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ORIGINAL ARTICLE

Comparison of health-related quality of life between patients with stage 3 and 4 chronic kidney disease and patients undergoing continuous ambulatory peritoneal dialysis

Suk Jeong LEE and Heesook SON

Red Cross College of Nursing, Chung-Ang University, Seoul, Korea

Abstract

Aim: This study compared health-related quality of life in patients with early to mid-stage chronic kidney disease.

Methods: This study utilized a comparative descriptive design. Patients receiving continuous ambulatory peritoneal dialysis were recruited from a hospital in Korea. Information from patients with stage 3 and 4 chronic kidney disease was obtained from Korean national survey data. A total of 75 pairs were matched using the propensity score method. Health-related quality of life was compared using the European Quality of Life–5 Dimensions questionnaire.

Results: Only 4% of patients with stage 3 or 4 chronic kidney disease are aware of their disease. These patients have decreased mobility and ability to perform their usual activities ($\chi^2 = 10.77$, $P = 0.001$; $\chi^2 = 7.22$, $P = 0.007$, respectively). However, they have lower levels of anxiety and depression than patients undergoing continuous ambulatory peritoneal dialysis ($\chi^2 = 13.37$, $P < 0.001$). The European Quality of Life–5 Dimensions utility scores do not differ between the two patient groups.

Conclusion: The results of this study suggest that more effective management programs are needed to improve health-related quality of life in patients at all stages of chronic kidney disease. Educational intervention in asymptomatic patients is important to increase awareness and early detection of chronic kidney disease.

Key words: chronic kidney disease, continuous ambulatory peritoneal dialysis, health-related quality of life.

INTRODUCTION

A growing number of people worldwide have been diagnosed with chronic kidney disease (CKD) (Stevens *et al.*, 2007). The number of patients in Korea with CKD has doubled in the last decade (ESRD Registry Committee, 2010). Management of patients with CKD has heavily focused on those with end-stage or stage 5 renal disease (Tong *et al.*, 2009). Patients in the early to mid-stages of CKD often do not receive appropriate healthcare services and nursing interventions, and many patients are not aware of CKD-related health risks and complications (McIntyre, Fluck, McIntyre, & Taal, 2012).

Considering the association between the glomerular filtration rates and mortality (Stevens *et al.*, 2007), it is crucial for professional healthcare providers to identify patients with early to mid-stage CKD. It is also important to improve patient quality of life, because health-related quality of life is one of the most powerful predictors of mortality in patients with CKD (Han *et al.*, 2008). More than half of patients with stage 3 CKD eventually progress to stages 4 or 5 (Baek *et al.*, 2012). Therefore, intervention and management are necessary to provide proper health care for patients with CKD and prevent progression to end-stage renal disease. Early intervention would also help to reduce healthcare costs and improve health outcomes and quality of life.

Correspondence: Heesook Son, Red Cross College of Nursing, Chung-Ang University, 84 Heukseok-ro, Dongjak-gu, Seoul 156-756, Korea. Email: hson@cau.ac.kr

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Impaired quality of life is related to extensive kidney damage and subsequent progression to stage 3 and 4 CKD as well as comorbidities with various symptoms (Soni, Weisbord, & Unruh, 2010). Based on utility scores from the European Quality of Life–5 Dimensions questionnaire, health-related quality of life scores for patients with stage 3 CKD were higher than those with cancer or end-stage renal disease, but lower than patients with diabetes or hypertension (Lee *et al*., 2012). Most studies have focused on the psychological and financial burdens of patients with end-stage renal disease to assess different aspects of quality of life (Tsai *et al*., 2010; Wyld, Morton, Hayen, Howard, & Webster, 2012). However, there are 50 times more patients with stage 1 to 4 CKD compared with those with end-stage renal disease (Coresh, Astor, Greene, Eknoyan, & Levey, 2003). Despite this, little is known about the quality of life among patients with early to mid-stage of CKD not yet undergoing renal replacement therapy. Improved awareness and understanding of the quality of life in these patients by nephrology nurses could have practical implications for better health outcomes.

