Original Research

The influence of multidisciplinary team clinic on the prognosis of patients with chronic kidney disease

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Impact Statement

Chronic kidney disease (CKD) seriously affects the quality of life and survival time of patients, and even affects social and national economic development. In China, how to effectively control the disease process of CKD outpatients has not been determined. The purpose of this study is to observe the prognosis of CKD patients in the multidisciplinary team (MDT) clinic, and to see if good outcomes can be achieved in the treatment of patients with CKD. The results showed that CKD seriously affects the quality of life and MDT clinic can effectively improve the prognosis of patients with CKD, delay kidney disease progression, and reduce mortality. This treatment mode is worthy of clinical application.

Abstract

Chronic kidney disease (CKD) seriously affects the quality of life and survival time of patients, and even affects social and national economic development. In China, how to effectively control the disease process of CKD outpatients has not been determined. A retrospective analysis was made to 100 patients with CKD. Fifty patients treated with traditional clinical treatment were in the control group, and the other fifty patients treated with multidisciplinary team (MDT) clinical treatment were in the MDT group. The prognosis of the two groups after treatment was compared, including glomerular filtration rate (GFR), number of renal replacement treatments, and mortality, to evaluate the actual effect of MDT clinic. CKD patients in the MDT group received the MDT clinic for 24 months. There was no significant difference between GFR and serum creatinine level before treatment, and the quality of life was significantly higher than before. In the control group, the GFR declined more dramatically, the serum creatinine level was higher, and the quality of life was lower than before ($P < 0.05$). The frequency of renal replacement therapy and mortality in the MDT group were significantly lower than those in the control group ($P < 0.05$). MDT clinic can effectively improve the prognosis of patients with CKD, delay kidney disease progression, and reduce mortality.

Keywords: Multidisciplinary team clinic, chronic kidney disease, renal function, quality of life, prognosis, mortality

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Introduction

Chronic kidney disease (CKD) is a clinical syndrome of renal dysfunction caused by various primary or secondary causes. It is characterized by proteinuria, hematuria, renal dysfunction, and a series of concurrent symptoms.[1,2] CKD has the characteristics of high morbidity, high mortality, high medical expenses, and low awareness rate. It is a major disease that seriously affects the quality of life and survival time of patients, and even affects socio-economic development. How to effectively control the disease progression of CKD patients, especially outpatients, deserves more attention.[3,4]

In 2012, KDIGO (Kidney Disease: Improving Global Outcomes) recommended that patients with CKD should be treated by a multidisciplinary team (MDT) including nephrology physicians, nurses, dietitians, and pharmacists.[5–8] Taiwan's CKD patients were treated with MDT clinical treatment according to the recommendations of the 2012 KDIGO guidelines;[7,9,10] we draw this experience and established a team of nephrology physicians, nurses, dietitians, and pharmacists in April 2012. The treatment team carried out an MDT treatment mode and standardized treatment of CKD patients. The purpose of this study is to observe the prognosis of CKD patients in the MDT clinic, and to see if good outcomes can be achieved in the treatment of patients with CKD.

Materials and methods

Study population

The patient data in this study were derived from outpatients of our department (Department of Nephrology, Shanghai Fourth People's Hospital) from December 2012 to December 2016. Consistent with the clinical diagnostic criteria of CKD were as follows: renal structural and/or functional disorders, including abnormal pathology; abnormal composition of serum or urine; abnormal imaging examination findings, or glomerular filtration rate (GFR) $<60\,mL/min/1.73\,m^2$ lasting for three months or longer.[3] The exclusion criteria

were as follows: patients with complications such as dehydration, shock, gastrointestinal bleeding, and heart failure; patients receiving renal replacement therapy; patients with mental disorders and mental retardation; patients who were unwilling to undergo regular follow-up treatment.

In this study, a retrospective statistical analysis was conducted on the data of MDT outpatients and general outpatients by random number sampling. Fifty patients receiving conventional clinical treatment were used as the control group, and the other fifty patients receiving MDT clinical treatment were used as the MDT group. This study was approved by the Ethics Committee of Shanghai Fourth People's Hospital (Ethics Approval No. 2012-0142). Notably, no prospective study was conducted considering the patient's own factors.

