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Original Article

Continuity of care for quality of life and clinical outcomes in patients with peritoneal dialysis

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Abstract: Objective: To evaluate the effect of continuity of care (COC) on the quality of life (QOL), clinical outcomes and complications in patients undergoing peritoneal dialysis (PD). Methods: A total of 118 patients were selected among the patients received continuous ambulatory PD in the Department of Nephropathy in our hospital from January 2014 December 2015. They were allocated into the continuity of care group (the intervention group) and the control group in terms of the care methods. The patients in the control group were assigned to receive routine telephone follow-ups while those in the intervention group were assigned to receive continuous ambulatory care intervention for 12 weeks. The improvements in QOL and renal functions between the two groups were compared based on the Kidney Disease Quality of Life Short Form (KDQOL-SF) scale, the creatinine clearance rate (CCR) and the urea clearance index (KT/V) of renal function at discharge, 6 and 12 weeks after discharge, respectively. Besides, the rates of peritonitis, catheter exit-site infection, electrolyte imbalance and other complications were compared between the two groups at the end of the 12-week follow-up. Results: In the KDQOL-SF scale, the scores of the three dimensions including the effects of kidney disease (P=0.019), general health perception (P=0.015), and overall health (P=0.042) were significantly improved in the two groups; the scores of symptoms (P=0.048), staff encouragement (P=0.037) and patient satisfaction (P=0.044) scores were strikingly higher in the intervention group than in the control group. There were significant interactions between the COC and time in the three dimensions of sleep, staff encouragement and patient satisfaction. The CCR rate in the intervention group was greatly higher than that of the control group (P=0.047), but the rate of peritonitis was significantly lower than that of the control group (10.3% vs 25%, P=0.037). Conclusion: COC can effectively enhance the QOL of patients with PD, reduce the incidence of peritonitis, and improve the effectiveness of PD.

Keywords: Peritoneal dialysis, continuity of care, quality of life, renal function, comorbidity

Introduction

With the acceleration of aging and the rapid growth of chronic diseases such as diabetes and hypertension, the prevalence of chronic renal failure has been increasing gradually in the Chinese population [1, 2]. A multicenter study revealed that in China nearly 120 million people had chronic kidney disease (CKD), with a rate of 10.8% [3]. Accordingly, the number of patients with end-stage renal failure (ESRF) progressing from CKD was also significantly increased. In 2008, the patients with ESRF increased by 52.9% in China, with more than 100 thousand cases in total [4]. Peritoneal dialysis (PD) is one of the important treatment methods for chronic renal failure, especially for ESRF. PD is more effective in protecting residual renal functions, maintaining homeostasis, reducing the dosage of erythropoietin (EPO) than hemodialysis. It is easy and convenient to operate, without the establishment of extracorporeal circulation and special instruments. As a result, the patients can be treated at home, with lower medical costs [5]. With the advance in the technique of PD, and the increase in medical insurance coverage and support of national policy, the application of PD has increased rapidly in China [6, 7]. Among all the ESRF patients, 38,000 have undergone PD, representing 13% of all the dialysis patients. China has become the country with the largest number of patients undergoing PD [8, 9].

It is difficult for patients to complete PD during hospitalization, so they need continuous ambu-

latory PD at home. Studies have shown that whether patients can make a steady transition from in-hospital to home dialysis is directly related to their quality of life and post-discharge continuity of care (COC) can significantly improve the quality of life of patients, but the outcome measures are not completely consistent with the findings of other studies [10-13]. The purpose of this study was to evaluate the roles that COC plays in the patients with continuous ambulatory PD, and get a good understanding of the effects of COC on the quality of life and clinical outcomes of the patients, so as to provide scientific evidence for improving the effects of PD care programs.

