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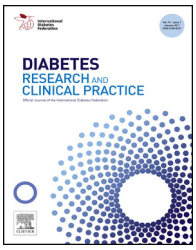

Clinical outcome and risk factors for mortality in Chinese patients with diabetes on peritoneal dialysis: A 5-year clinical cohort study

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ABSTRACT

Aims: We evaluated clinical outcome and risk factors affecting survival in patients with diabetes on continuous ambulatory peritoneal dialysis (CAPD) in Southern China.

Methods: This longitudinal cohort study enrolled all incident patients who used CAPD as their first renal replacement therapy modality in our center from January 2006 to December 2009 and who were followed until December 2011. Clinical outcomes were compared and risk factors for mortality in patients with diabetes were analyzed.

Results: Of 809 incident CAPD patients, 189 (23.4%) had diabetes. Death-censored technique survival showed no significant difference between patients with and without diabetes ($p = 0.271$). The 1-, 2-, 3- and 5-year patient survival rates were 90%, 72%, 63% and 36% in patients with diabetes and 95%, 92%, 87% and 73% in patients without diabetes, respectively ($p = 0.000$). Presence of cardiovascular disease (CVD) [hazard ratio (HR) 2.130, 95% confidence interval (CI) 1.199–3.786, $p = 0.010$], advanced age (HR 1.042, 95% CI 1.008–1.078, $p = 0.014$), higher glycated hemoglobin (HR 1.309, 95% CI 1.045–1.640, $p = 0.019$), lower hemoglobin (HR 0.978, 95% CI 0.964–0.992, $p = 0.003$) and lower serum albumin (HR 0.924, 95% CI 0.876–0.976, $p = 0.004$) at the initiation of CAPD were independent risk factors of mortality in CAPD patients with diabetes.

Conclusions: Technique survival in CAPD patients with diabetes was similar to those without diabetes. Although patients with diabetes had higher risk of mortality, the patient survival in our study seems to be improved compared with most other reports. Older age, presence of CVD, hyperglycemia, anemia and hypoalbuminemia at the commencement of CAPD affected survival in patients with diabetes.

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1. Introduction

Diabetes mellitus (DM) is the leading cause of end-stage renal disease (ESRD) in many countries. According to the United States Renal Data System (USRDS), the overall adjusted rate of incident ESRD in the United States was 355 per million population in 2009, among which a primary diagnosis of diabetes was made in 154 per million population [1]. Recently, it was reported that the total prevalence of diabetes is 9.7% in

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China, mainly due to rapid economic growth, increased life expectancy and changes in lifestyle [2]. Diabetes is the second most common cause of ESRD in China, accounting for 19–22.9% of the dialysis population. Given its prevalence, diabetes has become a major public health problem in China [3,4].

Most ESRD patients with diabetes are maintained on renal replacement therapy. Compared with patients without diabetes, patients with diabetes generally have poorer survival rates because of a higher incidence of complications and comorbidities [5–8]. With advances in techniques and medical care, the survival rates of patients with diabetes on peritoneal dialysis (PD) as well as hemodialysis (HD) have improved [9]. Data from the USRDS show that during 1994–1998 and 1999–2003, 5-year survival rates of patients with diabetes improved by 15.3% in HD and 27.1% in PD. Although the management of these high-risk patients has improved, mortality and morbidity remain high. It has been reported that the survival rates of incident patients with diabetes on both HD and PD were approximately 30% during a 5-year follow-up period [1].

With the rapidly growing use of PD in China, the issue of the survival rate of patients undergoing continuous ambulatory PD (CAPD) has been raised. Our previous studies and the reports from other centers have shown good outcomes in Chinese PD patients, with a 2-year patient survival rate of 87–91% and a 2-year technique survival rate of 82–95% [8,10,11]. However, the survival rate of patients with diabetes on PD in mainland China has been little explored. Therefore we undertook this longitudinal cohort study to evaluate the clinical outcomes and the risk factors associated with mortality in patients with diabetes undergoing CAPD in Southern China.