MDT treatment and traditional clinical treatment

In traditional clinical treatment, doctors measure blood pressure (BP) and blood glucose (BG) each time, and perform a routine physical examination and medical history inquiry on patients. In general, the abnormal laboratory indicators of patients were rechecked within three to six months. According to the patient's conditions and laboratory examinations, the antihypertensive drugs, hypoglycemic drugs, and compound α-ketoacid supplements were selected during treatment. Vitamin D, iron, and erythropoietin were also administrated. In the MDT treatment, in addition to the above points, patients were also given the following measures:

1. Health education. Introduce the concept, hazards, prevention, and control goals of CKD.
2. Self-monitoring of BG. It is recommended to instruct patients to measure their BG by themselves. It is recommended that patients measure their BG at least twice a day, once in the morning and once in the evening, and keep a BG record book. Follow the doctor's advice to take hypoglycemic drugs in time.
3. Dietary guidance.[11] Professional dietitians assess the nutritional status of CKD patients, and then give appropriate dietary guidance according to their nutritional problems. Dietary review analysis software and appropriate dietary models are employed to guide patient intake and diet. High-quality low-protein diet pattern: mainly animal protein, such as eggs, milk, lean meat, chicken, beef, and mutton. Daily protein intake (DPI) was 0.6–0.8 g/kg. Low-sodium diet pattern: daily sodium intake <6 g, instructs patients to eat less salty sauce, oil, and various preserved products. Low-fat diet pattern: daily lipid intake <25 g. Food can be boiled or steamed, avoiding frying. Intake less fatty animal innards and drink more low-fat or skim milk. Diabetes diet: instruct patients to have a fixed diet and to avoid foods with high sugar. Low-purine diet pattern: guide patients with hyperuricemia to intake less beer, seafood, mushrooms, hotpot, and so on.[12] Other: emphasize eating enough dairy, and calories are recommended as 125.5–146.4 kJ/(kg per day). Vegetable oils containing high amounts of unsaturated fatty acids are recommended and phosphorus intake is generally less than 10 mg/kg per day. Vitamin and mineral supplements, especially calcium, are recommended.
4. Daily exercise guidance. Get 30–60 min a day, and four to seven days a week of moderate aerobic exercises, such as brisk walking and Tai Chi. The target heart rate after exercise is 120–130 beats/min.
5. Follow-up. Specialist nurses regularly follow their patients over the phone, including their diet, exercise, medication, and answer questions. After 12 months of follow-up, the questionnaires survey and BG measurement were performed again.

Observation indicators

The changes of related indexes were observed at the first clinic visit and 24 months later. Before and after treatment, the clinical characteristics of patients were be recorded such as BP, urinary albumin/creatinine ratio, plasma albumin, hemoglobin, serum calcium and phosphorus, kidney function include serum creatinine level and GFR (calculation and simplified Modification of Diet in Renal Disease [MDRD] formula, $GFR = 186 \times Scr\text{-}1.154 \times Age\text{-}0.203 \times [0.742 \times female]$), BG, serum lipids, and iron metabolism. The quality-of-life evaluation was used 36-Item Short Form Health Survey (SF-36) to evaluate the physiology, physiological function, physical pain, general health, social function, emotional function, and mental health status of patients.[13] In addition, renal replacement therapy and mortality were observed.

Statistical analyses

Data were analyzed using SPSS 20.0 statistical software. The measurement data of normal distribution were described as mean value ± standard deviation (SD), and the comparison between groups was performed by Student's *t*-test. The comparison between before and after treatment was performed by the paired *t*-test. Chi-square test was used to determine the rate or composition ratio. The measurement data of non-normal distribution were described by median (P2.5–P97.5), and comparison between groups was performed by rank sum test. The counting data were represented by frequency (%). The Kruskal–Wallis test was used for comparison between groups. $P < 0.05$ was considered statistically significant.

Results

The mean serum creatinine level of 100 patients before treatment was (173.36 ± 69.63) μmol/L. There were 51 male and 49 female, aged 25–74 years old, with an average age of 54.01 ± 19.21 years old. Primary nephropathy included 32 cases of chronic nephritis, 30 cases of benign arteriolar nephrosclerosis, 29 cases of diabetic nephropathy, 2 cases of autosomal dominant polycystic kidney disease, and 7 cases of other causes. There were no significant differences in baseline data between age, gender, BP, urinary albumin/creatinine ratio, serum albumin, hemoglobin, renal function, calcium and phosphorus metabolism, GFR, BG, blood lipids, and iron metabolism (Table 1). There were no statistically

Table 1. Baseline of two groups before treatment.

