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Original Article

Critical care nursing can improve vital signs and treatment compliance of severe pancreatitis patients treated with continuous bedside hemofiltration

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Abstract: Objective: This paper was aimed at exploring the effects of critical care nursing (CCN) on improving the vital signs and treatment compliance of severe pancreatitis (SP) in patients who were treated with continuous bedside hemofiltration (CBHF). Methods: Treated with CBHF in Zhejiang Hospital and Zhejiang Hospital of Integrated Traditional Chinese and Western Medicine from May 2015 to July 2019, 132 SP patients were enrolled and divided into two groups based on different nursing interventions. Those in the control group were given the interventions of routine nursing (n = 60), whereas those in the experimental group were given CCN (n = 72). They were observed for the pre- and post-nursing vital signs and for post-nursing complications. Their pre- and post-nursing psychological states were assessed through the Self-Rating Depression Scale (SDS) and the Self-Rating Anxiety Scale (SAS). During nursing, their treatment compliance was also evaluated. Their self-care abilities were assessed by the Exercise of Self-Care Agency Scale (ESCA). Their prognoses were assessed by the Acute Physiology and Chronic Health Evaluation (APACHE II). Their quality of life (QOL) was assessed by the World Health Organization quality of Life Instrument (WHOQOL-BREF). Their nursing satisfaction was assessed by a self-made *Satisfaction Questionnaires* of our hospital. Results: After nursing, compared with those in the control group, patients in the experimental group had remarkably better indices of vital signs, remarkably lower scores of SAS, SDS and APACHE II, remarkably higher treatment compliance, ESCA and WHOQOL-BREF scores, and nursing satisfaction, and remarkably fewer adverse reactions. Conclusion: For SP patients who are treated with CBHF, CCN can strengthen their vital signs, improve their psychological states, and enhance their treatment compliance and self-care abilities, thus improving their QOL.

Keywords: Critical care nursing, severe pancreatitis, continuous bedside hemofiltration, vital signs, treatment compliance

Introduction

As an acute celiac disease that can locally progress to a disease involving in multiple organs, severe pancreatitis (SP) has the characteristics of complex conditions, many complications and a high mortality rate [1]. As people's dietary structure and habits change, the incidence of pancreatitis has been rising annually. Moreover, the disease has a sudden onset and poor prognosis, so the untimely treatment of it leads to worsen conditions and even patients' deaths [2, 3]. In clinical practice, SP is mostly treated by symptomatic treatment, infection control and prevention, surgical drainage or the removal of necrotic tissues, all of which have unsatisfactory efficacy [4, 5]. Therefore, such patients with unsatisfactory efficacy should be clinically treated with blood purification to filter various toxic substances in the blood [6]. In this study, the clinical efficacy of critical care nursing (CCN) on SP patients who were treated with continuous bedside hemofiltration (CBHF) was observed, and their prognoses were also recorded.

CBHF can scavenge inflammatory mediators and toxins, regulate water-electrolyte and acid-base balances, and maintain the stability of the internal environment, as well as regulate immune functions [7]. Although CBHF can effectively control conditions, complications

(such as urinary tract, respiratory tract and intra-abdominal infections) are easily induced during treatment, which affects the prognosis of patients [8]. Therefore, CCN was applied to patients treated with CBHF in this study. As a targeted nursing intervention, CCN is performed comprehensively on the aspects of anticoagulation and liquid during the treatment with hemofiltration [9]. According to some studies, this nursing model also provides psychological counseling for patients' negative emotions, to reduce their psychological burdens, enhance their confidence in treatment, and accelerate their physical recovery [10]. For instance, nursing interventions for patients with continuous veno-venous hemofiltration can ensure satisfactory vascular access, avoid unnecessary interruptions, and prevent complications [11].

Currently, there is little research on CCN in SP patients who are treated with CBHF. In this study, through the implementation of CCN, the application value of this nursing model in the patients was discussed, in order to provide a feasible nursing scheme for better treatment efficacy.

