PATIENT SURVIVAL AND TECHNIQUE FAILURE IN CONTINUOUS AMBULATORY PERITONEAL DIALYSIS PATIENTS WITH PRIOR STROKE

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◆ **Background:** To investigate patient survival and technical failure of patients with prior stroke receiving continuous ambulatory peritoneal dialysis (CAPD) in Southern China.

◆ **Methods:** This was a retrospective study. All subjects were recruited from the peritoneal dialysis center in The First Affiliated Hospital of Sun Yat-sen University from 1 January 2006 to 31 December 2010. All eligible patients were assigned to stroke group and non-stroke group according to a history of stroke before receiving CAPD. The primary outcomes were all-cause mortality and death-censored technical failure. Cox regression was used to estimate risk factors of all-cause mortality and death-censored technique failure.

◆ **Results:** Of the 1,068 recruited patients, 75 (7.0%) patients had a previous history of stroke. The all-cause mortality and death-censored technique failure were significantly higher in the stroke group compared with the non-stroke group, respectively (odds ratio [OR] 2.67, 95% confidence interval [CI] 1.59 – 4.46 and OR 2.52, 95% CI 1.19 – 5.34). Older age (changed by 10 years, hazard ratio [HR] 1.90, 95% CI 1.07 – 3.38), lower body mass index (BMI 18.5 – 23.9 vs < 18.5 kg/m² reference, HR 0.17, 95% CI 0.05 – 0.55) and time to the first episode of peritonitis (HR 0.93, 95% CI 0.89 – 0.96) were independently associated with increased risk of all-cause mortality in patients with prior stroke. In addition, time to the first episode of peritonitis was associated with decreased risk of death-censored technique failure (HR 0.91, 95% CI 0.84 – 0.99) in those with prior stroke.

◆ **Conclusions:** Continuous ambulatory peritoneal dialysis patients with prior stroke had high rates of all-cause mortality and technique failure compared with those without prior stroke. Older age, lower BMI, and time to the first episode of peritonitis were independent risk factors of all-cause mortality in patients with prior stroke.

past decades, long-term patient survival remains poor, with approximately 11% of PD patients surviving more than 10 years (2). Cardiovascular disease (CVD) is the main cause of death in PD patients, accounting for 40% – 50% of all-cause mortality in both Chinese and Caucasian dialysis populations (3,4). Stroke is the second or third cause of death following cardiac disease, accounting for approximately 10% of death during continuous ambulatory PD (CAPD) therapy (5,6). The incidence of stroke in the dialysis population is 5- to 10-fold higher than that in the general population and is related to a worse prognosis (7–9).

To date, there were only few retrospective studies regarding all-cause mortality in PD patients with pre-existing cardiac diseases. Stack *et al.* reported that all-cause mortality in PD patients with congestive heart disease was higher than in those without congestive heart disease (10). Ganesh *et al.* reported that patient survival was significantly lower in PD patients with coronary artery disease than in those without coronary artery disease (11). Compared with patients without stroke, patients with prior stroke tend to be older and are more likely to have cardiac disease, hypertension, and other comorbidities (12,13). However, all-cause mortality in PD patients with prior stroke has received very little attention. In this study, we try to test the hypothesis that CAPD patients with prior stroke may have higher all-cause mortality compared with those without prior stroke.

METHODS

STUDY POPULATION

This was a retrospective single-center study. All eligible participants were recruited from the PD center in The First Affiliated Hospital of Sun Yat-sen University from 1 January 2006 to 31 December 2010. The inclusion criteria were: (i) incident patients who received stable CAPD for 3 months

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Peritoneal dialysis (PD) is a safe and effective modality of renal replacement therapy, and has been widely accepted for treatment of patients with end-stage renal disease (ERSD) (1). Although patient survival has greatly improved in the

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or more; (ii) aged from 18 to 80 years old; (iii) no history of kidney transplantation; (iv) not transferred from hemodialysis. Eligible patients were assigned to the stroke group and non-stroke group based on the history of prior stroke presence before CAPD. Conventional PD solutions (Dianeal 1.5%, 2.5% or 4.25% dextrose; Baxter Healthcare, Guangzhou, China), Y-sets, and twin-bag systems were utilized in almost all of the CAPD patients. The study protocol was approved by the Ethics Committee of The First Affiliated Hospital of Sun Yat-sen University. Written informed consent forms were obtained from all participants. All patients were followed up until cessation of PD, death, or until December 31, 2011.