Most patients with stage 3 and 4 CKD are unaware of their disease status until there is extensive kidney damage with decreased glomerular function. Consequently, it is difficult for CKD patients to effectively manage their disease. In turn, patient health-related quality of life may also decline (Tuot *et al*., 2011). Therefore, the current study aimed to compare health-related quality of life between patients with stage 3 and 4 CKD and those undergoing continuous ambulatory peritoneal dialysis (CAPD).

METHODS

Design

This study utilized a comparative descriptive design.

Participants

Convenience sampling was used to enroll patients in the CAPD group. Patients undergoing CAPD at a hospital in Korea were invited to participate in the study. Approval from the institutional review board of the study hospital and informed consent from the study participants were obtained. Eighty patients participated in the study. After excluding patients with missing responses, 75 patients were included in the analyses.

Information on individuals with stage 3 and 4 CKD were derived from a total of 24,871 respondents in the Korean National Health and Nutritional Examination Survey IV. The Korean National Health and Nutritional Examination Survey IV was a nationwide survey conducted from 2007 to 2009 using a stratified cluster sampling method to extract household data. The data are publicly accessible and no personal information (name, resident registration number, or address) is included in the provided data file. Patients were eligible for participation if they were older than 19 years and had an estimated glomerular filtration rate between 15.0 and 59.9 mL/min per 1.73 m^2. A total of 798 individuals met the inclusion criteria and were included in the analyses.

Using the G*power program, 146 individuals were assessed using an independent Student's *t*-test at an α-level of 0.05, medium effect size of 0.5, and power of 0.85. After matching, 150 individuals (75 individuals paired between groups) were included in the analyses.

Measurements

The questionnaires distributed to the CAPD group were identical to the questions used in the Korean National Health and Nutritional Examination Survey IV. Demographic characteristics included age (≤64 or ≥65 years), sex, education level (up to high school or college or higher), and current occupation. For health-related information, patients were asked about their perceived health status on a 5 point Likert scale (very good, good, average, bad, and very bad), body mass index in five groups (<18.5, 18.5–22.9, 23–24.9, 25–29.9, and >30 kg/m^2) (WHO Western Pacific Region, 2000), and comorbidities of hypertension and diabetes mellitus. To assess physical activity, patients were asked "How many days in a week have you been working out at a moderately rapid rate over 10 min?". Estimated glomerular filtration rates were calculated using the original Modification of Diet in Renal Disease formula. Clinical data, including laboratory measurements of blood urea nitrogen and hemoglobin levels, were evaluated in each group. Information about patients in the CAPD group was obtained from medical records. Data from patients with stage 3 and 4 CKD were derived from the Korean National Health and Nutritional Examination Survey IV.

The European Quality of Life–5 Dimensions questionnaire was used to measure health-related quality of life. This questionnaire was developed and verified by the EuroQol Group to measure overall health status in a relatively simple way (The EuroQol Group, 1990). The European Quality of Life–5 Dimensions questionnaire consists of five dimensions of current health, mobility,

self-care, usual activities, pain/discomfort, and anxiety/depression. Respondents are asked to evaluate their health status on a 3 point Likert scale (no problems at all, some problems, and serious problems). The Korean version of the European Quality of Life–5 Dimensions was verified as reliable and valid in patients with rheumatoid arthritis (Kim, Cho, Uhm, Kim, & Bae, 2005). The European Quality of Life–5 Dimensions utility score was used for analysis in this study, based on the formula (weighted model) described by Nam, Kim, Kwon, Koh, and Poul (2007).