Materials and methods

Participants

This study was approved by the Hospital Ethics Committee. The patients who underwent continuous ambulatory PD in the Department of Nephropathy in our hospital from January 2014 to December 2015 were enrolled in this study. The patients, who had an age of 18 years or over; sober consciousness and normal intelligence, cooperated in filling out the questionnaires; had regular PD no less than 3 months were included. And the patients were excluded if they had cognitive impairment and mental illness, or were unable to make normal verbal communication; had severe complications such as heart failure and respiratory failure, and received other dialysis techniques or kidney transplantation.

Randomization and intervention

The patients were randomly assigned to the control group (n=65) and the comprehensive psychological intervention group (hereafter referred to as the intervention group, n=65) in terms of a random number table. Routine post-discharge telephone follow-ups were performed to the patients in the control group by the nurses from the PD Group. The intervention group received a post-discharge COC program for 12 weeks. The COC program included the establishment of a COC team, whose members consisted of the head nurse from the Department of Nephropathy as well as the staff in the PD Group in our hospital; The ways to perform COC were mainly telephone, WeChat, QQ, SMS etc., 24 hours hotline of the Department to provide guidance for PD patients at any time; the COC involved psychological intervention (encouraging the patients to improve self-management and enhance their confidence), guidance of PD operation (including PD preparation, operation time, care of catheter exit-site, unexpected emergency handling), nutritional guidance and body water and weight control, medication guidance, and informing patients of the ways to store and use drugs and dialysis fluid.

Outcome measures

Quality of life (QOL) outcome: The Kidney Disease Quality of Life Short Form (KDQOL-SF) scale was performed to assess the QOL of PD patients at discharge (T1), 6 weeks (T2) and 12 weeks after discharge (T3), respectively [14]. KDQOL-SF is a QOL assessment scale designed specifically for renal disease patients, including the two components of kidney disease targeted areas (KDTA) and health survey short form-36 items (SF-36). KDTA component covers 43 questions of 11 dimensions and the SF-36 covers 36 questions of 8 dimensions. Higher total score of the KDQOL scale indicates higher QOL of the patients. A Chinese version has been developed, and multiple studies have demonstrated its validity and reliability [15]. All the patients were instructed to fill in the KDQOL scales at the above three time points with the help of the regular staff and submit them to the professionals to calculate the score of each dimension.

Clinical outcomes and complications: The results of blood and urine tests, and changes in creatinine and urea levels in the dialysis fluid were collected from all the patients of the two groups at discharge, 6 and 12 weeks after discharge, respectively. In addition, ultra-filtration and urine volume of PD were recorded and the creatinine clearance rate (CCR) and urea clearance index (KT/V) of renal function were also calculated. The rates of peritonitis, catheter exit-site infection, electrolyte imbalance and other complications were compared between the two groups at the end of 12-week follow-up.

Statistical analysis

Measurement data were represented as mean ± standard deviation, and the inter-group differences in the measurement data at baseline

Table 1. General data of patients in the intervention group and the control group

Characteristic	Intervention (n=58)	Control (n=60)	X^2/t	*P* value
Age	58.9±7.1	57.1±6.9	1.397	0.165
Gender			0.286	0.593
Male	31 (53.4)	35 (58.3)		
Female	27 (46.6)	25 (41.7)		
Education			1.352	0.509
Junior secondary school or below	21 (36.2)	16 (26.7)		
High/Technical secondary school	24 (41.4)	27 (45.0)		
University or above	13 (22.4)	17 (28.3)		
Marital status				0.712*
Single	1 (1.7)	2 (3.3)		
Married	56 (96.6)	57 (91.7)		
Devoice/Widowed	1 (1.7)	1 (5.0)		
Work status			0.468	0.791
Employed full-time	7 (12.1)	5 (8.3)		
Employed part-time	17 (29.3)	19 (31.7)		
Retired/Sick leave	34 (58.6)	36 (60.0)		
Medical payment			1.339	0.247
Medical insurance/NCMS	54 (93.1)	52 (86.7)		
Self-financed	4 (6.9)	8 (13.3)		
Annual household income (yuan)			2.033	0.362
<50,000	7 (12.1)	13 (21.7)		
50,000-10,000	32 (55.2)	28 (46.7)		
>10,000	19 (32.8)	19 (31.7)		

Note: The Fisher's exact test. NCMS denotes the new rural cooperative medical insurance.