The primary outcomes were all-cause mortality and death-censored technical failure. Baseline characteristics and laboratory measurements in initiation of CAPD included age, gender, body mass index (BMI), measured glomerular filtration rate (mGFR), diabetes, hypertension, pre-existing cardiac diseases (coronary artery disease, myocardial infarction, angioplasty, coronary artery bypass, or congestive heart failure), mean arterial pressure (MAP), cause of end-stage renal disease (ESRD), hemoglobin, high sensitivity C-reactive protein (hs-CRP), serum albumin, cholesterol, triglyceride, high-density lipoprotein (HDL), and low-density lipoprotein (LDL). In addition, time to the first episode of peritonitis was also recorded, which was defined as the time from the initiation of CAPD to the first episode of peritonitis. Kt/v and assisted PD were also recorded during the follow-up periods.

DEFINITIONS

Stroke was defined as evidence of an acute disturbance of focal neurological function with symptoms lasting > 24 hours and considered to be due to intracerebral hemorrhage or ischemia as reported by the other investigators (14). Glomerular filtration rate was measured (mGFR) as the mean of urea and creatinine clearance, calculated from 24-hour urine collections and indexed for body surface area. Cardiovascular disease was defined as any diagnosis of coronary artery disease, myocardial infarction, angioplasty, coronary artery bypass, congestive heart failure, cerebrovascular disease, or peripheral arterial disease (15). Hypertension was defined as a systolic blood pressure of ≥ 140 mmHg, diastolic blood pressure of ≥ 90 mmHg, any use of antihypertensive medication in the last 2 weeks or any self-reported history of hypertension. Diabetes was defined as any self-reported history of diabetes, fasting plasma glucose of ≥ 7.0 mmol/L, or by hypoglycemic agents despite normal fasting plasma glucose. Body mass index was calculated as weight (kg)/height² (m²) and was categorized as < 18.5, 18.5 – 23.9, 24.0 – 27.9, and ≥ 28.0 kg/m² (16). Assisted PD is defined as a PD modality performed at the patients' home with the assistance of a family member or other assistants. Diagnosis of PD-associated peritonitis was made based on at least 2 of the following criteria: 1) abdominal pain or cloudiness of PD effluent; 2) white blood cell (WBC) count in PD effluent > 100/ μ L with > 50% polymorphonuclear leukocytes; and 3) a positive culture from PD effluent (17).

Death-censored technique failure was defined as transfer to hemodialysis for more than 90 days, and it was censored for death, kidney transplantation, and spontaneous recovery of renal function, move to other center, or "still on CAPD" until December 31, 2011 (18).

STATISTICAL ANALYSIS

Continuous variables were expressed as mean $\pm$ standard deviation (SD), whereas categorical variables were presented as percentages or frequencies. Comparison of means was made using Student's *t*-test or the non-parametric Mann-Whitney test. Comparison of qualitative variables was performed with Pearson's χ^2 test. Comparison of peritonitis rate was analyzed using a Poisson model. Time-to-event analysis of all-cause mortality and death-censored technique failure was calculated using Kaplan-Meier curves or Cox proportional hazards model. Factors analyzed by univariate analysis with $p < 0.10$ were included in multivariate Cox regression. Statistical significance was defined as $p < 0.05$ using 2-tailed tests. Statistical analyses were performed using SPSS 19.0 software (SPSS, Chicago, IL, USA).

RESULTS

BASELINE CHARACTERISTICS

A total of 1,193 ESRD patients were investigated. Of them, 62 (5.2%) patients who received CAPD less than 3 months, 14 (1.2%) patients younger than 18 years old, 6 (0.5%) patients older than 80 years old, 7 (0.6%) patients with a history of kidney transplantation, and 36 (3.0%) patients transferred from hemodialysis before receiving CAPD were excluded. Finally, 1,068 patients who met the inclusion criteria were recruited, with an average age of 48.0 ± 15.4 years old and average PD duration of 27.4 ± 15.6 months. Of these eligible patients, 75 (7.0%) patients had prior stroke (stroke group) and 993 (93.0%) patients had no prior stroke (non-stroke group). The flow diagram is shown in Figure 1.

