction in the two groups. The quality of life was evaluated according to QLQ-C30 in the two groups. The survival rate within 28 days after intervention was observed in both groups. After nursing, there was no significant difference in hemodynamic indices between the two groups. After nursing, APACHE II and SOFA scores of patients in the IG were significantly lower than those in the CG. After nursing, the level of inflammatory factors in the IG was significantly lower than that in the CG. After nursing, the incidence of complications in the IG was significantly lower than that in the CG. After nursing, the quality of life score and nursing satisfaction score of the IG were significantly higher than those of the CG. The mortality rate within 28 days after nursing in the IG was significantly lower than that in the CG. High-quality nursing can significantly improve the quality of life and hemodynamics, reduce the incidence of complications during treatment and stabilize the vital signs for septic shock patients treated with micro-pump injection of norepinephrine.

Keywords: High-quality nursing, micro-pump injection of norepinephrine, septic shock patients, hemodynamics, complications

Introduction

Septic shock is an important public health problem in the world, causing more than 5.3 million deaths every year [1]. Moreover, the high incidence rate, population aging and other complications continue to increase [2, 3]. The common treatments for septic shock include rapid use of antibiotics, etc. However, due to the complexity of the etiology and pathogenesis of septic shock, early personalized diagnosis and prognosis are still challenging [4, 5]. Besides the treatment of potential infection, the main methods of septic shock treatment are vasopressor and intravenous infusion therapy. Studies have shown that norepinephrine is a first-line vasopressor [6]. This study was designed to explore the prognosis and clinical effect of high-quality nursing combined with micro-pump injection of norepinephrine on septic shock patients.

Norepinephrine is a key molecule that is involved in a wide range of physiological processes [7]. Clinically, norepinephrine has always been the first choice of vasopressors, which can treat septic shock by targeting pro-inflammatory mediators [8]. Clinical studies have shown that patients with septic shock progress rapidly and it also affects multiple sys-

tem functions, and nursing programs for septic shock can effectively improve the medical effects [9]. This study was designed to apply high-quality nursing to intervene with the treatment of septic shock patients. High-quality nursing is a kind of nursing intervention for individual patients, which can deepen the professional connotation of nursing staff and improve the level of nursing service [10, 11]. Some studies have shown that high-quality nursing can provide psychological guidance for patients, reduce the psychological burden of patients and speed up the recovery of body functions [12]. Its nursing value has been confirmed, and high-quality nursing has been widely used in a variety of diseases, and the effects are relatively ideal [13]. Some studies have shown that high-quality nursing intervention on septic shock can further improve the prognosis of patients.

At present, there are few studies on the treatment of septic shock patients by high-quality nursing intervention combined with micro-pump injection of norepinephrine. This study was designed to explore the application value of high-quality nursing methods in the treatment of septic shock patients with micro-pump injection of norepinephrine, aiming to provide a feasible nursing intervention for the treatment of patients with septic shock by micro-pump injection of norepinephrine.

Materials and methods

Baseline data

From February 2017 to September 2019, a total of 74 septic shock patients were treated in Zhangjiagang TCM Hospital Affiliated with Nanjing University of Chinese Medicine, these patients were selected and divided into the IG (43 cases) and the CG (31 cases). In the CG, patients were treated with routine nursing methods during the course of micro-pump injection of norepinephrine therapy, while patients in the IG were treated with high-quality nursing methods. In the IG, there were 26 males and 17 females, aged 27-62 years old, with an average age of (47.61±3.61) years old. In the CG, there were 18 males and 13 females, aged 25-66 years old, with an average age of (47.01± 3.17) years old.

Inclusion and exclusion criteria

Inclusion criteria: All patients met the diagnostic criteria for septic shock [14]. Patients had independent thinking ability, complete general clinical data, systemic inflammatory response syndrome and blood pathogen culture (+), and the expected survival time was ≥1 month. The study was approved by the Ethics Committee of Zhangjiagang TCM Hospital Affiliated with Nanjing University of Chinese Medicine. The study participants and their families had been informed and signed the fully informed consent form.

Exclusion criteria were as follows: Mental diseases or family history of mental diseases, end-stage diseases, dropped out of the experiment midway, comorbid with acute coronary syndrome, lost patients to follow-up.

Nursing methods

In the CG, patients were treated with the routine nursing mode: The medical staff prepared the dosage of micro-pump injection of norepinephrine, helped the patients to learn basic health education, regularly monitored the patients' vital signs, monitored the changes of the patients' urine color and urine volume by indwelling catheter, gave the patients preventive care for complications before treatment, and gave them a comfortable ward environment.