Table 2. Clinical characteristics of patients in the intervention group and the control group

Characteristic	Intervention (n=58)	Control (n=60)	X^2/t	*P* value
Etiology			3.763	0.288
Glomerulonephritis	27 (46.6)	22 (36.7)		
Hypertensive nephropathy	11 (19.0)	16 (28.3)		
Diabetic nephropathy	10 (17.2)	7 (10.0)		
Other/Unknown	10 (17.2)	15 (25.0)		
PD (year)	2.7±1.9	2.3±2.0	1.113	0.268
Daily urine volume (ml)			2.143	0.143
<100	27 (46.6)	36 (60.0)		
≥100	31 (53.4)	24 (40.0)		

were compared with the use the independent two-sample t-test whereas the inter-group differences in categorical variables were measured using the chi-square test (χ^2) or the Fisher exact probability test. Intergroups (intervention vs control) effects, intragroups (three times) effects and interaction (group × time) effects in related to KDQOL-SF scale scores and renal function indexes were analyzed with repeated measures analysis of variance. The intergroup differences in the scores at each time point was examined by the t test with Bonferroni correction (two-sided alpha level of 0.05/3=0.0167). A two-sided alpha level of 0.05 was considered to be statistically significant except for Bonferroni t test.

Results

Basic data of patients in the two groups

During the follow-up period, in the intervention group, one patient was referred to receive hemodialysis, one died, and 5 were lost to follow up. In the control group, 2 died and 3 were lost to follow up in the late stage. The final enrolled patients for analysis were 58 and 60 patients in the intervention group and the control group, respectively. And the clinical and demographic characteristics of patients in the two groups at baseline are shown in **Tables 1**, **2**, respectively. The two groups were not significantly different in age, gender, education, marital status, work status, medical payment, income, etiology, dialysis time and daily urine volume.

Impact of COC on the QOL of PD patients

Table 3 shows the comparisons in each dimension score of the KDQOL-SF scale between the two groups at discharge, 6 and 12 weeks after discharge, respectively. The two groups did not