	Control group	MDT group	*P* value
Age (years)	54.21 ± 18.32	53.89 ± 20.32	0.880
Sex (male/female)	26/24	25/25	0.642
Systolic blood pressure (mmHg)	136.34 ± 21.86	141.71 ± 23.17	0.724
Diastolic blood pressure (mmHg)	87.51 ± 20.65	92.36 ± 24.59	0.628
Urine protein/creatinine ratio (mg/mmol)	35.26 ± 11.42	36.57 ± 13.76	0.549
BUN (mmol/L)	17.88 ± 3.17	16.90 ± 2.89	0.813
Scr (μmol/L)	170.14 ± 40.34	175.35 ± 45.81	0.903
UA (μmol/L)	521.79 ± 206.76	506.46 ± 136.25	0.873
GFR (mL/min/1.73 m^2)	36.41 ± 7.52	35.12 ± 7.56	0.748
Ca (mmol/L)	2.03 ± 0.29	2.00 ± 0.30	0.592
P (mmol/L)	1.62 ± 0.69	1.58 ± 0.43	0.682
Ca*P	3.26 ± 1.36	3.15 ± 0.96	0.794
iPTH (ng/L)	171.00 (20.90–416.49)	168.90 (26.80–407.20)	0.940
Globulin (g/L)	27.16 ± 6.20	27.96 ± 7.03	0.951
Albumin (g/L)	33.68 ± 6.42	32.58 ± 7.12	0.417
Prealbumin (g/L)	0.29 ± 0.08	0.24 ± 0.07	0.615
TC (mmol/L)	4.24 ± 1.29	4.65 ± 1.17	0.729
TG (mmol/L)	1.55 ± 0.90	1.59 ± 1.10	0.941
HDL (mmol/L)	1.17 ± 0.41	1.27 ± 0.41	0.823
LDL (mmol/L)	2.36 ± 1.01	2.66 ± 0.88	0.545
FPG (mmol/L)	5.84 ± 1.42	5.92 ± 2.90	0.628
SI (μmol/L)	11.70 ± 9.05	10.94 ± 4.77	0.697
TRF (g/L)	1.70 ± 0.44	1.70 ± 0.52	0.742
TS (%)	27.88 ± 19.00	20.20 ± 12.79	0.851
SF (μg/L)	127.59 (26.32–1059.50)	129.70 (9.42–1204.00)	0.984
Hb (g/L)	105.97 ± 19.88	101.62 ± 18.60	0.763
Hct (%)	22.72 ± 6.13	23.16 ± 5.33	0.683

BUN: blood urea nitrogen; Scr: serum creatinine; UA: blood uric acid; GFR: glomerular filtration rate; Ca: blood calcium; P: blood phosphorus; Ca*P: calcium and phosphorus product; iPTH: whole parathyroid hormone; TC: total cholesterol; TG: triglyceride; LDL: low-density lipoprotein; HDL: high-density lipoprotein; FPG: fasting blood glucose; SI: serum iron; TRF: transfer iron protein; TS: transferrin saturation; SF: serum ferritin; Hb: hemoglobin; Hct: hematocrit.

Table 2. The two groups of patients with the combined disease at the time before treatment (*n*, %).

Combined disease	Control group	MDT group	*P* value
Hypertension	35 (70.0)	36 (72.0)	0.880
Diabetes	32 (64.0)	30 (60.0)	0.734
Cerebrovascular disease	5 (10.0)	4 (8.0)	0.642
Cardiovascular disease	10 (20.0)	9 (18.0)	0.813
Chronic liver disease	2 (4.0)	2 (4.0)	0.906
Chronic obstructive pulmonary disease	5 (10.0)	4 (8.0)	0.875
Tumor	2 (4.0)	2 (4.0)	0.748
Other chronic diseases	9 (18.0)	10 (20.0)	0.592

MDT: multidisciplinary team.

Table 3. The quality of life (SF-36) before treatment of the two groups of patients.

Quality of life (SF-36 scale)	Control group	MDT group	*P* value
Physical function	74.36 ± 7.42	76.23 ± 7.52	0.897
Physical limitations	71.43 ± 8.28	71.37 ± 8.31	0.851
Somatic pain	83.55 ± 8.62	85.45 ± 8.71	0.923
General health	56.81 ± 5.19	58.18 ± 6.01	0.874
Social function	65.72 ± 7.11	64.71 ± 6.92	0.810
Emotional limitations	73.71 ± 8.11	74.19 ± 7.95	0.758
Mental health	75.71 ± 9.11	74.92 ± 9.23	0.692

MDT: multidisciplinary team.

significant differences in baseline data between the two groups before treatment in the combined disease, quality of life, and primary nephropathy (Tables 2 to 4). Furthermore, the percentage of CKD stages 1–5 between the two groups before treatment was no statistically significant difference either (Table 5).