In the IG, patients were treated with a high-quality nursing mode: (1) The preparation of medication and infusion tools: nursing staff had to master the balance between speed and measurement, which was of great importance to rescue patients. The name, dosage, concentration and speed of the drugs were recorded in detail on the record sheet, and were given to the next nurse in detail. According to the doctor's advice, the infusion speed was adjusted at any time on the basis of the patient's different changes in condition. According to patients' different infusion methods, medical staff took care of central venous catheterization, kept the pipeline unobscured, fixed the catheter and protected the catheter to prevent accidental extubation. It was also necessary to understand that norepinephrine cannot be mixed with alkalinity or other drugs, and norepinephrine must be injected out of the light. At the same time, it was necessary to carefully observe whether the infusion speed of medication was consistent with the remaining dose of medicine. It was also necessary to strictly implement the standard operating procedures of the micro pump. For example, first the operation of the infusion pump was suspended, and

then the syringe was replaced. It was necessary to ensure that the connection between all parts was tight, and then the operation of the infusion pump was started. This was to prevent blood pressure fluctuation in patients caused by operation error. (2) Ward environmental nursing: The medical staff provided each patient with a separate treatment room and performed disinfection. In and out of the ward, medical staff had to wear isolation clothes and hats, and strictly implement aseptic operations to avoid cross-infection. Medical staff also provided each patient with special inspection equipment and facilities. Before and after use, the facilities were strictly disinfected to avoid infection. (3) Psychological intervention: Nursing staff always inquired about patients' feelings, strengthened communication with patients, gave specific explanations to ease patients' doubts, and helped communicate with each patient to assist in effectively reducing patients' psychological pressure, anxiety and panic about the disease. Nursing staff established a trusting relationship between nurses and patients, helped patients to view diseases correctly and asked family members to give patients more encouragement, comfort and spiritual support during visits. (4) Observation of the condition: Nursing staff continuously and dynamically detected blood pressure changes of patients. Depending on the patient's condition, norepinephrine input was decreased, increased, or suspended at any time. The indwelling central venous catheter was connected with an invasive pressure measuring device, and the drug dosage was adjusted according to the value of CVP. The medical staff closely observed whether there was local leakage at the injection site and whether the indwelling needle slipped out of the blood vessel. If this occurred, the injection site was changed immediately. Because patients in shock often have low body temperature, it is necessary to pay attention to the temperature in the ward and provide heat preservation measures. (5) Nursing of complications: Indwelling catheter needed to be kept unblocked for drainage flow, to avoid retrograde infections. Vulva and urethral outlets were disinfected with iodophor. The medical staff closely observed whether the patient's blood pressure dropped sharply or not, as well as patient's changes in consciousness.

Outcome measures

After nursing, the heart rate (HR), mean arterial pressure (MAP), cardiac index (CI), systemic vascular resistance index (SVRI) and central venous pressure (CVP) were observed in the two groups.

Acute physiology and chronic health (APACHE II) score was used to evaluate the prognosis of patients. APACHE II score had three indicators, with a total score of 71. The higher the score, the worse the patient's condition.

SOFA was used to evaluate patients. When the SOFA score changed ≥2 per day, it indicated an acute change in organ failure. The higher the score, the worse the prognosis.

Serum inflammatory factors procalcitonin (PCT), C-reactive protein (CRP) and tumor necrosis factor-α (TNF-α) levels were observed. Among them, the levels of serum inflammatory factors PCT, CRP and TNF-α were determined by enzyme-linked immunosorbent assay (ELISA), which was strictly conducted in accordance with the instructions of the kits: human PCT ELISA, human CRP ELISA and human TNF-α ELISA (Hengfei Biotechnology Co., Ltd., Shanghai, China, SEA689Hu-1, K001607P, 130-110-101).

During treatment and nursing, the adverse reactions of patients were observed in the two groups.

The quality of life of patients was evaluated in the two groups by using the quality of life measurement table, which included physical function, cognitive function, emotional function, role function and social function. Each item had 100 points. The higher the score, the better the quality of life.

The self-made "nursing satisfaction questionnaire" of our hospital was used to evaluate the patients' nursing satisfaction, mainly including attitude, character, wearing, operation proficiency, etc. There were 20 questions in total, with 5 marks for each question. A score of < 70 meant dissatisfaction, 70-89 meant basically satisfactory, and ≥90 meant satisfaction. Satisfaction Degree = (Satisfaction + Basically satisfactory)/Total Cases ×100%.