Table 3. The KDQOL results in the groups

KDQOL	T1	T2	T3	Group effect		Time effect		Group*time interaction	
				F	P	F	P	F	P
Symptom				3.93	0.048*	2.71	0.068	1.87	0.155
Intervention	61.7 (14.6)	67.4 (15.9)	65.9 (16.8)						
Control	59.9 (14.1)	62.4 (13.8)	63.7 (14.2)						
t, p	0.681, 0.497	1.826, 0.070	0.769, 0.099						
EKD				0.87	0.352	4.01	0.019*	0.89	0.411
Intervention	54.6 (12.1)	59.9 (16.3)	59.1 (15.4)						
Control	55.3 (12.9)	57.7 (16.2)	57.8 (15.8)						
t, p	0.304, 0.762	0.735, 0.481	0.452, 0.652						
BKD				0.46	0.498	0.37	0.691	0.45	0.638
Intervention	29.3 (14.2)	29.7 (14.3)	32.1 (15.9)						
Control	27.3 (14.1)	27.4 (13.9)	29.5 (14.6)						
t, p	0.768, 0.444	0.189, 0.377	0.926, 0.357						
Work status				1.56	0.213	0.76	0.468	0.67	0.512
Intervention	18.2 (12.4)	20.7 (14.2)	19.5 (13.9)						
Control	14.9 (9.5)	16.3 (12.4)	15.2 (12.1)						
t, p	1.626, 0.107	1.795, 0.075	1.788, 0.076						
CF				1.03	0.311	0.79	0.454	0.92	0.399
Intervention	68.9 (23.7)	70.1 (22.6)	67.3 (22.9)						
Control	65.8 (25.2)	67.4 (21.3)	64.2 (23.4)						
t, p	0.688, 0.493	0.668, 0.505	0.727, 0.469						
QSI				0.98	0.323	0.61	0.543	0.67	0.512
Intervention	69.2 (20.3)	73.1 (17.9)	74.2 (18.4)						
Control	71.3 (18.9)	71.9 (17.4)	69.7 (16.8)						
t, p	0.582, 0.562	0.369, 0.713	1.388, 0.168						
SF				1.48	0.225	0.84	0.432	1.56	0.211
Intervention	81.8 (19.5)	83.2 (20.1)	84.1 (19.9)						
Control	82.9 (20.1)	79.2 (18.9)	78.7 (19.4)						
t, p	0.302, 0.764	1.114, 0.268	1.493, 0.138						
Sleep				3.44	0.065	4.19	0.016	3.90	0.021*
Intervention	50.3 (19.2)	57.3 (20.4)	55.8 (19.6)						
Control	48.7 (19.6)	46.9 (20.1)	47.6 (18.7)						
t, p	0.448, 0.655	2.789, 0.006**	2.326, 0.022						
Social support				1.37	0.243	1.62	0.199	0.89	0.411
Intervention	76.7 (16.9)	74.5 (18.4)	77.1 (19.7)						
Control	73.2 (18.3)	71.9 (17.3)	72.8 (17.9)						
t, p	1.078, 0.283	0.791, 0.431	1.242, 0.217						
SE				4.41	0.037*	1.48	0.229	4.22	0.015*
Intervention	78.2 (18.2)	84.1 (19.3)	85.9 (18.6)						
Control	80.3 (20.6)	75.8 (17.1)	78.1 (16.9)						
t, p	0.586, 0.558	2.475, 0.015**	2.386, 0.019						
PS				4.11	0.044*	1.41	0.245	4.24	0.015*
Intervention	72.1 (17.8)	73.9 (20.4)	75.2 (19.6)						
Control	71.2 (17.5)	69.7 (18.1)	65.3 (17.9)						
t, p	0.277, 0.782	1.834, 0.239	2.867, 0.005**						
PF				0.43	0.513	0.61	0.545	0.33	0.719
Intervention	58.3 (16.7)	62.2 (17.3)	60.4 (20.2)						
Control	59.4 (15.9)	61.1 (16.7)	58.5 (19.4)						

t (p)	0.367, 0.715	0.351, 0.726	0.521, 0.603						
RF				0.26	0.611	0.45	0.638	0.49	0.613
Intervention	34.9 (12.4)	36.1 (13.7)	32.7 (14.2)						
Control	32.1 (12.1)	33.5 (12.8)	33.9 (13.6)						
t, p	1.241, 0.217	1.066, 0.289	0.469, 0.640						
Pain				0.63	0.428	2.89	0.057	0.78	0.459
Intervention	58.6 (20.3)	63.2 (22.1)	65.5 (22.4)						
Control	61.0 (19.9)	57.9 (20.4)	62.6 (23.5)						
t, p	0.259, 0.518	1.354, 0.178	0.686, 0.494						
GHP				0.17	0.681	4.25	0.015*	0.36	0.680
Intervention	29.4 (10.2)	35.7 (11.9)	39.5 (13.2)						
Control	28.1 (11.3)	33.8 (12.1)	37.9 (12.8)						
t, p	0.655, 0.514	0.860, 0.392	0.668, 0.505						
EWE				0.32	0.572	0.71	0.492	0.26	0.771
Intervention	62.7 (17.4)	64.9 (18.2)	66.5 (19.3)						
Control	60.1 (18.3)	60.9 (19.5)	62.3 (20.2)						
t (p)	0.790, 0.350	1.151, 0.252	1.154, 0.251						
RE				0.57	0.451	1.24	0.290	0.86	0.423
Intervention	45.2 (23.1)	50.9 (24.5)	48.5 (22.3)						
Control	38.2 (19.6)	44.7 (25.1)	45.1 (23.7)						
t, p	1.778, 0.078	1.357, 0.177	0.802, 0.424						
Social function				0.59	0.443	3.23	0.040	0.29	0.748
Intervention	39.6 (19.5)	43.7 (20.9)	44.8 (23.1)						
Control	41.8 (20.6)	45.9 (21.3)	43.1 (20.2)						
t, p	0.595, 0.553	0.566, 0.572	0.426, 0.671						
Energy/fatigue				0.93	0.334	1.23	0.293	0.37	0.491
Intervention	44.2 (23.1)	48.3 (22.7)	46.7 (21.6)						
Control	41.6 (20.4)	43.8 (21.8)	44.5 (22.3)						
t, p	0.649, 0.519	1.098, 0.274	0.544, 0.587						
Overall health				1.67	0.198	3.19	0.042*	1.41	0.245
Intervention	45.6 (18.6)	50.6 (21.4)	50.7 (20.8)						
Control	43.1 (19.5)	45.2 (20.7)	47.5 (20.3)						
t, p	0.712, 0.478	1.393, 0.166	0.846, 0.399						