Data collection

Data from patients in the CAPD group were collected from March to April 2013 after obtaining approval from the hospital institutional review board (no. 2013–19). Detailed explanations and written consent forms were provided to the participants. They were informed that the collected data would be only for purposes related to this study and would be treated with full confidentiality and anonymity. The participants were also informed that they could withdraw from the study at any time. The questionnaires consisted of three pages and the self-report form, and required approximately 5–10 min to complete. Information from the group of patients with stage 3 and 4 CKD was obtained from the Korean National Health and Nutritional Examination Survey IV in November 2011.

Data analysis

Stata version 8.0 (StataCorp, College Station, TX, USA) was used to calculate the propensity score for matching. Propensity score matching attempts to reduce the influence of covariates (Rosenbaum & Rubin, 1983). Matching was used to minimize covariate differences between patients with stage 3–4 CKD and those undergoing CAPD.

RESULTS

Comparison of demographic and health-related characteristics before and after matching

Table 1 shows study participant characteristics. Before matching, women accounted for 66% ($n = 524$) of patients with stage 3 and 4 CKD and 56% ($n = 45$) of those undergoing CAPD. There are statistically significant differences in age, educational level, current occupation, and perceived health status between the patient groups. Patients undergoing CAPD are more likely to have comorbidities, including hypertension and diabetes mellitus, than those with stage 3 and 4 CKD ($P < 0.001$). Only 2% ($n = 19$) of patients with stage 3 and 4 CKD have been diagnosed and are aware of their CKD status. There is no difference in body mass index or days of moderate exercise per week between the two groups.

After matching, each group had 75 participants with the same proportion of sex, with females comprising 59% ($n = 44$) of both groups. Age, educational level, current occupation, body mass index, days of moderate exercise per week, and comorbidities are also comparable between the two groups after matching. Patients with stage 3 and 4 CKD ranged 29–79 years of age (mean, 61.4; standard deviation [SD], 9.9), and 22–83 years for those undergoing CAPD only (mean, 59.1; SD, 12.9). Only 4% ($n = 3$) of patients with stage 3 and 4 CKD are aware of their CKD status. Compared with patients undergoing CAPD, patients with stage 3 and 4 CKD have significantly lower blood urea nitrogen levels ($P < 0.001$) and significantly higher estimated glomerular filtration rate and hemoglobin levels ($P < 0.001$).

Comparison of European Quality of Life–5 Dimensions scores after matching

After matching, European Quality of Life–5 Dimensions results were examined using a 2 point scale, "having no problem at all" and "having a problem". Differences in scores between patients with stage 3 and 4 CKD and those undergoing CAPD were examined (Table 2). Compared with those with CAPD, patients with stage 3 and 4 CKD more frequently experience mobility problems ($\chi^2 = 10.77$, $P = 0.001$) and problems in usual daily activities ($\chi^2 = 7.22$, $P = 0.007$). In contrast, patients on CAPD have more problems with anxiety or depression than patients with stage 3 and 4 CKD ($\chi^2 = 13.37$, $P < 0.001$). There is no statistical difference in self-care ($P = 0.547$) or pain or discomfort ($P = 0.507$) between the two groups. The overall European Quality of Life–5 Dimensions scores also do not differ significantly between groups.

DISCUSSION

The current study compares health-related quality of life between patients with stage 3 and 4 CKD and patients undergoing CAPD. To eliminate the influence of confounding variables on health-related quality of life, the propensity score matching technique was used. Covariates including age, sex, education, current occupation, perceived health status, body mass index, and

Table 1 Comparison of sociodemographic and disease-related variables before and after propensity score matching