As shown in Table 1, 7.0% patients had a previous diagnosis of stroke, 23.1% with diabetes, 66.8% with hypertension, and 23.8% with pre-existing cardiac disease. Compared with those in the non-stroke group, patients in the prior-stroke group were older ($p < 0.001$), had a higher proportion of diabetes ($p < 0.001$), more hypertension ($p < 0.001$), and more diabetic nephropathy ($p < 0.001$); had higher hs-CRP ($p = 0.03$) lower HDL ($p = 0.02$) and serum albumin ($p = 0.03$), and less glomerulonephritis as the primary cause of ESRD ($p < 0.001$). In addition, the percentage of assisted PD was significantly higher in the stroke group compared with the non-stroke group ($p = 0.02$).

ALL-CAUSE MORTALITY AND ASSOCIATED RISK FACTORS

In this study, 173 (16.2%, 70.9/1,000 patient-years) patients died with a mean follow-up time of 21.7 ± 14.1 months.

Figure 1 — Flow diagram. CAPD = continuous ambulatory peritoneal dialysis.

The cause of death is shown in Table 2. Cardiovascular disease (61.8%) was the major cause of death in this study. All-cause mortality rates were 149.8/1000 patient-years (32.0%, 24/75 patients) in the stroke group and 65.4/1000 patient-years (15.0%, 149/993 patients) in the non-stroke group. The all-cause mortality rate was significantly higher in the stroke group compared with the non-stroke group (odds ratio [OR] 2.67 95% confidence interval [CI] 1.59 – 4.46). The cumulative all-cause mortality rate at 1, 2, 3, and 5 years in the stroke group was significantly higher than in the non-stroke group (10% vs 5%, 15% vs 11%, 23% vs 17%, 69% vs 32%, log rank = 15.555, $p < 0.001$, Figure 2).

By a univariate analysis, older age, diabetes, prior stroke, pre-existing heart diseases, time to first peritonitis, MAP, lower hemoglobin, higher hs-CRP and lower serum albumin (all p values < 0.05) were determined to be risk factors of all-cause mortality among the total population (Table 3). After adjustment for MAP, hs-CRP, and albumin, older age (increased by 10 years [hazard ratio] HR 1.36, 95% CI 1.19 – 1.56), diabetes (HR 2.02, 95% CI, 1.40 – 2.92), prior stroke (HR 1.82, 95% CI 1.21 – 2.53), pre-existing cardiac disease (HR 1.95, 95% CI 1.37 – 2.77), time to first peritonitis (HR 0.95, 95% CI 0.94 – 0.96), and lower hemoglobin (HR 0.98, 95% CI 0.97 – 0.99) were independently associated with increased risk of all-cause mortality in these patients. Older age, BMI, time to the first episode of peritonitis, MAP and serum albumin (all p values

< 0.05) were associated with all-cause mortality in the stroke group using univariate analysis. After adjustment for MAP and serum albumin, older age (changed by 10 years, HR 1.90, 95% CI 1.07 – 3.38), lower BMI (18.5 – 23.9 vs < 18.5 kg/m² reference, HR 0.17, 95% CI 0.05 – 0.55), and time to the first episode of peritonitis (1-month increase of time to the first episode of peritonitis was associated with a 7% decreased risk of mortality in patients with prior stroke, HR 0.93, 95% CI 0.89 – 0.96) were independent risk factors of all-cause mortality in the stroke group.

DEATH-CENSORED TECHNIQUE FAILURE AND ASSOCIATED RISK FACTORS

A total of 60 (5.6%, 24.6/1000 patient-years) patients developed death-censored technique failure with a mean follow-up time of 20.9 ± 12.6 months. The causes of technique failure were peritonitis (26 patients, 43.3%), inadequate dialysis (9 patients, 15.0%), ultrafiltration failure (3 patients, 5.0%), thoracoabdominal fistula (3 patients, 5.0%), edema of scrotum (4 patients, 6.7%), patient's choice (8 patients, 13.3%), and other causes (7 patients, 11.7%). Technique failure rates were 56.2/1000 patient-years (12.0%, 9/75) in the patients with previous stroke and 22.4/1000 patient-years (5.1%, 51/993) in the patients without stroke. The death-censored technique failure rate was significantly higher in the stroke group compared with