Note: *P<0.05, **P<0.0167 for Bonferroni t test. EKD denotes Effects of kidney disease, BKD, Burden of kidney disease, CF, Cognitive function, QSI, Quality of social interaction, SF, Sexual function, SE, Staff encouragement, PS, Patient satisfaction, PF, Physical functioning, RF, Role-physical, GHP, General health perception, EWB, Emotional well-being, RE, Role-emotional.

differ significantly in the scores of each dimension at discharge. In the repeated measures analysis of variance (ANOVA), the items with significant over inter-group differences included symptom (P=0.048), staff encouragement (P=0.037), and patient satisfaction (0.044). The scores in the above dimensions of the intervention group were higher than those of the control group. In addition, the sleep scores were also higher in the intervention group, and the difference was close to the significant level (P=0.065).

The effects of time factor (intragroup differences) were also shown in some item scoring of the two groups, including the effects of kidney disease (P=0.019), general health perception (P=0.015), and overall health (P=0.042). In addition, the intragroup difference in pain score was also nearly significantly different (P=0.057). This indicates that the scores in the above items of patients improved during the follow-up period.

In this study, there were significant interactions between the COC and time in the scores of sleep (P=0.021), staff encouragement (P=0.015) and patient satisfaction (P=0.015), suggesting that the scores of the two groups varied