Table 1. Comparison of the baseline data of patients in both groups [n (%)] (x±sd)

Classification	IG (n=43)	CG (n=31)	t/χ^2 value	*P* value
Gender			0.043	0.836
Male	26 (60.47)	18 (58.06)		
Female	17 (39.53)	13 (41.94)		
Age/years old	47.61±3.61	47.01±3.17	0.742	0.461
BMI (kg/m^2)	22.8±3.6	21.2±3.5	1.908	0.060
Place of residence			0.259	0.610
City	22 (51.16)	14 (45.16)		
Rural	21 (48.84)	17 (54.84)		
Nation			0.006	0.995
Han nationality	25 (58.14)	18 (58.06)		
Minority nationality	18 (41.86)	13 (41.94)		
Educational background			1.894	0.169
≥ high school	14 (32.56)	15 (48.39)		
< high school	29 (67.44)	16 (51.61)		
Infection locations			0.757	0.685
Pulmonary infection	18 (41.86)	14 (45.16)		
Catheter infection	10 (23.26)	9 (29.03)		
Soft tissue infection with large area	15 (34.88)	8 (25.81)		
Smoking history			0.114	0.736
Yes	28 (65.12)	19 (61.29)		
No	15 (34.88)	12 (38.71)		
Drinking history			0.683	0.408
Yes	29 (67.44)	18 (58.06)		
No	14 (32.56)	13 (41.94)		
Diabetes history			1.217	0.269
Yes	25 (58.14)	14 (45.16)		
No	18 (41.86)	17 (54.84)		

Table 2. Comparison of hemodynamic parameters of patients in the two groups (x±sd)

Grouping	n	HR (times/min)	MAP (mmHg)	CI [L/(min·m)]	SVRI (KP/L)	CVP (mmHg)
IG	43	95.21±5.01	72.13±5.03	4.11±0.31	117.08±10.03	7.12±1.21
CG	31	96.18±7.08	72.53±4.89	4.18±0.48	116.36±5.03	7.19±1.06
t	-	0.691	0.367	0.762	0.367	0.258
P	-	0.492	0.714	0.448	0.715	0.796

The mortality rate within 28 days after intervention was observed and calculated in both groups.

Results

Baseline data

There was no significant difference between the two groups in clinical baseline data such as gender, age, BIM, place of residence, nationality, education background, infection location, smoking history, drinking history, and diabetes history (P > 0.05) (**Table 1**).

Comparison of hemodynamic parameters of patients in the two groups

There was no significant difference in HR, MPA, CI, SVRI and CVP levels between the two groups after nursing (P > 0.05) (**Table 2**).

APACHE II and SOFA scores of patients in the two groups

Before nursing, the APACHE II and SOFA scores of patients were not significantly different in the two groups. While the APACHE II and SOFA scores of the IG after nursing were significan-

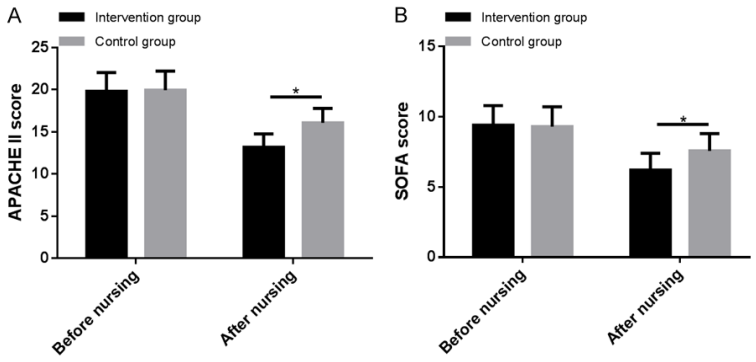

Figure 1. APACHE II and SOFA scores of patients in the two groups. A. There was no difference in APACHE II scores before nursing between the two groups. After nursing, APACHE II scores in the IG were significantly lower than those in the CG. B. There was no difference in SOFA scores before nursing between the two groups. After nursing, SOFA scores in the IG were significantly lower than those in the CG.

tly lower than those of the CG ($P < 0.05$) (**Figure 1**).

Comparison of inflammatory factors of patients between the two groups

Before nursing, the expressed concentrations of inflammatory factors PCT, CRP and TNF-α had no significant difference between the two groups ($P > 0.05$). While the expressed concentrations of inflammatory factors PCT, CRP and TNF-α after nursing in the IG were lower than those in the CG ($P < 0.05$) (**Figure 2**).