TABLE 1
Baseline of Characteristics of All Peritoneal Dialysis Patients

Variables	Total patients (n=1,068)	Non-stroke group (n=993)	Stroke group (n=75)	p
Age (years, mean±SD)	48.0±15.4	46.9±15.1	62.5±10.5	<0.001
Male (n, %)	628 (58.8)	576 (58.0)	52 (69.3)	0.07
BMI (kg/m ² , mean±SD)	21.19±3.05	21.16±3.05	21.55±3.10	0.29
mGFR (mL/min/1.73m ² , median, IQR)	2.58 (1.17–4.54)	2.59 (1.17–4.54)	2.23 (1.01–5.56)	0.72
Diabetes (n, %)	247 (23.1)	204 (20.5)	43 (57.3)	<0.001
Hypertension (n, %)	713 (66.8)	648 (65.3)	65 (86.7)	<0.001
Pre-existing heart diseases (n, %)	254 (23.8)	233 (23.5)	21 (28.0)	0.40
MAP (mmHg, mean±SD)	101.6±17.7	101.8±17.8	98.7±15.6	0.15
Assisted PD (n, %)	167 (15.6)	148 (14.9)	19 (25.3)	0.02
Kt/V(mean±SD)	2.38±0.63	2.38±0.63	2.33±0.54	0.58
Time to the first episode of peritonitis (months, mean±SD)	25.0±10.6	25.1±10.6	24.13±11.5	0.47
Cause of ESRD				
Glomerulonephritis (n, %)	648 (60.7)	631 (63.5)	17 (22.7)	<0.001
Diabetic nephropathy (n, %)	182 (17.0)	156 (15.7)	26 (34.7)	<0.001
Others (n, %)	238 (22.3)	206 (20.8)	32 (42.6)	<0.001
Laboratory measurements				
Hemoglobin (g/L, mean ± SD)	94.5±22.7	94.4±22.8	95.9±21.4	0.58
hs-CRP (mg/L, median, IQR)	1.94 (0.77–6.96)	1.84 (0.75–6.65)	3.00 (1.00–10.00)	0.03
Albumin (g/L, mean ± SD)	36.9±5.8	37.1±5.8	35.5±5.0	0.03
Cholesterol (mmol/L, mean±SD)	5.08±2.67	5.09±2.74	4.94±1.25	0.64
Triglyceride (mmol/L, mean±SD)	1.71±1.09	1.68±1.14	1.78±1.09	0.44
HDL (mmol/L, mean±SD)	1.26±0.60	1.28±0.62	1.10±0.40	0.02
LDL (mmol/L, mean±SD)	2.92±1.36	2.93±1.38	2.83±1.07	0.58

SD = standard deviation; BMI = body mass index; mGFR = measured glomerular filtration rate; IQR = interquartile range; MAP = mean arterial pressure; PD = peritoneal dialysis; ESRD = end-stage renal disease; hs-CRP = high sensitivity C-reactive protein; HDL = high-density lipoprotein; LDL = low-density lipoprotein.

TABLE 2
Cause of Death in All Participants

Cause of death	All patients (n=1,068)	Non-stroke group (n=993)	Stroke group (n=75)
CVD (n, %)	107 (10.0)	93 (9.4)	14 (18.7)*
Infections (n, %)	33 (3.1)	29 (2.9)	4 (5.3)
Gastrointestinal hemorrhage (n, %)	7 (0.7)	6 (0.6)	1 (1.3)
Tumor (n, %)	5 (0.5)	5 (0.5)	0 (0.0)
Others (n, %)	21 (2.0)	16 (1.6)	5 (6.7)
All-cause Mortality (n, %)	173 (16.2)	149 (15.0)	24 (32.0)*

CVD = cardiovascular and cerebrovascular disease. Stroke group vs non-stroke group **p* < 0.05.

the non-stroke group (OR 2.52, 95% CI 1.19 – 5.34). Of note, the peritonitis rate was 1/60.1 patient-months in the stroke group, whereas it was 1/71.3 patient-months in the non-stroke group (OR 1.12, 95% CI 1.04 – 1.28).

The cumulative death-censored technique failure rates at 1, 2, 3, and 5 years were 7%, 9%, 16%, and 31% in the stroke

group, while those in the non-stroke group were 1%, 4%, 7%, and 12%, respectively. The cumulative death-censored technique failure rate was significantly higher in the stroke group compared with the non-stroke group (log rank = 7.406, *p* = 0.007, Figure 2).

