Evaluation of adherence and depression among patients on peritoneal dialysis

Zhen Li Yu[1], MSocSc, *Lee Ying Yeoh*[2], MD, MRCP, *Ying Ying Seow*[2], MD, MRCP, *Xue Chun Luo*[2], AdvDip, Dip, *Konstadina Griva*[1], PhD

INTRODUCTION It is challenging for dialysis patients to maintain adherence to their medical regimen, and symptoms of depression are prevalent among them. Limited data is available about adherence and depression among patients receiving peritoneal dialysis (PD). This study aimed to examine the rates of treatment non-adherence and depression in PD patients.

METHODS A total of 20 PD patients (response rate 71.4%; mean age 64.4 ± 11.6 years) were assessed using the Beliefs about Medicines Questionnaire, Self Efficacy for Managing Chronic Disease Scale, Hospital Anxiety and Depression Scale (HAD) and Kidney Disease Quality of Life-Short Form. A self-reported adherence (PD exchanges, medication and diet) scale developed for the study was also included. Medical information (e.g. most recent biochemistry results) was obtained from chart review.

RESULTS The mean self-reported scores indicated an overall high level of adherence, although a significant proportion of patients were non-adherent. Among the latter, 20% of patients were non-adherent to medication and 26% to diet due to forgetfulness, while 15% and 26% of patients admitted to deliberate non-adherence to medication and diet, respectively. Treatment modality, employment, self-care status and self-efficacy were associated with overall adherence. Using a cutoff point of 8 for HAD depression and anxiety subscales, 40% of patients were found to be depressed and 30% had symptoms of anxiety.

CONCLUSION This is the first study to document treatment adherence and depression among PD patients in Singapore. Findings of high prevalence of depression and anxiety, and reports of poor adherence warrant development of intervention programmes.

Keywords: adherence, depression, peritoneal dialysis, quality of life
Singapore Med J 2012; 53(7): 474–480

INTRODUCTION

Peritoneal dialysis (PD) is an important therapy for people who suffer from end-stage renal disease (ESRD) in order to sustain life. In Singapore, 18.8% of prevalent dialysis patients were on PD in 2006.[1] To maximise the therapeutic effects of PD, patients are encouraged to adhere to complicated regimen guidelines. These include doing daily PD exchanges, taking medications, attending the hospital regularly for monitoring, following a diet low in salt and phosphate, managing their weight, quitting smoking and exercising regularly. Failure to do so is associated with a higher risk of complications, treatment failure and death.[2,3] Poor adherence is a well-recognised problem in ESRD, but factors that may explain adherence behaviours are not well-understood, especially in the context of PD. The rates of non-adherence in PD patients vary from 13% to 50%,[4] depending on the aspect of the treatment regimen and the criteria used for defining non-adherence. Previous studies have shown that age,[5-8] diabetic status,[7] complexity of medication regime,[9,10] perceived health competence,[7] efficacy expectations,[11] personality,[6,12] knowledge[8] and family functioning[13] are associated with treatment-related adherence. As most of the studies till date have focused mainly on haemodialysis, little is known about the prevalence and determinants of adherence in PD populations, especially in the local context.

The rigorous treatment regime associated with dialysis, self-care behaviours and lifestyle restrictions may also give rise to emotional distress. Symptoms of depression and anxiety are common in dialysis patients.[14,15] Depression reduces the patient's quality of life (QoL) and has been shown to be associated with hospitalisation, infections and mortality.[16-20] Depression may also lead to poor clinical outcomes, as it may result in suboptimal care and poor adherence to treatment recommendations.[21-23] The associations between emotional distress and adherence have yet to be examined in PD. The current study aimed to document the rates of adherence with respect to different aspects of PD care (e.g. prescribed PD exchanges, taking of medication and diet) and to measure QoL as well as the prevalence of anxiety and depression in a sample of PD patients.

