Short Communication

Contributors to nutritional status in continuous ambulatory peritoneal dialysis as practised in Henan Province, China

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Background and Objectives: To investigate the nutritional status of patients undergoing continuous ambulatory peritoneal dialysis (CAPD) and the factors involved. **Methods and Study Design:** We used the Subjective Global Assessment (SGA) of nutritional status, a general questionnaire, dietary records, and laboratory parameters from 3 consecutive days to develop a NS assessment with it, we assessed 240 patients undergoing CAPD at a dialysis center in Henan Province. **Results:** In this setting, the prevalence of malnutrition in patients undergoing CAPD was 11.7%. Univariate analysis showed that patient characteristics related to NS included energy and protein intakes, weight and BMI, dialysis duration, urinary creatinine, and total creatinine clearance rate. Multiple linear regression analysis revealed that dialysis duration (p<0.001) and energy intake (p=0.01) were the principal predictors of nutritional status and allowed 81% of the variance in nutritional status to be explained. **Conclusions:** Effective collaboration between nutritionists and other health care workers to minimise dialysis duration and optimize energy intake should improve the nutritionally-related quality of life and well-being among CAPD patients.

Key Words: nutritional deficiency, developing countries, Cambodia, anaemia, vitamin A deficiency

INTRODUCTION

Continuous ambulatory peritoneal dialysis (CAPD) improves patient management in end-stage renal disease. CAPD is associated with more favorable residual renal function than hemodialysis at a relatively lower economic cost,[1] which accounts for its widespread use. Nevertheless, malnutrition is highly prevalent in patients undergoing CAPD; it affects their quality of life and is associated with complications and an increased mortality rate.[2] The present study was based at the First Affiliated Hospital of Zhengzhou University, the major tertiary referral medical center in Henan Province. It examined how diet and nutritional status, assessed using an 8-item Subjective Global Assessment (SGA)-related nutrition score, which took into account clinical and laboratory indicators, could be optimized and malnutrition minimized among CAPD patients through an emphasis on food intake management.

METHODS

Patients

This study enrolled 240 patients (152 men and 88 women; age 39.1±10.4 years, range 18–65 years) who underwent CAPD between August 2015 and August 2016 in the First Affiliated Hospital of Zhengzhou University, Henan Province. A total of 92 and 76 patients underwent CAPD for chronic glomerulonephritis and hypertensive renal damage, respectively; the reason for dialysis was unclear in 50 patients, and 20 patients had other reasons (e.g. dia betes, gout, drug-induced kidney damage, kidney damage caused by hepatitis B and C, amyloid kidney damage, and systemic vasculitic kidney damage). The inclusion criteria

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were as follows: 1) prognosis was assessed according to the Kidney Disease: Improving Global Outcomes guideline; 2) age ≥18 years; 3) dialysis duration ≥1 month; 4) no difficulties in reading.

Methods

Overall nutritional assessment scale

We used the SGA3 and determined an 8-item (indicator) NS assessment based on: a body weight change over approximately 2 weeks, recent dietary change, gastrointestinal symptoms, stress, activity changes, muscle wasting, triceps skin fold thickness, and ankle edema. The eight items were each ranked by increasing severity as level of A, B or C. If more than five indicators were assigned to C, then the patient was said to have severe malnutrition; if more than five indicators were assigned at least level B, then the patient had moderate malnutrition; otherwise the patient was considered to have an acceptable NS (Appendix table 1).

Dietary intake

Food records were kept for 3 consecutive days. Nutrition specialist nurses guided patients in recording food consumption at morning, afternoon, and evening meals and snacking. Together, the food nutrition kit and food equivalent exchange method4 enabled the calculation of daily energy and protein intake.

Laboratory indicators

Venous blood was drawn for nutritional biochemistry (serum albumin, creatinine, iron, calcium, and phosphorus) and hematology (erythrocytes, hemoglobin, and platelets), and urine was collected to measure creatinine. Residual and total renal Kt/V (ratio of the amount of urea to the volume of the dialyzer at a certain dialysis time), residual renal creatinine clearance rate (Ccr), and total Ccr were calculated.

Survey

The investigator and 4 specialist nurses recorded additional details on the patient questionnaire. These included height, weight, body mass index (BMI), and peritoneal dialysis time. Of the 260 questionnaires distributed, 240 were returned valid (92.3% efficiency).