Information and results

General information

Treated with CBHF in Zhejiang Hospital and Zhejiang Hospital of Integrated Traditional Chinese and Western Medicine from May 2015 to July 2019, 132 SP patients were enrolled and divided into two groups based on different nursing interventions. Those in the control group were given the intervention of routine nursing (n = 60), whereas those in the experimental group were given CCN (n = 72). Inclusion criteria: Patients in both groups were confirmed with SP [12]; patients were aged ≥ 18 and had complete clinical data; patients had clear thinking and normal language competence. This study was approved by the Ethics Committee of our hospital. The research subjects and their families were informed of this study and signed the fully informed consent form. Exclusion criteria: Those complicated with other malignant tumors or acid-base and water-electrolyte disturbances; those with coagulation disorders, immune dysfunction or cognitive impairment; those who had withdrawn from this experiment midway; those who could not actively cooperate in this research; those who were lost to follow up.

Nursing methods

Patients in the control group were given routine nursing, which included oxygen inhalation treatment, maintaining the water-electrolyte and acid-base balance, fasting, gastrointestinal decompression, ECG monitoring, and basic oral, medication, and skin nursing. On this basis, those in the experimental group were also given CCN additionally, which included psychological nursing, comfort nursing, nursing related to hemofiltration, nutrition nursing, pipeline nursing, and traditional Chinese medicine nursing. The details were as follows:

Psychological nursing: Most of pancreatitis patients suffer from nausea and vomiting, abdominal pain and distention, and dry mouth. They were afraid of and nervous about intubation, hemofiltration, and other intervention measures. After they were admitted to the intensive care unit, their negative emotions (such as discomfort) were aggravated due to various reasons (such as isolation from families and relatives). The primary nurses made the individualized plans of psychological nursing according to the patients' conditions, explained the outcome of the disease and the purpose of operation and nursing to the patients, and publicized successful cases to them, so that they could cooperate in the treatment and relax their mood.

Comfort nursing: Because of the disease, the patients suffer from many discomforts, confined to their bed, and had declined abilities of self-living, so the primary nurses assist them to undergo comfort nursing and meet their living needs as much as possible. The pain of the patients can be relieved through proper analgesic drugs if not eased by psychological counseling. Abdominal distension could be relieved by the combined therapy of Chinese and Western medicine. For patients with dry mouth, their mouth can be moistened with a small amount of cotton swabs many times during the fasting period. Besides, gargling and the use of lip balm can relieve discomfort. For patients with nausea and vomiting, a gastric tube was place, and gastrointestinal decompression was performed, and pumpback was carried out to evaluate gastric contents. The

patients were told that their heads should be tilted to one side when vomiting in order to prevent aspiration. The treatment of pancreatitis patients undergoing hemofiltration was mostly more than 24 hours, which required great tolerance to cooperate in the treatment. For avoiding skin problems that are caused by a certain position for a long time, the nurses gave relevant education and nursing to the patients, and helped them change their position, so as to make the treatment go smoothly and avoid other problems.

Nursing related to hemofiltration: The nursing staff set the parameters of hemofiltration according to the doctor's advice, paid attention to the speed of ultrafiltration, and observed and fed back the patients' vital signs. They also stabilized ultrafiltration to ensure the patients' hemodynamic stability, and measured intake and output volume. The preparation of hemofiltration-related fluids was sterile to prevent infection. In order to reduce the risk of bleeding, anticoagulation without heparin or citrate was usually applied to treatment. The primary nurses monitored related indicators (such as blood gas and calcium) to ensure the smooth progress of ultrafiltration.

Nutrition nursing: Fasting and gastrointestinal decompression are often performed on pancreatitis patients, so jejunum feeding can be given to them according to their conditions. At present, short-peptide nutrition solution is mostly used, because it facilitates the digestion and absorption of patients. In order to increase the success rate of the indwelling jejunal nutrition tubes, B-ultrasound can be used as an adjuvant method to guide the tube placement. The basic nursing of the tubes was well performed to prevent blockage and folding.

Pipeline nursing: During the treatment with hemofiltration, the hemofiltration catheter was indwelt, and nursing was well carried out. During the treatment, the puncture site and the catheter were disinfected with chlorhexidine every day, and protected by sterile dressings with appropriate length. The condition of the skin at the puncture site was observed. Heparin diluent (500 iu) was chosen to seal the catheter, and urokinase was used to seal the catheter in those with embolism constitution or a history of catheter embolization. The condition of the skin at the placement site was observed to prevent crushing and the distortion and folding of the catheter. During the treatment, the pipeline of the hemofiltration was disinfected with chlorhexidine spray every 4 hours.