METHODS

This was a single-cohort cross-sectional study conducted between May 2010 and June 2010 on 29 chronic PD patients from Alexandra Hospital, Singapore (predecessor to Khoo Teck Puat Hospital). All the subjects were new ESRD patients with PD

[1]Department of Psychology, National University of Singapore, [2]Renal Medicine, Department of Medicine, Khoo Teck Puat Hospital, Singapore
Correspondence: Dr Griva Konstadina, Assistant Professor, Department of Psychology, National University of Singapore, AS4 Level 2, 9 Arts Link, Singapore 117570. psygk@nus.edu.sg

as their first choice of renal replacement modality. This study was approved by Singapore National Healthcare Group's Domain-Specific Review Board ethics approval committee. The senior PD nurse screened the patients for eligibility and provided a list of eligible patients (28 out of 29 patients met the study inclusion criteria). Patients were included if they were aged over 21 years. Patients were excluded if they were hospitalised (i.e. inpatients) at the time of recruitment and/or assessment or had any formal diagnosis of psychiatric disorder (e.g. major depression, schizophrenia) and/or diagnosed dementia.

Eligible participants were subsequently contacted by research assistants to participate in the survey. Interested participants indicated their preferred arrangements (location and time) for the assessments. After providing written consent, the following questionnaires were either self-completed (n = 3) or administered in the form of a structured interview (n = 17) as per the patients' preference/request. Completion time ranged from 30 minutes to two hours. The patients' demographics, treatment modality (automated peritoneal dialysis [APD] or continuous ambulatory peritoneal dialysis [CAPD]), dialysis vintage and comorbidities were obtained from case review.

The Beliefs about Medicines Questionnaire (BMQ)[24] comprises two five-item subscales assessing beliefs about the necessity of prescribed medication (necessity subscale) and concerns about prescribed medication based on beliefs about the dangers of dependence and long-term toxicity as well as the disruptive effects of medication (concerns subscale) outcomes. The aggregate score for each subscale ranged from 5 to 25, with higher scores denoting stronger beliefs in the necessity of medication or greater concerns about medication. Three scales were designed to assess adherence to medication intake (five items), diet recommendations (three items) and the prescribed PD regimen (three items). Participants were asked to rate their frequency of non-adherent behaviours (e.g. "alter the dose of medicines", "skip dialysis exchanges") on a five-point Likert scale that ranged from 'very often = 1' to 'never = 5'. Adherence scores were calculated by averaging across items separately for dialysis prescription, medicines and diet, with higher scores signifying greater adherence. The number of PD sessions missed or shortened during the past four weeks was also reported by the participants. In addition to self-reporting, serum phosphate and potassium levels were abstracted from chart review. Serum phosphate level reflected the patients' adherence to phosphate binder medication, as well as their adherence to diet and the prescribed dialysis exchanges.[25] Serum phosphate level > 1.78 mmol/L was judged as non-adherence based on the National Kidney Foundation Kidney Disease Outcome Quality Initiative goal.[26] Low potassium levels (< 3.5 mmol/L) showed non-adherence to potassium supplements or diet.

Self-efficacy was assessed with an instrument modified from the Self Efficacy for Managing Chronic Disease Scale,[27] which consisted of 14 items. Self-efficacy reflects an individual's confidence in executing a certain behaviour to produce desired outcomes.[28] Respondents were asked to rate their confidence (from 1 = not at all confident to 10 = totally confident) in performing the 14 tasks. The first six were general tasks in managing chronic disease (e.g. "Keep the physical discomfort or pain of your disease from interfering with the things you want to do"). The rest of the items were tasks related to PD treatment (e.g. "Perform your PD exchanges as instructed by your doctor").

The Hospital Anxiety and Depression Scale (HAD)[29] contains two seven-item subscales, one assessing anxiety and one assessing depression. Aggregate score for each subscale ranged from 0 to 21. A score > 7 on either subscale was considered as depression or anxiety.[30] The Kidney Disease Quality of Life-Short Form (KDQOL-SF)[31] supplemented the Short Form-36 (SF-36) with kidney disease-specific items. In this study, SF-36 was replaced by the Short Form-12 (SF-12) in order to minimise patients' burden. Eight SF-12 domain scores were calculated: physical functioning (PF); role-physical (RP); bodily pain (BP); general health (GH); vitality (VT); social functioning (SF); role-emotional (RE); and mental health (MH). Physical (PCS) and mental composite (MCS) scores were calculated to reflect overall physical and mental health, respectively.[32] Singapore SF-36 norms for these subscale scores were available for comparisons.[33] Six kidney disease-targeted subscales were used in this study: symptom; effect of kidney disease; burden of kidney disease; perceived social support; degree of patient satisfaction with care received for kidney disease; and perceived dialysis staff encouragement. Each subscale was scored from 0 to 100, with higher scores signifying better QoL/outcomes.