Statistical analysis

SPSS version 17.0 was used for the statistical analysis. Means ± standard deviations and medians are shown (shown in Table 1). Data were analyzed using t tests, analysis of variance, nonparametric tests, and multivariate linear regression.

RESULTS

Prevalence of malnutrition among patients undergoing CAPD

Among the 240 patients, 212 (88.3%) had apparently normal nutrition and 28 (11.7%) had malnutrition; of these, 20 patients had moderate malnutrition and 8 had severe malnutrition. Those with evident malnutrition had all undergone CAPD for more than 2 years.

Characteristics and associations of patients with malnutrition (Table 1)

Differences were found in energy and protein intake, weight and BMI, dialysis duration, urinary creatinine, and total Ccr.

Multivariate analysis of patients with malnutrition (Table 2)

On multivariate linear regression analysis, statistically significant patient indicators were considered the independent variables and NS was considered the dependent

Table 1. Association of sociodemographic, anthropometric, and dietary factors with the degree of malnutrition in patients undergoing CAPD

Characteristics	Nutritional status			F/ Z value	*p* value
	Acceptable	Moderate	Severe		
Age (years)*	38.1±10.2	47.8±11.0	42.5±2.74	4.20	0.02
Height (cm)*	167±7.31	162±2.12	171±1.41	1.80	0.18
Weight (kg)*	65.9±9.01	49.8±8.32	69.5±0.71	7.79	<0.001
BMI (kg/m^2)*	23.4±3.35	19.0±3.08	23.8±0.64	4.25	0.01
Energy intake (kcal per day)*	1301±293	863±46.0	781±144	8.55	<0.001
Dietary protein (g per day)*	44.7±9.17	33.9±5.72	31.5±2.12	5.19	0.01
Serum albumin (g/L)*	36.6±4.79	40.4±2.47	33.7±2.40	2.03	0.14
Serum creatinine (umol/l)*	918±324	872±239	1416±17.0	2.49	0.09
RBC (/L)*	3.43±0.62	3.58±0.51	3.19±0.24	0.31	0.73
Hemoglobin (g/L)*	100±17.0	109±14.7	97.5±2.12	0.68	0.51
Blood platelets (/L)*	191±71.3	235±55.1	223±131	0.98	0.38
Serum calcium (mmol/L)*	2.17±0.28	2.13±0.25	2.02±0.40	0.35	0.7
Serum phosphorus (mmol/L)*	1.70±0.42	1.71±0.34	1.74±0.23	0.01	1.00
Serum iron (umol/L)*	13.6±5.13	14.7±4.56	7.95±1.20	1.35	0.27
Dialysis duration (months)**	6 (3-11)	28 (22.8-31.3)	39.5 (39-40)	17.2	<0.001
Urine creatinine (umol/L)**	456 (3086-6202)	1975 (0-4049)	0.00 (0-0)	9.63	0.01
Remnant kidney Kt/V**	0.53 (0.37-0.78)	0.50 (0-1.02)	0.00 (0-0)	5.18	0.08
Total Kt/V**	1.84 (1.51-2.17)	2.10 (1.96-2.18)	1.29 (1.08-1.49)	5.39	0.07
Remnant kidney Ccr (ml/min)**	27.6 (20.5-41.3)	31.5 (0-48.57)	0.00 (0-0)	5.04	0.08
Total Ccr (ml/min)	67.7 (59.4-81.4)	41.1 (39.8-65.3)	41.8 (41.5-50.2)	7.65	0.02

†Parametric (*) or nonparametric (**) test as indicated. The meaning of the value of F or Z is used to test the results of the sample which can represent the overall degree of truth.

Table 2. Multivariate analysis of factors that may affect NS

Variable	Regression coefficients	Standard error	Standardized regression coefficients	T value	*p* value	R^2 (entire equation)	*F*
Dialysis duration	0.04	0.00	0.77	10.4	<0.001	0.81	32.1
Age	-0.00	0.00	-0.04	-0.66	0.51		
Energy intake	0.00	0.00	-0.27	-2.57	0.01		
Dietary protein	0.00	0.01	0.05	0.52	0.61		
Weight	0.01	0.01	0.15	1.62	0.11		
BMI	-0.00	0.02	-0.02	-0.17	0.87		
Urinary creatinine	-2.14	0.00	-0.01	-0.16	0.88		
Total Ccr	-0.00	0.00	-0.13	-1.75	0.09		

†The standardized regression coefficients have eliminated the influence of Unit in the independent variables on the dependent variable to provide an indication of relative importance in the determination of NS.

variable. Final dialysis duration and energy intake were entered into the regression equation.