Traditional Chinese medicine nursing: For those who could not sleep because of tension and anxiety, auricular point pressing with beans was used, and Vaccaria hispanica (Mill.) Rauschert was performed in the reflex zones of heart, Shenmen, and spleen in the ear, thus helping the patients calm down by massage. For those with abdominal distension, the external application of mirabilite to Shenque acupoint could relieve the distension. Besides, through abdominal massage and based on different syndromes, the correct strength and method of massage can be chosen to ease the distension. For those who had been in bed for a long time, drugs could be applied to Zusanli acupoint and Xuehai through point application therapy, so as to clear and activate the channels and collaterals and to prevent the occurrence of lower extremity deep venous thrombosis.

Outcome measures

1. The pre- and post-nursing indices of vital signs [body temperature, heart rate (HR), respiratory frequency (RF), blood oxygen saturation (SaO_2)] of the patients in both groups were observed and recorded.

2. The Self-Rating Depression Scale (SDS) and the Self-Rating Anxiety Scale (SAS) [13] were used for assessment. The SDS has 20 items with a depression score demarcation of 53 points. A score of 53-62 points indicates mild depression, and a score of 62-72 points indicates moderate depression, and a score of above 72 points indicates severe depression. The SAS has 20 items with an anexity score demarcation of 50 points. A score of 50-59 points indicates mild anxiety, and a score of 60-69 points indicates moderate anxiety, and a score of above 70 points indicates severe anxiety.

3. Treatment compliance [14]: Complete compliance indicates that the patients actively cooperate with the nursing staff in completing relevant operations, taking drugs according to

Table 1. General information sheet [n (%)] (mean ± SD)

Categories	Experimental group (n = 72)	Control group (n = 60)	t/χ^2 value	*P* value
Gender			0.851	0.356
Male	37 (51.39)	26 (43.33)		
Female	35 (48.61)	34 (56.67)		
Age (Years)	50.37±4.28	51.23±4.26	1.152	0.251
BMI (kg/m^2)	22.54±3.45	22.79±3.65	0.403	0.687
Time of onset	2.34±0.18	2.39±0.21	1.473	0.143
Place of residence			1.317	0.251
City	42 (58.33)	29 (48.33)		
Countryside	30 (41.67)	31 (51.67)		
Nationality			0.004	0.949
Han	40 (55.56)	33 (55.00)		
Ethnic minorities	32 (44.44)	27 (45.00)		
Educational background			0.292	0.589
≥ Senior high school	37 (51.39)	28 (46.67)		
< Senior high school	35 (48.61)	32 (53.33)		
History of smoking			0.025	0.872
Yes	41 (56.94)	35 (58.33)		
No	31 (43.06)	25 (41.67)		
History of drinking			0.068	0.793
Yes	44 (61.11)	38 (63.33)		
No	28 (38.89)	22 (36.67)		
Causes of disease			1.387	0.499
Hyperlipidemia	29 (40.28)	24 (40.00)		
Biliary pancreatitis	17 (23.61)	19 (31.67)		
Binge overeating	26 (36.11)	17 (28.33)		

the doctor's advice, stopping smoking and drinking, exercising reasonably, and maintaining a healthy diet. Compliance indicates that the patients can cooperate in the treatment, nursing, exercise and diet under the guidance of the nursing staff. Non-compliance indicates that the patients still could not cooperate in the treatment and nursing well under the guidance of the nursing staff. Overall compliance rate = (cases of complete compliance + compliance)/total number of cases ×100%.

4. The Exercise of Self-Care Agency Scale (ESCA) [15] was used, which consists of 4 fields and 43 items, with a total score of 172 points. The ESCA scores were counted after the patients' self-evaluation. Higher scores indicate stronger self-care abilities.

5. The Acute Physiology and Chronic Health Evaluation (APACHE II) [16] was used to evaluate the prognoses of the patients. The APACHE II has 3 indicators, with a total score of 71 points, and higher scores indicate more serious conditions.

6. The complications of the patients in both groups were observed and recorded.

7. Quality of life (QOL): The World Health Organization quality of Life Instrument (WHOQOL-BREF) [17] was used to measure the patients' QOL. The WHOQOL-BREF is divided into physiological, social, psychological and environmental fields, with a total score of 100 points (each item). The higher the score is, the better the post-nursing QOL is.