Continuous data was described as mean and standard deviation. Categorical data was described as frequency and percentage. Mann-Whitney *U* test was used to make comparisons between the two subgroups. SF-12 outcome comparisons were conducted between the current sample and the Singapore norms with one sample *t*-test. Pearson's correlation was used to reflect the degree of linear relationship among selected variables. A p-value < 0.05 was considered to be statistically significant. All analyses were conducted using the Statistical Package for the Social Sciences version 16.0 (SPSS Inc, Chicago, IL, USA).

RESULTS

Out of the 28 eligible patients, 20 provided informed consent and completed the questionnaire assessments (71.4% response rate). All participants were outpatients. Participants and non-participants did not differ in terms of age, gender, race or dialysis vintage (p > 0.05). The mean age of the patients was 64.4 ± 11.6 years and comprised predominantly patients on APD (n = 15) (Table I). Most were married. About half of the patients (n = 11) had been on PD for 6–12 months. The mean Charlson comorbidity score was low (mean 3.2 ± 2.4), with 15 (75%) diabetic patients and 19 (95%) hypertensive patients. A total of 14 out of the 20 patients were highly dependent on their family members to perform dialysis-related tasks, e.g. diet preparation,

Table I. Demographic characteristics of patients (n = 20).

Variable	No. (%)
Age* (yrs)	64.4 ± 11.6
Gender	
Female	8 (40)
Male	12 (60)
Race	
Chinese	12 (60)
Malay	6 (30)
Indian	2 (10)
Marital status	
Single	2 (10)
Married	14 (70)
Widowed	4 (20)
Employment	
Yes	6 (30)
No	14 (70)
Modality	
CAPD	5 (25)
APD	15 (75)
Dialysis duration (mths)	
6–12	11 (55)
13–24	3 (15)
> 24	6 (30)
Charlson comorbidity score*	3.2 ± 2.4
Comorbidity	
Diabetes mellitus	15 (75)
Hypertension	19 (95)
Cerebrovascular disease	5 (25)
Connective tissue disease	4 (20)
Others†	18 (90)

*Data is expressed as mean ± standard deviation †Such as bone disease and myocardial infarction
CAPD: continuous ambulatory peritoneal dialysis; APD: automatic peritoneal dialysis

medication, dialysis procedures. The BMQ necessity and concerns scores were 20.0 ± 4.4 and 10.9 ± 4.4, respectively, which signified that our cohort of patients had good awareness of the necessity of their medicines and a low level of concern about the disruptive effects of their medicines. They also reported a high level of self-efficacy in managing their disease, with a mean score of 8.3 ± 1.2 (Table II).

Self-reported adherence scores for diet, medication, dialysis prescription/exchanges were all above 4 (Table II), indicating satisfactory levels of adherence. This analysis showed that patients had the most difficulty with dietary recommendations, with 26% of patients admitting to being forgetful (n = 5), and the same number intentionally adjusting/altering their diet (26%). For medication, 20% of patients (n = 4) were judged as non-adherent due to forgetfulness and 15% (n = 3) due to deliberate reasons. Dialysis adherence rates were higher; only one APD (5%) patient and two CAPD (10%) patients reported skipping and shortening their dialysis in the past four weeks. Analysis of biochemical data showed that three (16%) patients were classified as non-adherent to diet/medication based on their serum phosphate levels (> 1.78 mmol/L) and three (16%) patients had potassium < 3.5 mmol/L, reflecting non-adherence to potassium supplements or diet.

Table II. BMQ, self-efficacy and overall adherence scores.

Score	No. of patients	Mean ± SD
BMQ necessity	20	20.0 ± 4.4
BMQ concern	20	10.9 ± 4.4
Self-efficacy*	19	8.3 ± 1.2
General*	19	7.7 ± 1.7
PD treatment-specific*	18	9.1 ± 0.8
Overall adherence		
Dialysis	20	4.8 ± 0.3
Medication	20	4.6 ± 0.5
Diet*	19	4.1 ± 0.7

*Data is missing for some patients.
SD: standard deviation; BMQ: Beliefs about Medicines Questionnaire; PD: peritoneal dialysis

Univariate analyses indicated significant associations between overall adherence and PD modality, employment, self-care status (self or others) and self-efficacy, albeit not consistently across all treatment aspects. Factors influencing overall adherence are presented in Table III. Adherence to dialytic exchanges was higher in APD patients compared to those on CAPD ($p = 0.033$). Medication adherence was significantly lower in patients on full-time or part-time employment compared to unemployed patients ($p = 0.033$). PD patients cared by others showed a significantly higher adherence to dietary restrictions compared to self-cared PD patients ($p = 0.009$). Higher levels of PD-specific self-efficacy beliefs were significantly associated with higher adherence to diet ($p < 0.001$).