	Before matching				After matching			
	CKD 3, 4 ($n = 798$) N (%)	CAPD ($n = 80$) N (%)	χ^2/t	P	CKD 3, 4 ($n = 75$) N (%)	CAPD ($n = 75$) N (%)	χ^2/t	P
Sex			2.83	0.093			0	1
Male	274 (34)	35 (44)			31 (41)	31 (41)		
Female	524 (66)	45 (56)			44 (59)	44 (59)		
Age (years)	68.5	58.9	6.53	<0.001	61.4	59.1	1.16	.248
Mean (SD)	(11.2)	(12.9)	37.55	<0.001	(9.91)	(12.9)	1.74	.187
≤64	239 (30)	51 (64)			39 (52)	47 (63)		
≥65	559 (70)	29 (36)			36 (48)	28 (37)		
Educational level			28.42	<0.001			1.32	.251
≤High school	720 (90)	58 (73)			60 (80)	54 (72)		
≥College	69 (9)	22 (28)			15 (20)	21 (28)		
Currently employed			13.04	0.005			0.35	0.554
Yes	240 (31)	21 (26)			15 (20)	18 (24)		
No	538 (69)	59 (74)			60 (80)	57 (76)		
Perceived health status			18.60	0.002			3.33	0.504
Very good	26 (3)	4 (5)			6 (8)	4 (5)		
Good	217 (27)	16 (20)			14 (19)	15 (20)		
Fair	212 (27)	37 (46)			27 (36)	34 (45)		
Bad	245 (31)	21 (26)			22 (29)	20 (27)		
Very bad	94 (12)	2 (3)			6 (8)	2 (3)		
Body mass index			4.75	0.314			6.31	0.177
<18.5	31 (4)	0 (0)			2 (3)	0 (0)		
18.5–22.9	219 (28)	20 (26)			16 (21)	20 (27)		
23.0–24.9	196 (25)	21 (28)			21 (28)	21 (28)		
25.0–29.9	297 (38)	33 (43)			28 (37)	32 (43)		
≥30	41 (5)	2 (3)			8 (11)	2 (3)		
Days of moderate exercise per week								
0	83 (10)	11 (14)	2.62	0.270	11 (15)	9 (12)	0.858	0.651
1	573 (72)	60 (75)			52 (69)	57 (76)		
≥2	141 (18)	9 (11)			12 (16)	9 (12)		
Comorbidities			54.89	<0.001				
Hypertension	425 (53)	77 (96)			70 (93)	72 (96)	0.53	0.467
Diabetes mellitus	193 (24)	39 (49)			40 (53)	37 (49)	0.24	0.624
CKD awareness			N/A				N/A	
Yes	19 (2)	80 (100)			3 (4)	75 (100)		
CAPD duration	N/A		N/A		N/A		N/A	N/A
≤2 years		25 (31)				21 (28)		
2–4 years		18 (23)				18 (24)		
4–6 years		14 (18)				13 (17)		
≥6 years		23 (29)				23 (31)		
BUN (mg/dL)	19.8	52.4	13.89	<0.001	21.0	52.1	9.69	<0.001
Mean (SD)	(6.7)	(16.9)			(7.5)	(17.1)		
eGFR (mL/min per 1.73 m^2)	52.4	6.3	14.76	<0.001	50.7	6.1	10.5	<0.001
Mean (SD)	(8.1)	(3.8)			(9.9)	(3.6)		
Hemoglobin (g/dL)	13.2	11.0	10.79	<0.001	13.3	11.0	8.59	<0.001
Mean (SD)	(1.7)	(1.7)			(1.6)	(1.7)		

BUN, blood nitrogen urea; CAPD, continuous ambulatory peritoneal dialysis; CKD 3, 4, CKD stages 3 and 4; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; SD, standard deviation.

Table 2 Comparison of European Quality of Life–5 Dimensions scores after propensity score matching

EQ-5D	CKD stage 3, 4 ($n = 75$) N (%)	CAPD ($n = 75$) N (%)	χ^2/t	P
Mobility			10.77	0.001
No problem	49 (65)	66 (88)		
Any problem	26 (35)	9 (12)		
Self-care			0.36	0.547
No problem	68 (91)	70 (93)		
Any problem	7 (9)	5 (7)		
Usual activity			7.22	0.007
No problem	54 (72)	67 (89)		
Any problem	21 (28)	8 (11)		
Pain/Discomfort			0.44	0.507
No problem	46 (61)	42 (56)		
Any problem	29 (39)	33 (44)		
Anxiety/depression			13.37	<0.001
No problem	61 (81)	40 (53)		
Any problem	14 (19)	35 (47)		
EQ-5D utility score				
Mean (SD)	0.87 (0.19)	0.90 (0.15)	0.00	1.00

