

Original Article

Effect of PDCA circulation combined with bundled nursing intervention in peritoneal dialysis patients

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Abstract: Objective: To explore the effects of combination of Plan-Do-Check-Act (PDCA) circulation and bundled nursing intervention in patients with peritoneal dialysis. Methods: A total of 97 ambulatory peritoneal dialysis patients admitted to our hospital between May 2016 and May 2018 were selected and divided into observation group (n=50) and control group (n=47) based on the patients' admission time. The control group was given routine treatment on the basis of conventional treatment. The observation group was given PDCA circulation combined with bundled nursing intervention on the basis of the control group. The nursing effects were compared between two groups. Results: After the intervention, the SAS and SDS scores of the two groups were significantly lower than those before the intervention ($P<0.05$). SAS and SDS scores in the observation group were significantly lower than those in the control group after intervention ($P<0.05$). There were no significant differences in the WHOQOL-100 life quality scores between the two groups of patients before the intervention ($P>0.05$), and the life quality scores of the two groups of patients after the intervention were significantly higher than those before the intervention ($P<0.05$). The life quality score of the patients in the observation group was significantly higher than that of the control group after the intervention ($P<0.05$). The incidence of dialysis-related complications in the control group was significantly higher than that in the observation group ($P<0.05$). The incidence of dialysis-related complications in the observation group was significantly lower than that in the control group ($P<0.05$). Conclusion: PDCA circulation management combined with bundled nursing mode can effectively improve the psychological state and life quality of patients with peritoneal dialysis and help reduce the incidence of dialysis-related complications during dialysis, thereby improving the quality of clinical care. It is worthy of promotion.

Keywords: PDCA circulation, bundled nursing intervention, peritoneal dialysis

Introduction

In peritoneal dialysis, the patient's own peritoneum is used as the dialysis membrane. The dialysis fluid is infused into the abdominal cavity to exchange solutes and water with the components in plasma in the capillaries on the other side of the peritoneum, thereby effectively removing the metabolites retained in the body and excessive water and supplying the patient with necessary substances through dialysate [1, 2]. The peritoneum is used as a mediator for substance exchange, through which blood metabolites and excess water enter the dialysate [3]. However, patients are prone to peritonitis due to accidental contact with pollution sources or catheter-related infections

during treatment [4]. The occurrence of peritonitis will seriously affect the dialysis effect and life quality of patients. Therefore, effective nursing interventions are necessary to prevent the incidence of peritoneal dialysis complications and improve the life quality of patients. The concept of bundled care refers to a group of nursing interventions implemented for a certain type of patients [5]. This group of nursing interventions is based on evidence-based medicine and requires the implementer to implement each intervention continuously and uninterruptedly. In addition, the PDCA circulation is proposed by the famous American quality management expert Dai Ming [6]. It is a standardized and scientific cycle system widely used in quality management of various fields, and it has

also become one of the most basic ways in the quality management of nursing [7]. To further improve the care management quality for peritoneal dialysis patients, improve the life quality of patients and reduce the incidence rate of complications, we proposed the combination of PDCA circulation management mode and bundled nursing interventions in this study.

Materials and methods

General data

A total of 97 ambulatory peritoneal dialysis patients who were admitted to our hospital between June 2016 and May 2018 were included in this study.

Inclusion criteria: diagnosed with end-stage renal disease, and newly admitted for ambulatory peritoneal dialysis; age between 18-80 years; currently living with at least one family member; and the patients who voluntarily signed an informed consent. Exclusion criteria: patients with severe cerebrovascular disease, such as stroke or acute myocardial infarction; patients with severe mental illness; and patients with malignant tumor. Based on the time of admission, the patients were divided into 47 cases in the control group (June 2016-May 2017) and 50 cases in the observation group (June 2017-May 2018) randomly. All patients signed the informed consent form, and the study was approved by the ethics committee of the hospital.

Methods

Control group: The routine nursing mode was given on the basis of conventional treatment. The routine treatment includes antihypertensive drugs, correction of anemia, control of blood calcium and phosphorus metabolism of the body, and control of parathyroid hormone. Conventional nursing modes mainly include: After admission, explain the related knowledge of peritoneal dialysis to the patient and provide the peritoneal dialysis instruction manual; instruct the patient to perform the peritoneal dialysis fluid replacement operation until the patient and his family can independently perform the peritoneal dialysis fluid exchange; when the patient is discharged, the patient discharge guidance is implemented; regular follow-up visits to the peritoneal dialysis clinic

once a month, inquire the patient's daily diet, urine volume, ultrafiltration volume, influent and effluent conditions, and sleep conditions; check the patient's dialysis diary; and check the patient's peritoneal dialysis catheterization condition and whether there is edema.