Age and depression were not associated with any adherence measures (i.e. overall, intentional non-adherence, forgetfulness/unintentional non-adherence scores). Multivariate regression analyses were not performed since the patient numbers were too small. The HAD scores for anxiety and depression were 5.2 ± 4.4 and 6.9 ± 5.1, respectively (Table IV). Analysis of score distribution revealed that 30% (n = 6) and 40% (n = 8) of patients scored above the cutoff of 8 for anxiety and depression, respectively. PD patients also reported poor QoL, with three of the eight domain scores of SF-12 being lower than age-, gender- and race-matched Singapore general population norms:[33] PF, RP and GH ($p < 0.05$, Table V). KDQOL-SF scores (Table V) indicate that patients were the least bothered about dialysis disease-related symptoms (mean score 84.3 ± 12.9), but most concerned with disease-related lifestyle burden (mean score 50.6 ± 29.0).

DISCUSSION

The non-adherence rates in our PD sample showed many similarities with those reported in previous studies conducted on dialysis patients.[9,34] First, most recipients in our sample were adherent to treatment recommendations. The second point of similarity is the marked variability in our sample's non-adherence rates across areas of the medical regimen, with non-adherence to dialysis exchanges and medication being relatively rare, while non-adherence to lifestyle aspects, i.e. diet, was much more common.[9,34] A similar pattern was found in a study of 173 CAPD patients in Hong Kong, in which the patients reported better

Table III. Factors influencing overall adherence scores.

	Dialysis	p-value	Medication	p-value	Diet	p-value
Modality*						
APD	4.9 ± 0.2	0.033	4.5 ± 0.5	0.672	4.2 ± 0.7	0.185
CAPD	4.5 ± 0.3		4.6 ± 0.5		3.8 ± 0.7	
Employment*						
Yes	4.7 ± 0.4	0.274	4.1 ± 0.6	0.033	3.8 ± 0.6	0.087
No	4.9 ± 0.2		4.8 ± 0.4		4.3 ± 0.6	
Carer*						
Self	4.6 ± 0.3	0.051	4.3 ± 0.7	0.312	3.6 ± 0.4	0.009
Other	4.9 ± 0.2		4.7 ± 0.4		4.4 ± 0.6	
PD-specific self-efficacy	0.232†	0.355	0.008†	0.973	0.754†	< 0.001

*Data is expressed as mean ± standard deviation (Mann-Whitney *U* test); † Data is expressed as r (Pearson's correlation coefficient).
APD: automated peritoneal dialysis; CAPD: continuous ambulatory peritoneal dialysis; PD: peritoneal dialysis

Table IV. Hospital Anxiety and Depression (HAD) scores (n = 20).

HAD scale	No. (%)
Anxiety score*	5.2 ± 4.4
Normal (0–7)	14 (70)
Borderline (8–10)	5 (25)
Abnormal (11–21)	1 (5)
Depression score*	6.9 ± 5.1
Normal (0–7)	12 (60)
Borderline (8–10)	3 (15)
Abnormal (11–21)	5 (25)

*Data is expressed as mean ± standard deviation.

Table V. Short-form 12/36 and KDQOL-SF scores.