CAPD, continuous ambulatory peritoneal dialysis; CKD, chronic kidney disease; EQ-5D, European Quality of Life 5-Dimensions scores; SD, standard deviation.

comorbidities of hypertension and diabetes mellitus were homogeneous between groups after matching.

In both groups, 84% of patients perform less than 1 day of moderate exercise per week, indicating a poor level of exercise in patients with CKD. This may be related to frailty characterized by muscle weakness, low gait speed, unintentional weight loss, exhaustion, and low physical activity. Frailty is more prevalent in patients with CKD (Mansur, Colugnati, Grincenkov, & Bastos, 2014). Although patients in both groups have lower levels of moderate exercise, patients with stage 3 and 4 CKD more frequently experienced problems with mobility and usual activities than those undergoing CAPD. This finding indicates that patients with better kidney function have more problems with mobility and usual activities. Patients with CKD who have not started dialysis reportedly experience poorer physical function with decreasing renal function (Hiraki *et al*., 2013; Johansen & Painter, 2012).

One possible reason for these findings may be that patients with stage 3 and 4 CKD may be unaware of their disease and less motivated to practice a healthy lifestyle, including exercise, than those undergoing CAPD. Physical inactivity may result in more problems with mobility and usual activities. The propensity matching method used in this study homogenized characteristics between patient groups. After considering other confounding variables, patients with stage 3 and 4 CKD have better renal function, but more frequently report problems with mobility and usual activities than those undergoing CAPD, whose conditions may be more stabilized due to dialysis treatment. Although the reasons for these differences between patient groups are unclear, unmeasured confounding variables such as malnutrition or other comorbidities may also play a role (Soni *et al*., 2010). Furthermore, CAPD is indicated for patients able to care for themselves, and patients on CAPD have fewer limitations in physical activities compared with those on hemodialysis (Stack & Murthy, 2008). Thus, patients undergoing CAPD in this study may have better capabilities for activity than those with stage 3 and 4 CKD. Because there is a close relationship between physical function and clinical outcomes (Painter & Roshanraven, 2013), nephrology nurses should regularly assess physical function and provide referrals and interventions as necessary.

Anxiety or depression were more than twice as common in patients undergoing CAPD (47%) than in those with stage 3 and 4 CKD (19%) in this study, a finding consistent with a previous study that reported a higher prevalence of depression in patients on dialysis treatment compared with pre-dialysis patients (Amira,

2011). Alvarez-Ude Cotera and Rebollo Alvarez (2008) suggest that anemia and lower glomerular filtration rate levels may be linked to depression in patients with end-stage renal disease. The proportion of patients with stage 3 and 4 CKD with anxiety or depression problems is relatively lower than in those undergoing CAPD in the current study, although the potential for depression should not be clinically overlooked. According to a recent 4 year longitudinal study of patients with CKD (Tsai *et al*., 2012), there is a higher incidence of end-stage renal disease and mortality due to CKD and a faster decrease in estimated glomerular filtration rate with increasing depression severity. Therefore, it is crucial for nurses to evaluate psychological distress and provide supportive interventions for patients with mid-stage CKD or those undergoing CAPD.

After matching, approximately half of the participants in both groups reported pain and discomfort. In patients with CKD, chronic pain is often not recognized or properly treated (Pham *et al*., 2009). Pain is also related to decreased health-related quality of life in patients with stage 3–5 CKD (Perlman *et al*., 2005). Thus, pain should be regularly evaluated and chronic pain management provided as necessary.