8. Nursing satisfaction: The self-made *Satisfaction Questionnaires* of our hospital were used for assessment, with a total score of 100 points. Higher scores indicate higher satisfaction with the service.

Statistical methods

SPSS 22.0 (Easy Bio System Inc., Beijing, China) was used for statistical analysis. GraphPad Prism 7 was used for plotting figures in this study. Count data were expressed as [n (%)] and compared between groups by a chi-square test. When the theoretical frequency in the chi-square test was less than 5, the comparison was conducted by a chi-square test with correction for continuity. Measurement data were expressed as mean ± standard deviation (mean ± SD), and compared between groups by an independent samples t test, with the comparison within groups before and after nursing conducted by a paired t test. $P < 0.05$ indicated a statistically significant difference.

Results

Comparison of general information

The differences were not significant between the experimental and control groups in gender, age, body mass index (BMI), time of onset, place of residence, nationality, educational background, history of smoking, history of drinking and causes of disease ($P > 0.05$) (**Table 1**).

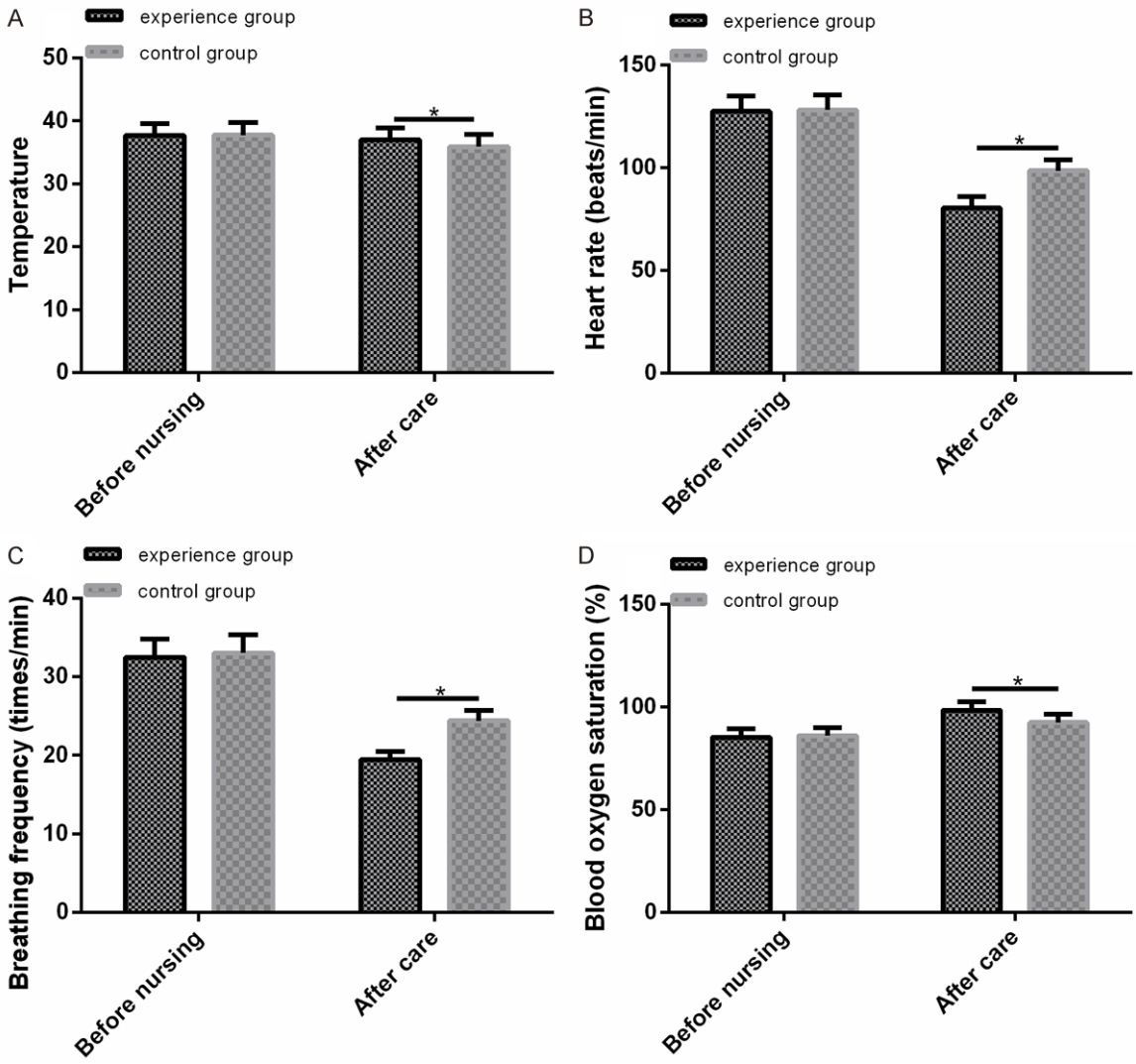

Figure 1. Comparison of pre- and post-nursing indices of vital signs. A. Before nursing, there was no significant difference between the two groups in body temperature, the improvement of which was better in the experimental group than that in the control group after nursing. B. Before nursing, there was no significant difference between the two groups in HR, the improvement of which was better in the experimental group than that in the control group after nursing. C. Before