2. Subjects, materials and methods

All incident patients who used CAPD as their first renal replacement therapy (RRT) modality and who were followed up at the PD center of The First Affiliated Hospital, Sun Yat-sen University, Guangzhou, China from January 1, 2006, to December 31, 2009, were recruited in this study. The criteria employed for initiating dialysis therapy were estimated glomerular filtration rate (eGFR) $\leq$ 15 ml/min per 1.73 m^2 with symptoms of uremia for patients with CKD 5 stage according to the recommendations of the National Kidney Foundation Disease Outcomes Quality Initiative guidelines for initiation of dialysis [12]. Inclusion criteria were age $\geq$ 18 years at the start of CAPD and survival for at least 90 days from the first CAPD therapy. The incident CAPD patients who transferred from HD or failed renal transplantation were excluded in this study. The study was conducted in compliance with the ethical principles of the Helsinki Declaration (http://www.wma.net/en/30publications/10policies/b3/index.html) and approved by the Human Ethics Committees of Sun Yat-sen University. Written informed consent was obtained from all participants.

The patients were followed up until cessation of PD, death or December 31, 2011. Baseline demographic data included age, gender, primary cause of ESRD and presence of cardiovascular disease (CVD). Clinical and biochemical data at the initiation of CAPD included body mass index (BMI), blood pressure, hemoglobin, serum albumin, serum glucose, serum creatinine, blood urea nitrogen, total cholesterol, triglycerides, corrected serum calcium, phosphate, intact parathyroid hormone, high-sensitivity C-reactive protein (hsCRP), Kt/V and baseline dialysate-to-plasma ratio of creatinine (D/Pcr), which were measured using a standard peritoneal equilibration test. Glycated hemoglobin A1c (HbA1c) was also recorded in patients with diabetes. All data were obtained during the first 1–3 months of CAPD. Residual renal function was measured by eGFR with the four-variable modification of diet in renal disease. Diabetes was defined according to the 1999 World Health Organization diagnostic criteria [13] as type 1 or type 2 and was registered as the primary cause of ESRD. CVD was defined as a history of myocardial infarction, angina, congestive heart failure, cerebrovascular event or peripheral vascular disease with or without amputation. Comorbidity was graded according to the Charlson comorbidity index [14].

2.1. Statistical methods

Results were expressed as frequencies and percentages for categorical variables, mean $\pm$ standard deviation for continuous variables and median (interquartile range) for skewed distributions. Death as the end point was used for analysis of patient survival. When calculating death-censored technique survival, the end events included any situation in which a patient on PD switched to HD for more than 3 months. The censored events for both patient and technique survival were renal transplantation, move to another center, and still on PD at December 31, 2011. In addition, the censored data included switching to HD for patient survival and death for technique survival. Survival times were estimated from Kaplan–Meier curves, and differences in survival probabilities between groups were assessed using the log-rank test. Risk factors for mortality in the CAPD patients with diabetes were first determined using univariate analysis. The variables included in the univariate Cox model were age, gender, BMI, previous CVD, 24-h urine output, blood pressure, hemoglobin, serum albumin, serum glucose, HbA1c and CRP. Covariates with p values < 0.26 in the univariate Cox analysis were used for multivariate Cox proportional hazards regression. HbA1c was added into the model because it is an important factor affecting clinical outcomes of patients with diabetes. We used Cox proportional hazards regression for multivariate modeling of survival probabilities. The results were expressed as the hazard ratio (HR) and 95% confidence interval (CI). All descriptive and multivariate analyses were conducted using SPSS version 17 (SPSS Inc., Chicago, IL, USA). A value of $p < 0.05$ was considered statistically significant.

3. Results

3.1. Clinical characteristics at the start of CAPD

During 2006–2009, there were a total of 926 incident PD patients in our center, of whom 25 were transferred from permanent HD, 7 were transferred from renal transplant failure and the rest of 894 patients were offered a choice between HD and PD and agreed to use CAPD as their first renal

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