DISCUSSION

Nutritional status

On univariate analysis, dialysis duration, energy intake, age, urinary creatinine, total Ccr, dietary protein, BMI and weight were associated with nutritional impairment. With reduced energy and protein intakes, NS gradually decreased and, the longer the dialysis duration, the more serious the status of malnutrition. NS for the 240 patients, was acceptable for 212 (88.3%) while 28 had malnutrition (11.7%); specifically, 20 had moderate malnutrition and 8 had severe malnutrition. These observations are consistent with previous reports. Other studies have reported malnutrition rates of 18%–56% in patients undergoing CAPD, with 35% of patients having mild to moderate malnutrition. However, in developing countries, severe malnutrition is reportedly more prevalent (up to 76.2%) in these patients; up to 4.8% have severe malnutrition.[5] Moreover, malnutrition is linked with long-term complications in 30%–60% of patients undergoing CAPD.[6,7] In the present study, the nutritional status of the majority of patients was adequate, which may be because they had undergone CAPD at a dialysis center for less than 2 years, and that a shorter duration of dialysis is advantageous.

Multifactorial analysis of putative contributors to malnutrition

On multivariate linear regression analysis, statistically significant patient indicators were considered the independent variables and NS was considered the dependent variable. When dialysis duration and energy intake were entered into the regression equation, they were predictors of nutritional status and 81.1% of the variance was explained.

The SGA is widely used for assessing the nutritional status of patients undergoing CAPD. In the present study, a prolonged CAPD duration was associated with severe malnutrition, as judged by our NS, which accommodates the SGA. Undergoing CAPD for 12 months has been reported not to lead to recognizable changes in appetite, while, by 18 months, appetite gradually decreases and the risk of malnutrition increases.[8,9] Conversely, patients with malnutrition tend to have a longer CAPD duration. CAPD-related malnutrition may be associated with not only a prolonged duration of dialysis, but also the accumulation of glycosylated compounds, which may lead to peritoneal thickening, a gradual decline in peritoneal ultrafiltration, and a loss of appetite.

The present study revealed that malnutrition in patients undergoing CAPD is associated with a decrease in energy intake, a prolonged dialysis duration, related complications, and presumptive in vivo carbohydrate and protein catabolic disorders (on the basis of energy intake and body composition). In addition, patients who are dissatisfied with their CAPD treatment may experience pessimism, depression, and loss of appetite, followed by varying degrees of malnutrition. This interpretation is consistent with previous observations of dialysis patients.1 Whatever the sequence, an adequate intake of nutritious energy sources during CAPD is required. Appetite, food habits and intake must be carefully monitored to reduce malnutrition and improve the quality of life of these patients.

Summary

Patients undergoing CAPD require comprehensive team management. Furthermore, recognition and management of their nutritional status is integral to their overall care. This is especially pertinent when patients undergo prolonged dialysis and experience compromised physical activity with a lower plane of energy throughput, requiring greater nutrient and other food component density along with a healthy gut microbiome. Nutrition support teams should involve medical practitioners, clinical nurses, and nutritionists and dietitians. The codevelopment of evidence-based information about underlying diseases, dietary principles, and preferred eating patterns, accompanied by regular follow-up should improve patient motivation and dietary adherence for better overall health outcomes in CAPD.

AUTHOR DISCLOSURES

The authors declare no conflict of interest.

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Appendix table 1. Subjective global assessment, SGA

Index	Nutritional level		
	A	B	C
1. A body weight change over approximately 2 weeks	No/Rise	Decrease <5%	Decrease >5%
2. Recent dietary change	No	Decrease	Do eating/Low calorie snacks
3. Gastrointestinal symptoms	No/Not diminished of appetite	Mild nausea, vomiting	Serious nausea, vomiting
4. Stress	No/Mildly	Moderate	Severe
5. Activity changes	No/Diminished	Can get out of bed	Bed rest
6. Muscle wasting	No	Mildly	Severe
7. Triceps skin fold thickness	Normal	Mild reduction	Severe reduction
8. Ankle edema	No	Mildly	Severe

†Among the above eight items, if more than five ones were accessed C, then it's assessed as severe malnutrition; if more than five ones were accessed B, then it's assessed as moderate malnutrition; the rest was assessed as normal.