nursing, there was no significant difference between the two groups in RF, the improvement of which was better in the experimental group than that in the control group after nursing. D. Before nursing, there was no significant difference between the two groups in SaO_2, the improvement of which was better in the experimental group than that in the control group after nursing. Note: * indicates $P < 0.05$ when there is a comparison between two groups.

Comparison of pre- and post-nursing indices of vital signs

Before nursing, there were no significant differences between the experimental and control groups in terms of body temperature, HR, RF and SaO_2 ($P > 0.05$). After nursing, the improvement of the indices in both groups was remarkably better than that before nursing ($P < 0.05$), and the indices were remarkably better in the experimental group than those in the control group ($P < 0.05$) (**Figure 1**).

Comparison of SAS and SDS scores before and after nursing

Before nursing, the differences were not significant in SAS and SDS scores between the experimental and control groups ($P > 0.05$). After nursing, the two scores in both groups

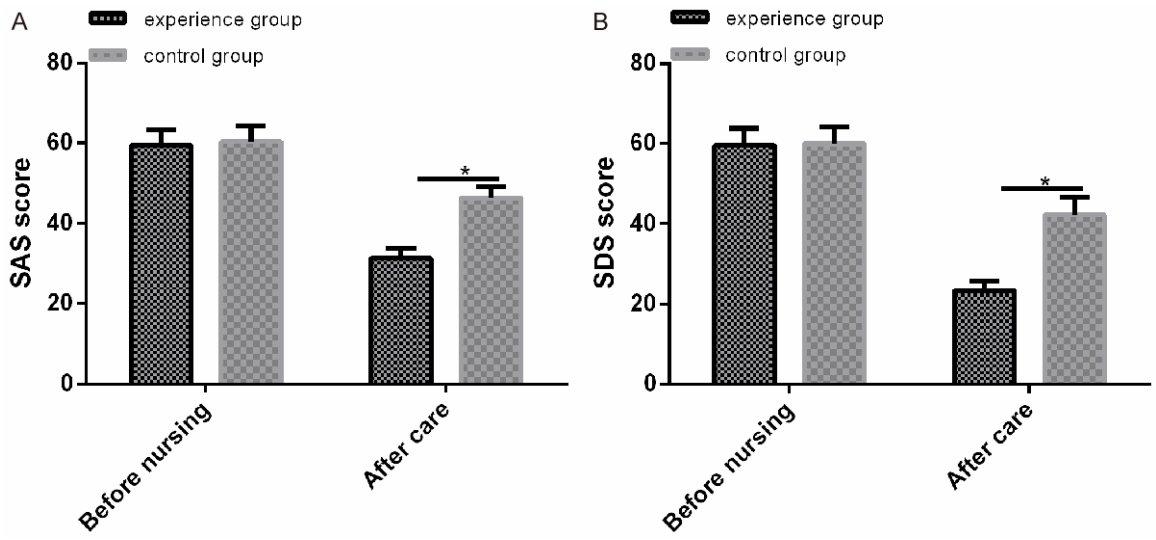

Figure 2. Comparison of SAS and SDS scores before and after nursing. A. Before nursing, there were no significant differences between the two groups in SAS scores, which were remarkably lower in the experimental group than those in the control group after nursing. B. Before nursing, there were no significant differences between the two groups in SDS scores, which were remarkably lower in the experimental group than those in the control group after nursing. Note: * indicates $P < 0.05$ when there is a comparison between two groups.