Death-censored technique failure was associated with prior stroke, time to the first episode of peritonitis, and lower LDL (all *p* values < 0.05) among this study population in a univariate Cox analysis. Furthermore, after adjustment for age, gender, diabetes, BMI, assisted PD, hemoglobin, and albumin, the results showed that prior stroke (HR 2.46, 95% CI 1.20 – 5.04) and time to the first peritonitis (HR 0.95, 95% CI 0.93 – 0.96) were independent risk factors for technique failure in the same study population using multivariate Cox regression analysis (Table 4). In patients with prior stroke, a 1-month increase in the time to the first episode of peritonitis was associated with a 9% decreased risk of death-censored technique failure (HR 0.91, 95% CI 0.84 – 0.99) after adjustment for the same key factors.

DISCUSSION

The results of this study show that all-cause mortality and death-censored technique failure were significantly higher in

Figure 2 — Kaplan-Meier curves of patients at risk for all-cause and death-censored technique failure. A: Survival curves for all-cause mortality (log rank=15.555, $p<0.001$). B: Survival curves for death-censored technique failure (log rank=7.406, $p=0.007$). PD = peritoneal dialysis.

TABLE 3
Adjusted Hazard Ratio for All-Cause Mortality

Risk factors	All patients ^a HR (95% CI)	Non-stroke group ^b HR (95% CI)	Stroke group ^c HR (95% CI)
Age (change by 10 years)	1.36 (1.19–1.56)	1.31 (1.14–1.51)	1.90 (1.07–3.38)
BMI (kg/m ²)			
<18.5	—	—	reference
18.5–23.9	—	—	0.17 (0.05–0.55)
24.0–27.9	—	—	0.96 (0.18–5.26)
≥28.0	—	—	0.37 (0.04–3.28)
Diabetes (yes/no)	2.02 (1.40–2.92)	1.93 (1.29–2.87)	—
Prior stroke (yes/no)	1.82 (1.21–2.53)	—	—
Pre-existing heart disease (yes/no)	1.95 (1.37–2.77)	2.35 (1.60–3.44)	—
Time to the first episode of peritonitis ^d	0.95 (0.94–0.96)	0.96 (0.94–0.97)	0.93 (0.89–0.96)
Hemoglobin (per 1-g/L increase)	0.98 (0.97–0.99)	0.98 (0.97–0.99)	—

HR = hazard ratio; CI = confidence interval; BMI = body mass index; MAP = mean arterial pressure; hs-CRP = high sensitivity C-reactive protein.

^a Covariates included prior stroke, age, diabetes, pre-existing heart disease, time to the first episode of peritonitis, MAP, hemoglobin, hs-CRP and serum albumin.

^b Adjusted for ^acovariates with the exception for prior stroke.

^c Adjusted for BMI and ^acovariates with the exception of prior stroke, diabetes, pre-existing heart disease, MAP, hs-CRP, and hemoglobin.

^d Per month increase.

TABLE 4
Adjusted Hazard Ratio for Death-Censored Technique Failure

Risk factors	All patients ^a HR (95% CI)	Non-stroke group ^a HR (95% CI)	Stroke group ^a HR (95% CI)
Prior stroke (yes/no)	2.46 (1.20–5.04)	—	—
Time to the first episode of peritonitis ^b	0.95 (0.93–0.96)	0.95 (0.93–0.96)	0.91 (0.84–0.99)

HR = hazard ratio; CI = confidence interval; BMI = body mass index; PD = peritoneal dialysis; LDL = low-density lipoprotein.

^a Covariates included age, gender, prior stroke, diabetes, BMI, assisted PD, hemoglobin, albumin, time to the first episode of peritonitis and LDL.

^b Per month increase.

CAPD patients with prior stroke compared with those without prior stroke. Older age, lower BMI, and time to the first episode of peritonitis were independently associated with an increased risk of all-cause mortality in patients with prior stroke.