Incidence of complications of patients in the two groups

In both groups, complications developed in patients during the nursing process. The results showed that the incidence of complications after nursing in the IG was significantly lower than that in the CG ($P < 0.05$) (**Table 3**).

Comparison of quality of life of patients in the two groups

After nursing, the quality of life scores in the IG were significantly higher than those in the CG ($P < 0.05$) (**Table 4**).

Comparison of nursing satisfaction of patients between the two groups

In the IG, there were 28 cases of great satisfaction (65.12%), 11 cases of satisfaction (25.58%) and 4 cases of dissatisfaction (9.30%), with a nursing satisfaction of 90.70%. In the CG, there were 10 cases of great satisfaction (32.26%), 12 cases of satisfaction (38.71%) and 9 cases of dissatisfaction (29.03%), with a nursing satisfaction of 70.97%. After nursing, the nursing satisfaction of the patients in the IG was significantly higher than that of the patients in the CG ($P < 0.05$) (**Table 5**).

Mortality rate within 28 days after intervention in both groups

The mortality rate was 7 (16.28%) cases in the IG and 12 (38.71%) cases in the CG within 28 days after intervention. The mortality rate of the IG was significantly lower than that of the CG within 28 days ($P < 0.05$) (**Figure 3**).

Discussion

Septic shock is a life-threatening disease [15]. With the increase in the number of patients, septic shock has become a difficulty and focus of clinical treatment. Its symptoms are highly variable, so it is difficult to diagnose and evaluate its severity [16, 17]. Hemodynamics and liver function impairment are major problems in patients with septic shock [18]. Clinical evidence has shown that norepinephrine is the main vasopressor used for the recovery of septic shock [19].

In this study, high-quality nursing was applied to carry out nursing intervention on septic shock patients who were treated by micro-pump injection of norepinephrine, and it was found that the patient's condition clearly improved after nursing intervention. The nursing mode provided comprehensive and targeted professional nursing for each patient [20, 21]. In the studies of Fenton-Jones M et al. [22], professional care for children with early septic shock can effectively identify diseases and improve the long-term prognosis of children. The results of this study showed that there was no significant difference in hemodynamic indexes of patients between the two groups after nursing, indicating that micro-pump injection of norepinephrine could effectively improve the hemodynamic level of patients with septic shock, which had nothing to do with nursing

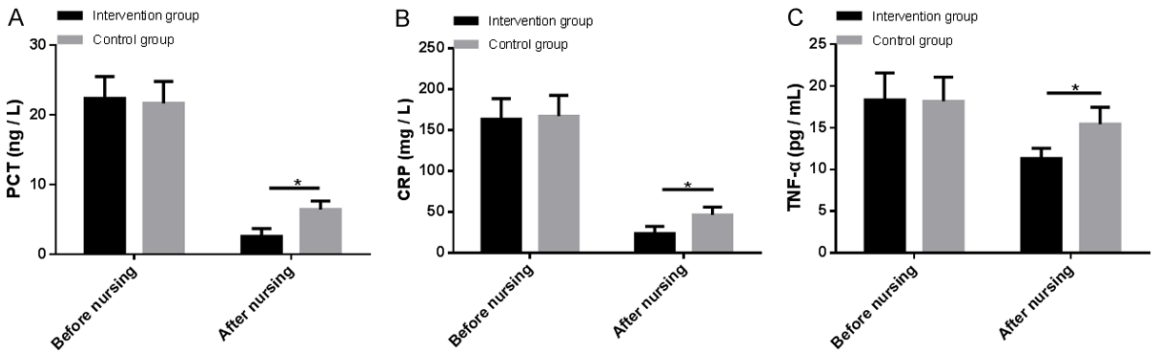

Figure 2. Comparison of inflammatory factors of patients between the two groups. A. There was no difference in PCT concentration between the two groups before nursing. After nursing, PCT concentration in the IG was significantly lower than that in the CG. B. There was no difference in CRP concentration between the two groups before nursing. After nursing, CRP concentration in the IG was significantly lower than that in the CG. C. There was no difference in TNF-α concentration between the two groups before nursing. After nursing, TNF-α concentration in the IG was significantly lower than that in the CG.