Scoring scale	Mean ± SD		p-value†
	PD sample	Singapore norms*	
SF-12/SF-36			
Physical functioning	53.8 ± 38.3	78.3 ± 24.0	0.01
Role-physical	58.1 ± 34.0	82.1 ± 31.6	0.005
Bodily pain	82.5 ± 25.8	78.7 ± 19.8	0.52
General health	50.0 ± 28.1	68.6 ± 16.4	0.008
Vitality	53.0 ± 34.5	65.8 ± 17.1	0.11
Social functioning	67.5 ± 39.0	82.1 ± 19.0	0.11
Role-emotional	80.0 ± 30.7	80.4 ± 34.5	0.96
Mental health	71.0 ± 25.7	74.6 ± 17.2	0.53
PCS	41.3 ± 10.6	50.8 ± 10.0	0.001
MCS	50.2 ± 20.6	50.5 ± 9.8	0.92
KDQOL-SF			
Symptom	84.3 ± 12.9	-	-
Effect of kidney disease	82.5 ± 11.9	-	-
Burden of kidney disease	50.6 ± 29.0	-	-
Social support	69.2 ± 26.9	-	-
Patient satisfaction	78.3 ± 20.3	-	-
Staff encouragement	76.9 ± 27.9	-	-

*SF-36 Singapore norms were used instead of SF-12 Singapore norms (unavailable). †One sample t-test.
SD: standard deviation; SF: short-form; PCS: physical composite score; MCS: mental composite score; PD: peritoneal dialysis; KDQOL-SF: Kidney Disease Quality of Life-Short Form

adherence to medication (83%) and dialysis (93%) compared to fluid (64%) and dietary restrictions (38%).[35]

Several reasons may account for the observed differences in adherence levels for the different treatment aspects. On the one hand, it is likely that the nearly perfect level of adherence with respect to dialysis prescription is partly due to the direct involvement of others (family member, carer or domestic helper) in the preparation and performance of PD exchanges, which may leave less room for forgetfulness or deliberate shortening/skipping behaviours by patients. It is also likely that patients themselves are more knowledgeable or aware of the necessity of dialysis and/or medication in prolonging life and alleviating symptoms of uraemia, thereby perceiving greater incentives in following through with the recommended PD exchanges. On the other hand, there may be greater barriers to adherence to lifestyle aspects such as diet. Low health literacy may be an issue, particularly for the elderly and lower socioeconomic and education groups (includes both patients and their carers). Barriers related to availability of suitable dietary options when eating out or on social occasions are also commonly reported by patients on dialysis.[35] Responses to PD-specific self-efficacy measures show that patients lack confidence in following renal dietary guidelines when eating out. It is also important to recognise when adherence is unintentional (e.g. due to forgetfulness) versus deliberate (e.g. making a decision to divert from recommendations). This important distinction has not been explored in previous studies, yet it can have important implications for clinical practice and programmes aimed at preventing non-adherence or enhancing adherence. Our study findings showed that poor adherence may be attributed to either forgetfulness or more deliberate reasons.

Forgetting to follow treatment regimens (i.e. unintentional non-adherence) is quite common across different patient populations, especially in older adults due to cognitive impairment[36,37] For example, 31.2% of HD patients in one study cited forgetfulness as the primary reason for not taking medication as directed.[38] Our study revealed that 20% and 26% of patients were non-adherent to medication and diet, respectively, due to forgetfulness. Although none of the participants had a diagnosis of dementia, it is likely that some might have presented with mild cognitive impairments, which have been widely documented in chronic kidney disease and dialysis patients.[39-41] The lack of significant association between age and unintentional non-adherence, however, indicates that generalised age-related cognitive decline may have played only a minor role in the observed rates of forgetfulness in this sample. It is necessary to

further investigate the relationship between forgetfulness and cognitive decline in studies with larger sample sizes. Forgetfulness in this sample was more likely to be caused by other contributing factors such as a lack of routines and low health literacy, as cited in the literature.[42] Simplifying treatment regimens, the use of memory aids and reminder devices (e.g. wristwatch alarms) may be effective methods to lessen the effects of forgetfulness.[36,43,44] Social support (e.g. a telephone call from a friend) could largely help forgetful patients.[36]

Besides forgetfulness, intentional non-adherence behaviours were found in 15% of patients with respect to medication and 26% of patients with regard to diet recommendations. Previous evidence indicates that deliberate non-adherence may happen when patients do not believe in the necessity of the treatment regimen, or try to avoid the side effects of medication or regain control in their illness by deciding the regimens that work for them.[44,45] Lopez et al reported a positive relationship between intentional non-adherence and depression,[46] although this was not supported by our data. It is very likely that intentional non-adherence might be a form of self-harm behaviour chosen by depressed patients, but further work is needed to explore this relationship. It is of paramount importance to elicit the patients' perspectives on treatment, as this may be driving rational non-adherence decisions and behaviours. Addressing misconceptions and fostering a patient-centred approach where concerns can be openly discussed may be helpful in preventing or reducing deliberate non-adherence. Intervention programmes aimed at improving non-adherence behaviours need to take all these factors into consideration. Knowing which groups of patients are likely to be non-adherent can be of great importance to clinicians. Contradictory to previous findings that no significant relationship exists between employment status and medication adherence,[8,47,48] unemployed patients in the present study reported better medication adherence than employed patients. This may be related to employed patients' pre-occupation with job responsibilities in the competitive context of Singapore or their decision to hide their medical condition from colleagues to avoid embarrassment.