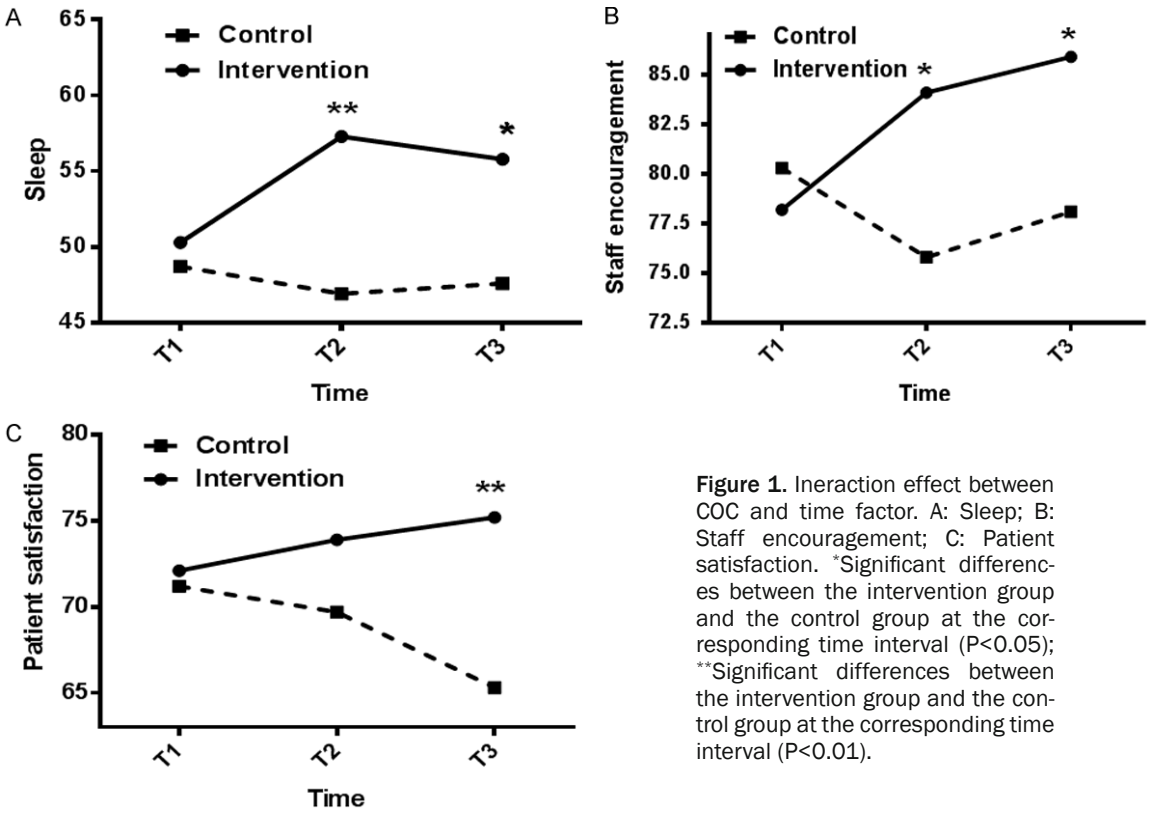

Figure 1. Ineraction effect between COC and time factor. A: Sleep; B: Staff encouragement; C: Patient satisfaction. *Significant differences between the intervention group and the control group at the corresponding time interval (P<0.05); **Significant differences between the intervention group and the control group at the corresponding time interval (P<0.01).

Table 4. Clinical outcomes of the two groups

Variable	T1	T2	T3	Group effect		Time effect		Group*time interaction	
				F	P	F	P	F	P
CCR				0.98	0.047*	3.09	0.046*	2.19	0.113
Intervention	56.4 (9.2)	63.8 (10.4)	62.1 (9.7)						
Control	55.1 (9.4)	58.9 (10.5)	58.9 (10.2)						
t, p	0.759, 0.449	2.546, 0.012**	1.745, 0.084						
KT/V				2.63	0.106	2.31	0.100	0.32	0.726
Intervention	2.01 (0.29)	2.18 (0.25)	2.15 (0.28)						
Control	1.95 (0.22)	2.09 (0.31)	2.07 (0.31)						
t, p	1.269, 0.207	1.732, 0.086	1.470, 0.144						

Note: *P<0.05. **P<0.0167 for Bonferroni t test. CCR denotes creatinine clearance rate.

greatly in different time points. As far as the sleep score is concerned, the highest sleep score was at 6 weeks, and then dropped slightly later in the intervention group; in contrast, the sleep score was lower at 6 weeks than at discharge and then rose slightly later in the control group. The inter-group differences in sleep scores were significantly at 6 weeks, respectively (P=0.006). **Figure 1** summarizes the interactions among sleep, staff encouragement, and patient satisfaction.

Effect of COC on renal functions and complications in patients undergoing PD

Tables 3 and **4** show the comparisons of the creatinine clearance rate (CCR) and urea clearance index (KT/V) between the two study groups at discharge and at 6 and 12 weeks after discharge, respectively. The intra-group difference in CCR was significant (P=0.046), indicating that the CCR of both groups improved over time, with significantly greater improve-

ment in the intervention group (P=0.047). The intra-group difference in CCR was statistically significant at 6 weeks (63.8 vs 58.9, P=0.012).