Table 3. Incidence of complications of patients after nursing in the two groups [n (%)]

Items	IG (n=43)	CG (n=31)	χ^2 value	*P* value
Palpitation	0 (0.00)	2 (6.45)	2.851	0.091
Vomiting	2 (4.65)	5 (16.13)	2.771	0.096
Vertigo	1 (2.33)	3 (9.68)	1.904	0.168
Incidence of complications	3 (6.98)	10 (32.26)	7.950	0.005

Table 4. Comparison of quality of life scores of patients after nursing in the two groups (x±sd)

Quality of life scores	IG (n=43)	CG (n=31)	t value	*P* value
Quality of life	77.83±5.02	64.03±3.46	13.200	< 0.001
Physical function	72.17±5.44	61.01±4.03	9.662	< 0.001
Emotional function	75.02±6.61	62.19±4.16	9.523	< 0.001
Role function	78.83±7.58	60.03±6.35	11.250	< 0.001
Social function	79.03±8.03	65.23±7.35	7.554	< 0.001

Table 5. Nursing satisfaction of patients after nursing in the two groups [n (%)]

Items	IG (n=43)	CG (n=31)	χ^2 value	*P* value
Great satisfaction	28 (65.12)	10 (32.26)	-	-
Satisfactory	11 (25.58)	12 (38.71)	-	-
Dissatisfaction	4 (9.30)	9 (29.03)	-	-
Nursing satisfaction	39 (90.70)	22 (70.97)	4.842	0.028

mode. Studies have shown that APACHE II and SOFA scores can predict the treatment success and prognosis of septic shock patients [23, 24]. This study was designed to include two scores to evaluate the effect of two nursing modes on septic shock patients. The research results showed that APACHE II and SOFA scores of patients in the IG after nursing were significantly lower than those in the CG, which indicated that high-quality nursing intervention can improve the condition of septic shock patients who were treated with micro-pump injection of norepinephrine. This study was also designed to compare the inflammatory reactions of patients after nursing in the two groups. Studies have shown that comprehensive high-quality nursing can not only improve the quality of life, anxiety and depression of patients, but also inhibit inflammatory and stress reactions and reduce the incidence of complications [25]. However, the results showed that the level of inflammatory factors after nursing in the IG was significantly lower than that in the CG, which indicated that high-quality nursing can significantly improve the level of inflammation in patients. We observed the complications in the nursing process in the two groups and found that complications in the nursing process of the patients in the IG were significantly lower than those in the CG, indicating that high-quality nursing can provide more comprehensive care to patients and reduce complications.

The quality of life score reflected the recovery effect of patients after treatment and surgery. The research showed that survivors of septic

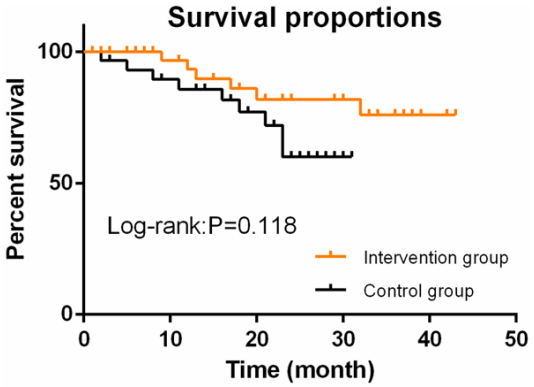

Figure 3. Mortality rate within 28 days after intervention in both groups.

shock patients have reduced quality of life and increased mortality because of residual inflammatory reactions and immune function impairment in the body. Therefore, this study was designed to give high quality nursing to septic shock patients who were treated with micro-pump injection of norepinephrine. It was found that the quality of life of patients in the IG was significantly higher than that in the CG after nursing, which indicated that high quality nursing for patients can improve the patients' self-recovery consciousness and the quality of life. We also further compared the satisfaction of patients after nursing in the two groups. Statistics showed that the satisfaction of the IG who received high-quality nursing was higher than that of the CG; which also showed that patients preferred to receive high-quality nursing intervention. We also compared the mortality rate of patients within 28 days after intervention in the two groups. The mortality rate of the IG was 16.28%, and that of the CG was 38.71%. The mortality rate in the IG was significantly lower than that in the CG within 28 days, suggesting that high-quality nursing was conducive to reduce the risk of death and improve the prognosis of patients with septic shock.

Although this study revealed that high-quality nursing can bring better benefits to patients with septic shock who were treated with micro-pump injection of norepinephrine, there is still room for improvement in this study. For example, we can further evaluate the treatment compliance of patients with septic shock and analyze the risk factors that affect the adverse prognosis of patients with septic shock, which will help nursing staff to identify which risk factors require additional attention. In the future, it will be gradually supplemented and studied from the above perspectives.

To sum up, high-quality nursing can significantly improve quality of life, and hemodynamics; as well as reduce the incidence of complications during treatment and stabilize the vital signs for septic shock patients treated with micro-pump injection of norepinephrine.

Disclosure of conflict of interest

None.

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