In line with previous works, our study findings showed that a considerable number of PD patients experienced symptoms of anxiety and depression,[23,49,50] with the prevalence rate of depression (40%) being similar to those reported in recent studies on PD populations[51] as well as data from the Dialysis Outcomes and Practice Study.[52] Emotional distress has been shown to be associated with the burden of comorbidity as well as treatment exigencies and related engendered stressors, such as uncertainty about illness and social isolation.[49,53,54] Although the latter factors were not directly measured in this study, 70% of study participants were home-bound and complained (unprompted) of low social support and minimal social interactions. In the light of evidence on the association of depression with poor clinical outcomes, such as risk of peritonitis and mortality,[16-18,23] it is critical for clinicians to routinely screen their PD patients for depression. These patients should be encouraged to seek professional treatment.

This study had several limitations. First, the cross-sectional nature of the data limited causal inferences about the directionality of observed associations. Unfortunately, it was not possible to expand the recruitment window or schedule follow-up assessments to plot out the course of emotional and adherence outcomes due to a planned move of the PD unit into a new/different hospital site. In addition to issues related to potentially different organisational structures within the different sites, the PD patient cohort registered at the original site was further segmented, with some patients assigned to or opting for the newly formed PD unit in the new hospital and others remaining in the original site or requesting for referral to other PD units elsewhere.

Second, the small sample size and the considerable non-response rate, albeit typical of this type of research, limited the generalisability of findings to the national PD population. The sample was recruited from a single hospital's PD unit and consisted of only 20 participants and short dialysis vintage, with about half the patients having been on PD for only 6–12 months. Furthermore, similar to most studies of this type, the present study relied on volunteers and may therefore have attracted healthier individuals or those with better adherence compared with the dialysis population in general. Although the pool of patients in the unit was very small (n = 29), and there were no significant case-mix differences between respondents and non-respondents, it is deemed to be essential to replicate findings in larger samples that are more representative of national PD population.

Third, the mode of administration may have introduced a bias. Questionnaires were mostly completed as an interview, with few patients opting for self-report/self-completion. Although interviews were conducted by independent researchers who were not involved in the patients' care in order to minimise social desirability bias and facilitate disclosure, patients' responses to face-to-face interviews may still have been affected by social desirability bias. Data may also be threatened by patients' inaccurate recall, either due to the time frame of the questions/items (e.g. adherence status in the past month) or the lack of personal awareness regarding the prescribed treatment guidelines. The majority of patients were elderly and highly dependent on their carers for treatment, which may imply that they themselves were unfamiliar with the treatment recommendations and procedures. These issues limit the generalisability of findings to younger, more independent and potentially knowledgeable PD patients, and warrant further investigation using larger and more diverse PD cohorts.

It is also important to note that the majority of patients (75%) were on APD, which has been shown to have higher adherence to treatment therapy.[55] Depression has been shown to be higher among CAPD patients,[56] which suggests that the already observed high rates of emotional distress may be even higher if only CAPD patients are considered. Our numbers were

too small to allow for subgroup analysis between APD and CAPD patients, and thus, this warrants future research.

Fourth, the patients' family members/carers, who often share or single-handedly assume the responsibility of treatment management and related healthcare decisions, were not assessed in this study. The effects of illness and treatment exigencies on the PD carers' well-being and the effects of caregiving burden on patients' outcomes have not been considered. Future studies should assess the involvement of family members in the care of PD patients and their influence on patients' adherence and emotional status. Finally, longitudinal studies are required to describe the dynamics of adherence and depression over the course of illness and treatment as well as to tease out causal and temporal relationships.