Observation group: The PDCA circulation combined bundled nursing intervention was given based on the control group, as follows:

Plan: Set up a PDCA circulation nursing group, in which the head nurse is the team leader and is responsible for preparing the corresponding care plan, 2 supervisor nurses are responsible for the guidance and training of nursing operations; 12 senior nurses and nursing staff as team members are responsible for the implementation of various nursing tasks in the plan. The group members formulated the corresponding nursing intervention plan according to the requirements of cluster nursing.

Do: Before treatment, make a detailed assessment on the patient's condition, and understand the patient's family environment, psychological status, and cognitive status of the disease, explain the principles of peritoneal dialysis, contraindications and indications to the patient, and give the patient appropriate advice. During treatment, introduce the patient to the catheterization process and eliminate the patient's nervousness. At the night before the operation, allow the patient to sleep well and relieve his/her nervousness. Patients are instructed to urinate before surgery. Observe the changes in vital signs after the operation and observe the surgical incision and the connection of the catheters. Health education was implemented 7 days after operation.

Day 1: Explain how to keep clean and protect the dialysis tube. Keep the space for fluid exchange clean, dry, and well-lit. Follow the correct procedures when changing the fluid. Explain the need for proper hand washing, teach patients the "six-step hand washing method", and demonstrate how to wash their hands properly, the role of dialysis tubes and the methods to keep tubes in place; **Day 2:** Explain how to change fluids safely. Introduce the correct name of each part, the requirements of the place for fluid exchange, and the method of heating the dialysate; **Day 3:** Explain how to maintain fluid balance, including the

importance of fluid balance, discussing methods to control fluid balance, symptoms of excessive fluid, signs of dehydration, demonstrating how to measure blood pressure and guiding how to change fluids. Day 4: Handling of abnormal situations: Infections at tunnels and exits, peritonitis, catheter displacement and obstruction, leakage of dialysate, hernia, contaminated joints, detachment of pipes, constipation, and itching; Day 5: Considerations for home dialysis: Preparation of family peritoneal dialysis room, weight self-monitoring, blood pressure, body temperature, bathing methods, exercise and travel, diet, work, and family environment; Day 6: Product related issues: How to calculate the amount of fluid demand, how to calculate the amount of safe stock, storage of dialysate, handling of quality problems of dialysate, order and delivery, and provide contact phone number and address; Day 7: Question answering and assessment: Discharge guidance: Patients joined the peritoneal dialysis WeChat group before discharge. Some studies have shown that continuous care based on WeChat platform can improve patient compliance and treatment compliance. Inform patients of self-care methods and precautions after discharge, follow-up 2 weeks after discharge, 1-month follow-up after stabilization, and the follow-up ways include outpatient follow-up and telephone follow-up.

Check: Draw up the inspection plan in the group, and the supervisor assists the team members to complete various inspections. The team leader conducts random checks on various tasks and collects patients' opinions on improving the quality of care. The meeting is held every week to discuss difficulties encountered in the nursing process and corresponding improvement measures are proposed.

Act: Provide guidance on the nursing problems in the first 3 stages, modify the corresponding bundled nursing management plan in accordance with the actual situation of the hospital, and put the unresolved issues into the next circulation to further improve PDCA recurring plan.

Observation indexes

The clinical data of the two groups of patients, including gender, age, education level, marital status, monthly out-of-pocket medical expenses,

cardiovascular complications, annual family income, and employment status were recorded; the dialysis indexes and laboratory test results of the two groups were compared, including body mass index (BMI), systolic blood pressure, diastolic blood pressure, ultracentrifugation (total ultrafiltration volume of peritoneal dialysis fluid within 24 hours), urine volume, dialysis time, creatinine, urea nitrogen, cardiothoracic ratio and hemoglobin, albumin, blood phosphorus, blood calcium, creatinine clearance (CCr), urea clearance to volume ratio (Kt/V), and glomerular filtration rate (eGFR). The self-rating anxiety score (SAS) and self-rating depression scale (SDS) were used to analyze the psychological status of the patients before and after intervention. Both scales contained 20 items, each of which was scored on a scale of 1 to 4, which were compiled by William W.K. Zung. The sum of the scores of each item is the total score. An SAS score of SDS was used to analyze the psychological status of the patients before and after intervention. Both scales contained 20 items, each of which was scored on a scale of 1 to 4, the scores of each item is the total score. An SAS score of SDS was used to analyze the psychological status of the patients before and after intervention. The scale includes 6 dimensions, namely psychological field, physiological field, social relationship, environmental field, independence, and personal beliefs, with a total of 100 entries. Each item has a 5-level score of 1 to 5 points. The higher score represents the higher life quality. Cronbach's α coefficient of WHOQOL-100 scale is 0.85. A questionnaire survey was conducted before intervention and 6 months after discharge. Patients filled in the questionnaire by themselves and collected it on the spot. The dialysis-related complications in the two groups after 6 months of discharge were observed.