Table 2. Comparison of treatment compliance after nursing [n (%)]

Groups	n	Complete compliance	Partial compliance	Non-compliance	Overall compliance rate
Experimental group	72	44 (61.11)	23 (31.94)	5 (6.94)	67 (93.06)
Control group	60	19 (31.67)	24 (40.00)	17 (28.33)	43 (71.67)
t	-	-	-	-	10.781
P	-	-	-	-	0.001

were remarkably improved ($P < 0.05$), and they were remarkably lower in the experimental group than those in the control group ($P < 0.05$) (**Figure 2**).

Comparison of treatment compliance after nursing

After nursing, the overall compliance rate in the experimental group was 93.06%, which was remarkably higher than 71.67% in the control group ($P < 0.05$) (**Table 2**).

Comparison of ESCA scores before and after nursing

Before nursing, the differences were not significant in ESCA scores between the experimental and control groups ($P > 0.05$). After nursing, the scores in both groups were improved ($P < 0.05$), and they were remarkably higher in the experimental group than those in the control group ($P < 0.05$) (**Table 3**).

Comparison of APACHE II scores before and after nursing

Before nursing, the differences were not significant in APACHE II scores between the experimental and control groups ($P > 0.05$). After nursing, the scores in both groups were improved ($P < 0.05$), and they were remarkably lower in the experimental group than those in the control group ($P < 0.05$) (**Table 4**).

Comparison of complications

The incidence of complications was 8.33% in the experimental group and 31.67% in the control group. The total incidence of complications was remarkably lower in the experimental group than that in the control group ($P < 0.05$) (**Table 5**).

Table 3. Comparison of ESCA scores before and after nursing (mean ± SD)

Groups	n	ESCA scores	
		Before nursing	After nursing
Experimental group	72	74.36±6.42	121.43±7.32
Control group	60	74.71±6.41	90.67±6.94
T	-	0.312	24.610
P	-	0.755	< 0.001

Table 4. Comparison of APACHE II scores before and after nursing (mean ± SD)

Groups	n	APACHE II scores	
		Before nursing	After nursing
Experimental group	72	18.32±2.12	6.68±2.01
Control group	60	17.89±2.09	11.16±2.38
T	-	1.168	11.730
P	-	0.245	< 0.001

Comparison of WHOQOL-BREF scores after nursing

After nursing, the scores of the physiological, social, psychological and environmental fields in the WHOQOL-BREF were remarkably higher in the experimental group than those in the control group ($P < 0.05$) (**Table 6**).

Comparison of nursing satisfaction after nursing

The nursing satisfaction in the experimental group was 94.44%, which was remarkably higher than 63.33% in the control group ($P < 0.05$) (**Table 7**).

Discussion

SP is a common acute celiac disease and an is the result of acute inflammation of pancreatic acinar cells, which is accompanied by the autolysis of local tissues and followed by ischemic necrosis [18]. If patients suffer from pathological deterioration, a large amount of inflammatory responses and pancreatic enzymes released into the circulation, the peripancreatic tissue and other organs and systems in the body will be affected, which eventually results in systemic inflammatory response syndrome and multiple organ dysfunction [19, 20]. Studies have shown that CBHF can remove inflammatory cytokines and regulate water-electrolyte balance in the body [21].

In this study, we conducted CCN in SP patients who were treated with CBHF, and found that their conditions were remarkably relieved after nursing. This intervention model provided comprehensive targeted nursing for each patient. According to previous studies, patients in intensive care units develop anxiety, depression, fear and death about an uncertain future, but understanding their experiences and giving them targeted nursing can improve the understanding of the nursing staff to their pressure source of the patients, thus helping nursing staff to further assist in the care of their psychological states and improve prognoses [22]. After nursing, the improvement of the indices of vital signs were remarkably higher in the experimental group, which suggests that CCN helps the patients correctly recognize SP and CBHF, enables them to maintain a relatively stable mind during treatment, and prevents the influence of their mood swings on the stability of vital signs. In this study, SAS and SDS scores were included to observe the patients' post-nursing psychological states. After nursing, the two scores were remarkably lower in the experimental group. This indicates that CCN is conducive to easing negative emotions and building confidence in overcoming diseases through fine psychological nursing, so that the patients can face the disease positively. The treatment compliance of patients is a major health issue, related to the incidences and mortality rates of various diseases [23, 24]. Patients with higher treatment compliance have better health outcomes. As reported by a previous study, nursing interventions can improve the treatment compliance of hemodialysis patients and the therapeutic effect [25]. In our study, after nursing, the treatment compliance was remarkably higher in the experimental group. This reveals that in addition to improving the patients' cognition about CBHF, effective communication can help them form correct health attitudes, construct healthy behaviors and develop healthy habits, thereby improving the therapeutic effect.