A systematic review of 190 studies on utility-based quality of life in CKD (Wyld *et al*., 2012) revealed a mean utility score of 0.79 among patients with CKD stages 3–5 and 0.72 for patients undergoing CAPD (Wyld *et al*., 2012). These scores were lower than those in the present authors' study (0.87 and 0.90, respectively). This discrepancy may be due to differences in patient characteristics. Patients with stage 5 CKD were included in the study by Wyld *et al*. (2012), but not in the current study. Also, 76% of participants in the former study were Americans and Europeans, while this study examined only Koreans. Different ethnicities may also contribute to the discrepancies between these studies.

After matching, the European Quality of Life–5 Dimensions utility scores are not statistically different between the two groups, consistent with other studies showing that lower levels of estimated glomerular filtration rates do not play an independent role in decreasing health-related quality of life (Perlman *et al*., 2005) and that the influence of renal function on health-related quality of life is attenuated by demographic and social factors (Odden, Whooley, & Shlipak, 2006). Given that health-related quality of life of patients with stage 3 and 4 CKD is as low as that of patients undergoing CAPD, healthcare providers must establish specific interventions for both groups.

Early detection of CKD could delay disease progression, allowing more effective management (Stevens *et al*., 2007). However, many patients with stage 3 and 4 CKD are unaware of their symptoms in the early to mid-stages, as they are barely detectable until the later stages of the disease. For example, approximately 90% of patients with two to four clinical markers and 84% of patients with more than five markers related to renal function are unaware of disease onset (Tuot *et al*., 2011). In the present authors' study, 4% of patients with stage 3 and 4 CKD reported awareness of their disease onset only after receiving a doctor's diagnosis. In Korea, patient awareness of hypertension and diabetes mellitus are relatively high (51% and 56%, respectively), but less than 10% of patients with stage 1–3 CKD are aware of their disease status (Chin *et al*., 2010) and only 8% of patients in the USA with stage 3 CKD are aware of their disease status (Plantinga *et al*., 2008).

Lack of disease awareness in both patients and healthcare professionals could be a barrier to delayed progression and effective CKD management (Rastogi, Linden, & Nissenson, 2008). Because hypertension and diabetes mellitus are common chronic diseases related to CKD, healthcare professionals in local point-of-care clinics for patients with these conditions should regularly monitor patient kidney function. Screening tests for early detection of CKD are cost-effective, delaying onset of end-stage renal disease and reducing the number of end-stage renal disease patients (Thorp, Eastman, Smith, & Johnson, 2006). For early detection of CKD, it is important to monitor the results of clinical tests, such as urine, blood, physical performance, or cognitive function, and to refer patients to a nephrologist as needed. For patients with CKD, healthcare professionals also need to suggest more realistic guidelines for information about CKD and provide adequate educational interventions to increase awareness of the disease and adherence to treatment and management.

Limitations

There are several weaknesses in the current study. The criteria to be matched were derived from the group with fewer participants. As a result, the characteristics of the 75 patients undergoing CAPD were matched with patients with stage 3 or 4 CKD, leading to a smaller sample size in the final analysis. This might have also have decreased the generalizability of the study findings. In addition, it may not be possible to draw causal relationships based on its findings.

CONCLUSION

Patients with stage 3 and 4 CKD have reduced mobility and ability to perform their usual activities, whereas patients with CAPD have increased anxiety and depression. European Quality of Life–5 Dimensions utility scores are not significantly different between patients with stage 3 and 4 CKD and those undergoing CAPD. This finding implies that more effective management programs are needed to improve health-related quality of life in patients in all stages of CKD. Given that most patients with early to mid-stage CKD are unaware of their disease status, it is important for asymptomatic patients to receive educational interventions to increase awareness and early CKD detection.

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CONFLICT OF INTEREST

No conflict of interest has been declared by the authors.

AUTHOR CONTRIBUTIONS

All authors have contributed significantly and all authors are in agreement with the content of manuscript.

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