Table 4. The primary kidney disease of the two groups before treatment (*n*, %).

The primary kidney disease	Control group	MDT group	*P* value
Chronic nephritis	17 (34.0)	15 (30.0)	0.732
Benign arteriolar nephrosclerosis limitations	14 (28.0)	16 (32.0)	0.847
Diabetic nephropathy	15 (30.0)	14 (28.0)	0.631
Autosomal dominant polycystic kidney disease	1 (2.0)	1 (2.0)	0.815
Other causes	3 (6.0)	4 (8.0)	0.504

MDT: multidisciplinary team.

Table 5. The percentage of CKD stages 1–5 in each group before treatment (*n*, %).

The percentage of CKD stage	Control group	MDT group	*P* value
CKD stage 1	7 (14.0)	8 (16.0)	0.578
CKD stage 2	15 (30.0)	14 (28.0)	0.839
CKD stage 3	14 (28.0)	13 (26.0)	0.625
CKD stage 4	10 (20.0)	11 (22.0)	0.717
CKD stage 5	4 (8.0)	4 (8.0)	0.942

CKD: chronic kidney disease; MDT: multidisciplinary team.

In the MDT group, BP and BG decreased after treatment. There was no statistically significant difference in other clinical parameters before and after treatment. Compared with the preadministration of MDT group, social function, emotional function, mental health index, and other quality-of-life indicators were significantly improved ($P < 0.05$). However, the GFR of the control group decreased significantly after 24 months of treatment. What's more, the serum creatinine level was significantly higher than that before treatment, and the quality-of-life indicators such as physiology, overall health, social function, and mental health index were also significantly declined compared with the preadministration ($P < 0.05$) (Table 6).

After 24 months of treatment, the mortality and proportion of patients in the MDT group who needed renal replacement therapy (including hemodialysis, peritoneal dialysis, and kidney transplantation) were significantly lower than those of the control group ($P < 0.05$) (Table 7). In the control group, four people died. The cause of death was CKD stage 5 (one case), heart failure (one case), and acute myocardial infarction (one case). In contrast, one person in the MDT group died from a cerebral hemorrhage.

Discussion

The prevalence of CKD continues to rise worldwide.[14] There are more than 20 million CKD patients in the United States, and more than 1 million patients are hospitalized every year.[15] The prevalence rate of CKD in China is 10.8%, and the number of adults with CKD is about 119.5 million.[16]

The pathogenesis of CKD is currently widely believed to be the progressive deterioration of renal dysfunction due to a variety of causes,[17] including the proliferation of glomerular mesangial cell, thickening of the basement membrane, and renal hemodynamic abnormalities. Platelet aggregation and adhesion as well as local microthrombus formation due to vascular endothelial injury, and other factors such as urinary protein, abnormal lipid metabolism, hypertension, hyperglycemia, immune complex deposition, and disorders of calcium and phosphorus metabolism are involved in kidney damage. The process eventually leads to glomerular sclerosis, tubular necrosis, renal interstitial fibrosis, and renal dysfunction.

The 2008 CKD progression model recommended by the US K/DOQI (Guidelines for Quality of Life for Kidney Diseases and Dialysis Patients) suggests that if CKD is not effectively controlled and treated, it will eventually develop into end-stage renal disease.[18,19] They will lead to the lower quality of life and shorten the survival time of patients, and increase the financial burden of the family and country. Therefore, how to treat CKD and delay the deterioration of renal function in patients with CKD has become a medical topic that has attracted people's attention recently.

At present, the United States, Japan, and other developed countries have realized the importance of MDT in the prevention and treatment of CKD.[20,21] Taiwan has been training professionals to educate and treat CKD patients since 2001. The treatment of CKD patients in mainland China is still in its infancy. There is a lack of evidence-based medical evidence for the effectiveness and necessity of MDT clinical treatment.

In order to effectively implement health management, it is currently advocated to establish a co-operative team, including renal medicine specialists, dietitians, nurses, social volunteers, and so on.[16] For example, studies have shown that specially trained nurses can well control BP of CKD patients.[5] Earl and Henstenburg[6] proposed that nutritionists participate in management of sodium intake and diet, and exercise in patients with CKD is beneficial to delay the prognosis of disease. Cueto-Manzano *et al.*[22] also showed that health management could improve the prognosis of CKD patients. In this study, health management was performed by follow-up staff of our hospital's CKD MDT clinic, including specialists in kidney medicine, dietitians, and nurses. These results proved that this model could receive good results.