The knowledge, activities and attitudes of patients towards pain management affects their self-management ability, which can be improved through effective nursing interventions [26]. In our study, after nursing, the ESCA scores were remarkably higher in the experimental group, which suggests that CCN not

Table 5. Comparison of complications [n (%)]

Categories	Experimental group (n = 72)	Control group (n = 60)	χ^2 value	*P* value
Respiratory failure	1 (1.39)	3 (5.00)	1.452	0.228
Peripancreatic infection	2 (2.78)	4 (6.67)	1.141	0.285
Intra-abdominal infection	1 (1.39)	5 (8.33)	3.638	0.056
Respiratory tract infection	1 (1.39)	4 (6.67)	2.501	0.113
Organ failure	1 (1.39)	3 (5.00)	1.452	0.228
Total incidence of complications	6 (8.33)	19 (31.67)	11.611	0.001

Table 6. Comparison of WHOQOL-BREF scores after nursing (mean ± SD)

Groups	n	Physiological field	Social field	Psychological field	Environmental field
Experimental group	72	78.36±4.23	80.53±4.02	80.48±3.75	77.47±4.28
Control group	60	70.25±3.89	73.12±3.68	74.28±3.53	71.48±4.02
t	-	11.370	10.960	9.713	8.229
P	-	< 0.001	< 0.001	< 0.001	< 0.001

Table 7. Comparison of nursing satisfaction after nursing [n (%)]

Items	Experimental group (n = 72)	Control group (n = 60)	χ^2 value	*P* value
Very satisfied	49 (68.06)	15 (25.00)	-	-
Satisfied	19 (26.39)	23 (38.33)	-	-
Dissatisfied	4 (5.56)	22 (36.67)	-	-
Nursing satisfaction	68 (94.44)	38 (63.33)	20.031	< 0.001

only strengthens the patients' cognition of SP and CBHF, but also enhances their self-care abilities. To provide special or preventive treatment for SP patients, it is necessary to determine the risk of complications in each patient, and APACHE-II scores can be used to predict the complications of SP and the success of the treatment [27]. After nursing, the APACHE-II scores were remarkably lower in the experimental group, indicating that CCN during the treatment with CBHF can effectively relieve the patients' conditions. During nursing, the remarkably fewer complications in the experimental group reveal that CCN ensures unblocked blood flow and aseptic operations during treatment and the effectiveness of catheter locking after treatment, further guaranteeing the safety of patients during CBHF. SP affects the QOL of patients, so efforts should be made to improve the QOL [28]. According to Zhang H and others, evidence-based nursing can improve the QOL and nursing satisfaction of patients with severe acute pancreatitis [29]. This is similar to the results of this study. In this study, after nursing, the scores of the four fields in the WHOQOL-BREF were all remarkably higher in the experimental group. This shows that CCN helps the patients develop healthy living and eating habits, makes them maintain a healthy physiological state, and promotes their recovery from SP, thus improving their QOL. Finally, we scored the patients' nursing satisfaction, which was remarkably higher in the experimental group. This demonstrates that the patients highly approve of this model of CCN, which provides powerful reference for subsequent clinical application.

This study has confirmed that CCN can bring more benefits to SP patients who are treated with CBHF, but it still needs improvement. For example, we can further analyze the risk factors that affect the poor prognosis of the patients, and this will help nursing staff to identify which risk factor should be paid additional attention to. Therefore, supplementary research will be gradually carried out in the future from the above perspective.

In summary, for SP patients who are treated with CBHF, CCN can strengthen their vital signs, improve their psychological states, and enhance their treatment compliance and self-care abilities, thus improving their QOL.

Disclosure of conflict of interest

None.

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