Statistical analysis

The statistical software SPSS 22.0 was used to analyze the data. Measurement data which are normally distributed were expressed as mean \pm standard deviation ($\bar{x} \pm sd$). Comparisons were performed using the *t* test. Measurement data which are not normally distributed were expressed as M (Q1, Q3) and compared using rank sum test. Enumeration data are expressed as percentages, and comparisons were per-

Table 1. Comparison of general information between two groups of patients

General information	Observation group (n=50)	Control group (n=47)	t/x ²	P
Gender				
male	28	26	0.005	0.946
female	22	21		
Age (year, $\bar{x} \pm sd$)	47.29±12.04	48.17±13.44	0.340	0.735
Degree of Education				
Junior high school and below	26	24	0.068	0.946
high school	15	16		
Junior college or above	9	7		
Monthly out of Pocket Medical Expenses (Yuan, $\bar{x} \pm sd$)	1864.82±276.40	1821.94±254.87	0.793	0.430
Cardiovascular complications				
Yes	9	11	0.432	0.511
No	41	36		
Annual income				
<30 thousand yuan	9	9	0.626	0.532
30~50 thousand yuan	13	15		
50~100 thousand yuan	25	21		
>100 thousand yuan	3	2		

formed with X² test. $P < 0.05$ is considered as statistically significant.

Results

Comparison of general information between the two groups of patients

Gender, age, education level, monthly out of pocket medical expenses, cardiovascular complications and annual income between two groups were not statistically different ($P > 0.05$) (Table 1).

Comparison of dialysis related indicators and laboratory test results between the two groups

BMI, systolic blood pressure, diastolic blood pressure, ultrasound, urine volume, hemodialysis time, creatinine, urea nitrogen, cardiothoracic ratio, hemoglobin, albumin, blood phosphorus, blood calcium, CCr, kt/V, and eGFR between the two groups were not significantly different ($P > 0.05$) (Table 2).

Changes in psychological status before and after intervention in the two groups of patients

SAS and SDS scores of the two groups were not statistically different ($P > 0.05$). After the intervention, the SAS and SDS scores of the two groups were significantly lower than those be-

fore the intervention ($P < 0.05$). After the intervention, the two groups were compared, the scores of SAS and SDS in the observation group were significantly lower than those in the control group ($P < 0.05$) (Table 3; Figures 1 and 2).

Comparison of life quality before and after intervention between the two groups of patients

Before the intervention, there were no significant differences in the WHOQOL-100 life quality scores of psychological domain, physiological domain, social relationship domain, environmental domain, independence domain, and personal belief between the two groups of patients ($P > 0.05$), and the scores of the life quality of the two groups of patients after the intervention were significantly higher than those before the intervention ($P < 0.05$). After the intervention, the two groups were compared, the life quality scores of the patients in the observation group after the intervention were significantly higher than those of the control group ($P < 0.05$) (Table 4).

Comparison of the incidence of complications between the two groups of patients

In the observation group, peritonitis occurred in 2 cases, drainage was not smooth in 1 case, and the incidence of complications was 8%. In

Table 2. Comparison of dialysis related indicators and laboratory test results between two groups of patients

index	Observation group (n=50)	Control group (n=47)	t	P
BMI (kg/m ²)	22.01±3.74	21.97±3.92	0.051	0.959
SBP (mmHg)	137.92±21.81	133.05±19.74	1.151	0.253
DBP (mmHg)	86.30±7.02	85.26±8.13	0.676	0.501
ultracentrifugation (ml)	458.37±122.93	460.94±140.53	0.096	0.924
Urine volume (ml)	360.73±89.05	371.85±95.37	0.594	0.554
Dialysis time (month)	19.83±5.64	18.97±6.22	0.714	0.477
Creatinine (mmol/L)	987.37±308.47	927.83±310.59	0.947	0.346
Urea nitrogen (mmol/L)	24.08±4.37	24.11±3.98	0.035	0.972
Cardiothoracic ratio	0.56±0.15	0.52±0.17	1.231	0.222
Hemoglobin (g/L)	104.72±21.95	98.38±20.54	1.467	0.146
Albumin (g/L)	37.21±7.95	38.31±8.33	0.666	0.507
Blood phosphorus (mmol/L)	1.80±0.53	1.81±0.59	0.088	0.930
Blood calcium (mmol/L)	2.35±0.47	2.41±0.58	0.561	0.576
CCr (ml/min)	58.39±12.31	60.49±14.02	0.785	0.434
Kt/V	1.94±0.60	1.89±0.55	0.427	0.670
eGFR (ml/min)	4.21±1.26	4.09±1.33	0.456	0.649