Table 6. Comparison of changes in indicators before and after treatment in the MDT group.

	Control group			MDT group		
	Before treatment	After treatment	*P* value	Before treatment	After treatment	*P* value
Systolic blood pressure (mmHg)	136.34 ± 21.86	139.42 ± 19.25	0.621	141.71 ± 23.17	130.28 ± 19.63	0.041*
Diastolic blood pressure (mmHg)	87.51 ± 20.65	88.25 ± 21.34	0.546	92.36 ± 24.59	81.47 ± 20.64	0.032*
Urine protein/creatinine ratio (mg/mmol)	35.26 ± 11.42	37.45 ± 16.81	0.861	36.57 ± 13.76	32.62 ± 14.41	0.357
BUN (mmol/L)	17.88 ± 3.17	19.31 ± 3.62	0.681	16.90 ± 2.89	17.18 ± 3.07	0.681
Scr (μmol/L)	170.14 ± 40.34	240.43 ± 43.75	0.015*	175.35 ± 45.81	171.14 ± 40.34	0.095
UA (μmol/L)	521.79 ± 206.76	534.79 ± 201.67	0.946	506.46 ± 136.25	521.91 ± 207.16	0.946
GFR (mL/min/1.73 m^2)	36.41 ± 7.52	24.31 ± 7.52	0.021*	35.12 ± 7.56	32.41 ± 7.52	0.052
Ca (mmol/L)	2.03 ± 0.29	1.97 ± 0.32	0.418	2.00 ± 0.30	1.98 ± 0.29	0.418
P (mmol/L)	1.62 ± 0.69	1.87 ± 0.93	0.749	1.58 ± 0.43	1.65 ± 0.68	0.749
Ca*P	3.26 ± 1.36	3.01 ± 1.42	0.593	3.15 ± 0.96	3.36 ± 1.31	0.593
iPTH (ng/L)	171.00 (20.90–416.49)	203.00 (30.92–524.78)	0.682	168.90 (26.80–407.20)	172.00 (29.90–426.49)	0.682
Globulin (g/L)	27.16 ± 6.20	28.15 ± 7.26	0.617	27.96 ± 7.03	27.46 ± 6.20	0.617
A (g/L)	33.68 ± 6.42	31.81 ± 6.43	0.728	32.58 ± 7.12	31.68 ± 6.42	0.728
PreA (g/L)	0.29 ± 0.08	0.21 ± 0.07	0.942	0.24 ± 0.07	0.24 ± 0.08	0.942
TC (mmol/L)	4.24 ± 1.29	4.54 ± 1.94	0.824	4.65 ± 1.17	4.44 ± 1.21	0.824
TG (mmol/L)	1.55 ± 0.90	1.67 ± 0.92	0.545	1.59 ± 1.10	1.56 ± 0.92	0.545
HDL (mmol/L)	1.17 ± 0.41	1.01 ± 0.40	0.629	1.27 ± 0.41	1.19 ± 0.42	0.629
LDL (mmol/L)	2.36 ± 1.01	2.67 ± 1.34	0.697	2.66 ± 0.88	2.56 ± 1.21	0.697
FPG (mmol/L)	5.84 ± 1.42	5.86 ± 1.37	0.752	5.92 ± 2.90	5.04 ± 1.43	0.032*
SI (μmol/L)	11.70 ± 9.05	11.04 ± 9.21	0.681	10.94 ± 4.77	10.70 ± 9.05	0.681
TRF (g/L)	1.70 ± 0.44	1.67 ± 0.48	0.743	1.70 ± 0.52	1.72 ± 0.43	0.743
TS (%)	27.88 ± 19.00	27.15 ± 19.36	0.852	20.20 ± 12.79	21.88 ± 19.10	0.852
SF (μg/L)	127.59 (26.32–1059.50)	135.59 (30.23–1247.04)	0.905	129.70 (9.42–1204.00)	129.59 (26.32–1059.50)	0.905
Hb (g/L)	105.97 ± 19.88	101.79 ± 20.81	0.754	101.62 ± 18.60	99.97 ± 19.82	0.754
Hct (%)	22.72 ± 6.13	22.27 ± 6.32	0.836	23.16 ± 5.33	22.92 ± 6.01	0.836
Physical function	74.36 ± 7.42	62.36 ± 7.21	0.041	76.23 ± 7.52	73.36 ± 7.42	0.545
Physical limitations	71.43 ± 8.28	69.71 ± 8.19	0.824	71.37 ± 8.31	69.47 ± 8.18	0.629
Somatic pain	83.55 ± 8.62	80.12 ± 8.43	0.545	85.45 ± 8.71	80.52 ± 8.23	0.697
General health	56.81 ± 5.19	45.16 ± 5.24	0.029	58.18 ± 6.01	51.86 ± 5.14	0.752
Social function	65.72 ± 7.11	56.82 ± 7.31	0.037*	64.71 ± 6.92	71.78 ± 7.01	0.035*
Emotional limitations	73.71 ± 8.11	70.17 ± 8.14	0.752	74.19 ± 7.95	79.17 ± 8.21	0.043*
Mental health	75.71 ± 9.11	64.17 ± 9.04	0.021*	74.92 ± 9.23	80.74 ± 9.14	0.042*