Han *et al.* reported that the incidence of all-cause mortality and technique failure was 98.8/1,000 patient-years and 42.8/1,000 patient-years in those patients undergoing conventional dialysis treatments, respectively (19). Kircelli *et al.* reported that the incidence of all-cause mortality and technique failure was 48.4/1,000 patient-years and 95.5/1,000 patient-years in those PD patients under strict volume control (20). Michels *et al.* reported that the incidence of all-cause mortality and technique failure was 110/1,000 patient-years and 279/1,000 patient-years in CAPD patients, respectively (21). In our study, the incidence of all-cause mortality and technique failure was 70.9/1,000 patient-years and 24.6/1,000 patient-years in this cohort, respectively. However, the current study results showed that patients with prior stroke had higher incidence of all-cause mortality and technique failure (149.8/1,000 patient-years and 56.2/1,000 patient-years, respectively), compared with those of patients without prior stroke (65.4/1,000 patient-years and 22.4/1,000 patient-years, respectively).

It is well known that older age is independently associated with increased risk of all-cause mortality in dialysis patients (22). We reported previously that older age may be inversely related to survival in patients with diabetes (23). In the present study, older age was also independently associated with all-cause mortality in all CAPD patients, including those with a history of stroke. Compared with patients without prior stroke, those with prior stroke had advanced age (62.5 ± 10.5 years) and the greatest risk of death (HR 1.90, 95% CI 1.07 – 3.38), which no doubt contributed to the higher rate of mortality for the patients with prior stroke.

Malnutrition is well recognized as a strong risk factor for all-cause mortality in patients on PD (24,25). Several authors have suggested that malnutrition in ESRD patients reflects not merely poor nutrient intake, but also the effects of a chronic inflammatory state, which may contribute to CVD mortality (26,27). In patients on hemodialysis, higher BMI is associated with better survival, whereas lower BMI and weight loss are associated with increased mortality (28,29). In a prospective study, Snyder *et al.* reported an association between mortality and BMI changes over time, with better survival among overweight and obese patients until the third year of PD (30). These findings are in contrast to the general population, in which obesity, rather than malnutrition, is positively correlated with an increased risk of mortality (31,32). In our study, low mortality rates were observed in stroke PD patients with a BMI of 18.5 – 23.9, compared with those patients with a BMI of < 18.5 kg/m², 24.0 – 27.9, or ≥ 28.0 kg/m². But no differences were observed among these 3 groups, including patients with a BMI of < 18.5 kg/m², 24.0 – 27.9, or ≥ 28.0 kg/m², which indicated that these patients should keep their body weight in a normal range.

A previous study reported that the risk of infection may be attributed to stroke-induced immunodepression syndrome

(33). In our study, CAPD patients with prior stroke had higher rates of peritonitis than those without a history of stroke. Infections (peritonitis and catheter-related) were the leading cause of switching from PD to hemodialysis (34). In the present study, peritonitis events also were the main cause of switching from PD to hemodialysis. Of note, we found that every 1-month increase in time to the first episode of peritonitis was associated with a 7% decreased risk of patient mortality (HR 0.93; 95% CI, 0.89 – 0.96) and a 9% decreased risk of death-censored technique failure (HR 0.91; 95% CI 0.84 – 0.99), which indicated that early peritonitis events were closely associated with increased risks of all-cause mortality and technique failure.

In addition, patients with prior stroke needed a higher percentage of assisted PD compared with those without stroke. The reasons may include the following: (i) CAPD patients with prior stroke were older and more likely to have comorbidities compared with those without previous stroke (12,13); (ii) stroke patients often suffer from deficits in physical, psychosocial, and cognitive functioning (35), which commonly causes these patients to need assisted PD. Cheng *et al.* reported that older assisted PD patients had poorer survival and technique survival rates than those of self-care patients (36). However, there were no significant differences in patient survival and technique failure between assisted PD patients and those with self-care patients in our study (data not shown).

There were some limitations to this study. Firstly, a small sample size of 75 CAPD patients with prior stroke were included and analyzed. We failed to do subgroup analyses with regard to mortality and technique failure in those with prior stroke subtypes such as hemorrhagic or ischemic stroke, due to the small sample size of these patients. Thus, further prospective studies with large sample sizes regarding those with prior stroke subtypes are needed, which may provide more information about the outcomes of the subgroups and how to take proper medical care for patients with different subgroup complications. In addition, there may have been some management bias in these CAPD patients from a single center.

In conclusion, this study found that CAPD patients with prior stroke had higher mortality and technique failure compared with those without prior stroke. Older age, lower BMI and time to the first episode of peritonitis are independently associated with an increased risk for all-cause mortality in those with prior stroke, which suggests that these kinds of patients need more intensive care and proper nutrition improvement.

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DISCLOSURE

The authors have no conflicts of interest to declare.

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