In addition, the rate of peritonitis in the intervention group was 10.3% (6/58), significantly lower than that of the control group (25%, 15/60; P=0.037). The rates of catheter exit-site infection and electrolyte disturbance in the intervention group were respective 15.5% (9/58) and 31% (18/58), which were lower than 31.7% (19/60) and 43.3% (26/60) of the control group, but the differences were not statistically significant between the two groups.

Discussion

Studies have shown that PD improves clinical outcomes and survival of patients with end-stage renal disease [16, 17]. With the transition of the medical model to the bio-psycho-social medical model, dialysis has been increasingly focused on improving the QOL of patients in addition to prolonging their lives. Because most PD is conducted at home by the patients, it is prone to presence of poor compliance, leading to a variety of physiological, psychological and social problems. Therefore, how to improve the patients' ability of post-discharge self-management and QOL has been one of the hotspots in the studies on PD care intervention [18, 19].

According to the definition developed by the American Geriatrics Society, the COC is to help the patients to receive the COC of various level in different health care establishments (such as hospitals, communities and families) and at the same place (such as the various departments of the hospital) in the premise of program design. Some studies have demonstrated that COC improves the QOL of patients undergoing PD [11-13, 20, 21]. In the present study, significantly higher scores of symptoms, staff encouragement, and patient satisfaction of patients were showed in the intervention group as compared to the control group, and the sleep scores at 6 and 12 weeks after discharge were also superior to those of the control group. Both groups improved substantially in the three dimensions of the effects of kidney disease, general health perception and overall health. What's more, there were intervention effects between intervention and time in the three dimensions of sleep, staff encouragement and patient satisfaction, respectively. Although these results and those of other studies suggest that COC improved QOL of patients, they differed slightly in specific dimensions and interactions. For example, in a randomized controlled trial, the program of post-discharge telephone supportive COC for patients led to significant improvements in the scores of symptoms, work status, staff encouragement, patient satisfaction and energy/fatigue in the KDQOL-SF scale, and time and intervention were interactive in the dimensions of sleep, pain, and staff encouragement [11].

In the present study, the CCR of the intervention group was significantly higher than that of the control group, but no significant differences in the rates of catheter exit-site infection and electrolyte disturbances were observed between the two groups. In other studies, the biochemical parameters of the two study groups were not different during the study period [11, 12, 21]. However, in some studies in China, the renal functions and biochemical parameters of patients in the continuity of care group improved considerably [20]. Given peritonitis is still the most common complication in PD, in this study, the incidence of peritonitis was considered as one of the indexes for evaluating the effectiveness of PD [22]. The results show that the COC also significantly reduced the incidence of peritonitis, similar to that in other studies [23, 24]. Nevertheless, the incidence of peritonitis was insignificantly different between the COC group and the control group in other studies [11, 12]. In addition, in the recent studies on assessing the QOL of patients with PD, the instruments of QOL assessment are not exactly the same. For example, the KDQOL-SF scale was applied in some studies and the WHOQOL-BREF scale was used in other [25]. Therefore, further studies are needed to assess the impact of COC on QOL and clinical outcomes.

In conclusion, COC interventions for PD patients were conductive to improving the QOL of patients and significantly reducing the incidence of peritonitis. However, there are still some limitations in the present study. Firstly, despite randomization, the blind design was not conducted, so it failed to avoid the impact of certain bias. Secondly, this study was of single-center and small sample size, it limited the extrapolation of the results. Thirdly, the intervention period was short, so further evaluation

is needed for the long-term effect of COC. In the future research, large-sample, randomized, controlled intervention studies with specific evaluation parameters and outcomes are still required to evaluate the long-term outcomes of comprehensive COC in PD patients, so as to improve the QOL of patients with PD and provide more evidence for how to improve the clinical outcomes.

Disclosure of conflict of interest

None.

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