BUN: blood urea nitrogen; Scr: serum creatinine; UA: blood uric acid; GFR: glomerular filtration rate; Ca: blood calcium; P: blood phosphorus; Ca*P: calcium and phosphorus product; iPTH: whole parathyroid hormone; A: albumin; PreA: prealbumin; TC: total cholesterol; TG: triglyceride; LDL: low-density lipoprotein; HDL: high-density lipoprotein; FPG: fasting blood glucose; SI: serum iron; TRF: transfer iron protein; TS: transferrin saturation; SF: serum ferritin; Hb: hemoglobin; Hct: hematocrit.
*$P < 0.05$.

Table 7. The renal replacement therapy population and mortality after treatment (*n*, %).

	Control group	MDT group	*P* value
Hemodialysis (person)	6 (12.0)	3 (6.0)	
Peritoneal dialysis (person)	5 (10.0)	2 (4.0)	
Renal transplantation (person)	2 (4.0)	0 (0.0)	
Total renal replacement therapy (person)	13 (26.0)	5 (10.0)	0.011
All cause of death (person)	4 (8.0)	1 (2.0)	0.009

MDT: multidisciplinary team.

This study proved that the conditions of CKD patients who were regularly followed up in the MDT clinic of our hospital were under control, and the quality of life was significantly improved. The reason may be related to better BP and BG control. It is well-known that BP and diabetes control are the key factors that influence the progression of CKD. In the MDT clinic, due to more detailed publicity and education management, the BP and BG of the patients decreased significantly after treatment. Due to the large number of drugs used by patients in China, and the timely adjustment of treatment plan according to patients' BP and blood sugar fluctuations during the study, it is not possible to accurately count each drug. Therefore, renal function did not deteriorate in the MDT group after 24 months, while it did

in the control group. This suggests that the MDT clinic is an effective treatment for chronic disease in patients with CKD, which improves the quality of life of patients, effectively controls disease progression and death events. The ratio plays a very important role.

CKD is a chronic disease that requires lifelong management and treatment. It involves a variety of diseases, and therefore requires the participation and co-operation of specialists, nurses, dietitians, and other multidisciplinary personnel.[22] Previous studies have shown that MDT clinic can effectively improve the condition of patients, and is an effective treatment for patients with CKD.[23–25] This treatment mode is worthy of clinical application.

However, there are still some limitations in this study. Although the current clinical nutrition management of kidney disease has started, but the lack of a perfect payment system, related nutrition products are mostly non-medical insurance payment items, resulting in unsatisfactory patient co-operation, the treatment effect is greatly affected. Furthermore, due to the wide variety of drugs used in patients in China, and the drug treatment plan was adjusted according to the fluctuation of patients' BP, blood sugar, calcium, phosphorus, and parathyroid hormone (PTH) at any time during the study, the time and dose of each drug including phosphate binder could not be accurately counted. In addition, this study was a single-center retrospective study with a small sample size, and short follow-up time. Larger sample size randomized controlled multicenter studies and longer follow-up times are needed to observe the clinical benefits of MDT clinic for CKD patients.

AUTHORS' CONTRIBUTIONS

Z.B. participated in the study design, manuscript drafting, and data interpretation. Q.Z. was involved in the data analysis and interpretation. L.S. took part in collecting the patients' information. S.C. revised the manuscript.

DECLARATION OF CONFLICTING INTERESTS

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

ETHICAL APPROVAL

This study was approved by the Ethics Committee of Shanghai Fourth People's Hospital (Ethics Approval No. 2012-0142).

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