Table 3. Changes in psychological status before and after intervention in two groups of patients (point, $\bar{x} \pm sd$)

Group	Time	SAS	SDS
Observation group (n=50)	Before intervention	60.28±7.21	63.22±6.20
	After intervention	46.40±5.37*	45.68±5.17*
	t	10.917	15.364
	P	0.000	0.000
Control group (n=47)	Before intervention	61.27±6.29	62.93±5.96
	After intervention	52.45±6.05	54.28±5.97
	t	6.928	7.030
	P	0.000	0.000

Note: * $P < 0.05$ vs. Control group.

the control group, peritonitis occurred in 4 cases, water electrolyte imbalance in 3 cases, catheter outlet infection in 2 cases, and poor drainage in 4 cases. The incidence of complications was 27.66%. The incidence of dialysis-related complications in the control group was significantly higher than that in the observation group ($P < 0.05$) (Table 5).

Discussion

At present, due to the shortage of medical resources in China, some medical institutions are short of beds [8, 9]. To accelerate bed turnover and solve the problem of patients waiting long for admission, each medical institution

uses the average length of hospitalization as one of the indicators of medical work quality assessment [10, 11]. And the length of hospital stay is one of the key factors affecting the cost of hospitalization of patients [12]. Therefore, some scholars have proposed to use bundled nursing interventions in patients with peritoneal dialysis to further shorten the length of hospital stay for

patients and obtain better quality nursing efficiency [13, 14]. At present, peritoneal dialysis is a main treatment method for patients with chronic kidney disease, which can effectively extend the patient's survival time, but its application process easily leads to short-term withdrawal of patients [15, 16]. The main reasons are poor patient compliance, the emergence of peritoneal dialysis complications, weight increase and loss of protein [17-19]. To further improve the treatment compliance of patients with peritoneal dialysis and improve the life quality of patients, we explored and analyzed in this study the application effect of PDCA circulation combined with bundled nursing intervention in patients with peritoneal dialysis.

Application of nursing intervention in peritoneal dialysis patients

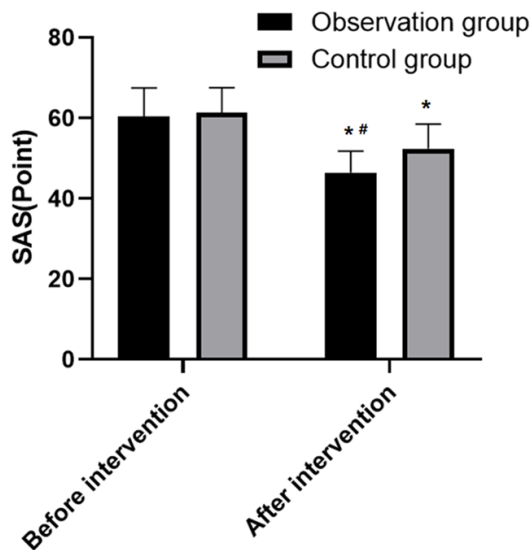


Figure 1. Comparison of SAS scores between the two groups before and after intervention. * $P<0.05$ vs. before intervention; # $P<0.05$ vs. control group.

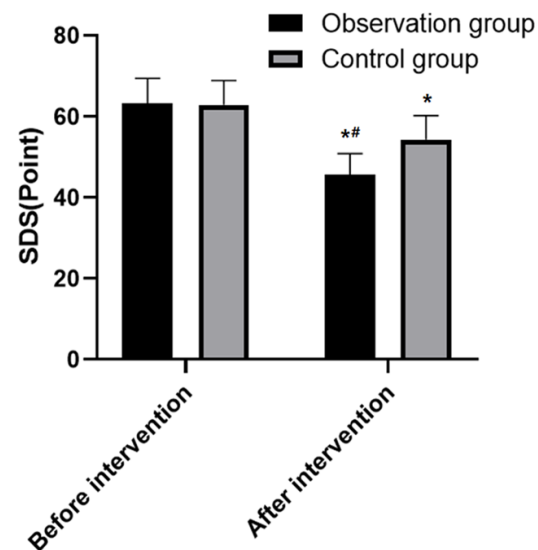


Figure 2. Comparison of SDS scores between the two groups before and after intervention. * $P<0.05$ vs. before intervention; # $P<0.05$ vs. control group.

Bundled nursing is a comprehensive nursing program that is a series of evidence-based medical measures [20]. Its successful and effective implementation is conducive to the improvement of nursing quality [21, 22]. The PDCA circulation mode, as an effective management mode, requires that various tasks are planned, implemented, and checked for effects in the quality management activities [23, 24]. Then the successfully completed ones are included in the standard, and unsuccessful should wait for the next cycle to be resolved again [25]. In this study, we combined bundled nursing with PDCA circulation management model so as to explore a bundled nursing model that is more in line with clinical needs in practice, and further improve the life quality of patients.

The results of this study showed that the SAS and SDS scores of the two groups after intervention were significantly lower than those before the intervention ($P<0.05$), and the SAS and SDS scores of the observation group were significantly lower than those of the control group after the intervention ($P<0.05$), suggesting that the combination of PDCA circulation management mode and bundled nursing intervention could effectively improve the patients' anxiety and depression. Similar to the results reported by other studies [26], the effective nursing intervention can improve the compli-

ance of patients and help improve the clinical treatment effect and reduce adverse reactions further. It further improves the patient's confidence during the treatment, enhances the patient's enthusiasm for treatment, helps to improve the psychological state of patient, and forms a virtuous circle of psycho-therapy mutual promotion [26]. The life quality scores of the two groups of patients after intervention were significantly higher than those before intervention ($P<0.05$), and the life quality scores of patients in the observation group were significantly higher than those in the control group after intervention ($P<0.05$), which suggests that PDCA circulation management combined with bundled nursing can help improve the life quality of peritoneal dialysis patients. It is considered that it is closely related to the improvement of patients' psychological state and the improvement of treatment enthusiasm [27]. In addition, the incidence of dialysis-related complications was significantly higher in the control group than observation group ($P<0.05$). Consistent with the results reported by previous studies, effective nursing interventions can significantly reduce dialysis-related complications during peritoneal dialysis, mainly because patients can better grasp the precautions of peritoneal dialysis after nursing intervention, and improve patient compliance, help reduce the incidence-related adverse reactions such as peritonitis, thereby promoting the improve-

Table 4. Comparison of life quality between two groups of patients before and after intervention (point, $\bar{x} \pm sd$)

Group	Time	Psychological field	Physiological field	Social relations	Environmental field	Areas of independence	Personal belief
Observation group (n=50)	Before intervention	62.81±7.95	64.27±8.35	60.35±7.49	65.38±6.75	67.32±8.43	61.27±7.38
	After intervention	79.47±10.22*	82.67±9.32*	80.28±8.45*	82.37±7.27*	82.64±7.95*	79.58±6.42*
	t	9.098	10.398	12.481	12.110	9.349	13.236
	P	0.000	0.000	0.000	0.000	0.000	0.000
Control group (n=47)	Before intervention	63.48±8.10	63.02±9.64	61.21±8.33	64.93±7.33	66.32±7.92	62.13±8.46
	After intervention	73.94±9.12	74.20±8.26	71.62±7.95	73.41±6.95	75.25±8.30	72.83±7.44
	t	5.879	6.038	6.198	5.755	5.336	6.511
	P	0.000	0.000	0.000	0.000	0.000	0.000

Note: * $P < 0.05$ vs. Control group.

Table 5. Comparison of the incidence of complications between the two groups of patients

Group	n	Peritonitis	Water electrolyte imbalance	Infection at catheter outlet	Poor drainage	Total (n, %)
Observation group	50	2	0	1	1	4 (8.00)
Control group	47	4	3	2	4	13 (27.66)
χ^2	-	-	-	-	-	6.478
P	-	-	-	-	-	<0.05

ment of patients' life quality and adverse psychological state [28].

The sample size in our study is relatively small, and the research results may be biased. Further research needs to expand the sample size to obtain more reliable research data and improve the quality of clinical nursing.

In conclusion, PDCA circulation management combined with bundled nursing mode can effectively improve the psychological state and life quality of peritoneal dialysis patients, and help reduce the incidence of dialysis-related complications during dialysis, thereby improving the quality of clinical care. It is also worth promoting.

Disclosure of conflict of interest

None.

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