In conclusion, the findings of this study provide preliminary evidence that adherence levels are satisfactory for the majority of local PD patients, yet a substantial number of patients experience symptoms of anxiety and depression. This highlights the need for regular monitoring and potential interventions to support patients in managing and adjusting to their illness and treatment.

ACKNOWLEDGEMENTS

This research was supported by a grant from the National University of Singapore Academic Research Fund. We thank the healthcare professionals in Alexandra Hospital for their support in this project and their assistance in collating the medical data. We are also thankful to all the patients for taking the time to complete the study questionnaires.

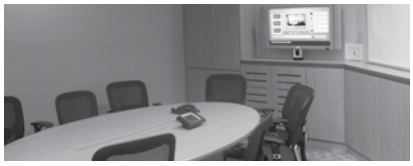
REFERENCES

1. Choong HL, ed. Sixth Report of the Singapore Renal Registry 2005/2006. Singapore: Health Promotion Board, 2009.
2. Bloembergen WE, Port FK, Mauger EA, Wolfe RA. A comparison of mortality between patients treated with hemodialysis and peritoneal dialysis. J Am Soc Nephrol 1995; 6:177-83.
3. Port FK, Wolfe RA, Bloembergen WE, Held PJ, Young EW. The study of outcomes for CAPD versus hemodialysis patients. Perit Dial Int 1996; 16:628-33.
4. McCarthy A, Shaban R, Boys J, Winch S. Compliance, normality, and the patient on peritoneal dialysis. Nephrol Nurs J 2010; 37:243-50.
5. Christensen AJ, Smith TW, Turner CW, Cundick KE. Patient adherence and adjustment in renal dialysis: a person x treatment interactive approach. J Behav Med 1994; 17:549-66.
6. Christensen AJ, Smith TW. Personality and patient adherence: correlates of the five-factor model in renal dialysis. J Behav Med 1995; 18:305-13.
7. Christensen AJ, Wiebe JS, Benotsch EG, Lawton WJ. Perceived health competence, health locus of control, and patient adherence in renal dialysis. Cognit Ther Res 1996; 20:411-21.
8. Stamatakis MK, Pecora PG, Gunel E. Factors influencing adherence in chronic dialysis patients with hyperphosphatemia. J Ren Nutr 1997; 7:144-8.
9. Cummings KM, Becker MH, Kirscht JP, Levin NW. Psychosocial factors affecting adherence to medical regimens in a group of hemodialysis patients. Med Care 1982; 20:567-80.
10. Tomasello S, Dhupar S, Sherman RA. Phosphate binders, K/DOQI guidelines, and compliance: the unfortunate reality. Dial Transplant 2004; 33:236-42.
11. Eitel P, Friend R, Griffin KW, Wadhwa NK. Cognitive control and consistency in compliance. Psychol Health 1998; 13:953-73.
12. Schlebusch L, Levin A. Can poor compliance in hemodialysis patients be predicted. Dial Transplant 1982; 11:601-4.
13. Steidl JH, Finkelstein OF, Wexler JP, Medical condition, adherence to treatment regimens, and family functioning: their interactions in patients receiving long-term dialysis treatment. Arch Gen Psychiat 1980; 37:1025-7.
14. Cukor D, Peterson RA, Cohen SD, Kimmel PL. Depression in end-stage renal disease hemodialysis patients. Nat Clin Pract Nephrol 2006; 2:678-87.
15. Cukor D, Coplan J, Brown C, et al. Depression and anxiety in urban hemodialysis patients. Clin J Am Soc Nephrol 2007; 2:484-90.
16. Einwohner R, Bernardini J, Fried L, Piraino B. The effect of depressive symptoms on survival in peritoneal dialysis patients. Perit Dial Int 2004; 24:256-63.
17. Hedayati SS, Bosworth HB, Briley LP, et al. Death or hospitalization of patients on chronic hemodialysis is associated with a physician-based diagnosis of depression. Kidney Int 2008; 74:930-6.
18. Kimmel PL, Peterson RA, Weihs KL, et al. Multiple measurements of depression predict mortality in a longitudinal study of chronic hemodialysis outpatients. Kidney Int 2000; 57:2093-8.
19. Patel SS, Shah VS, Peterson RA, Kimmel PL. Psychosocial variables, quality of life, and religious beliefs in ESRD patients treated with hemodialysis. Am J Kidney Dis 2002; 40:1013-22.
20. Troidle L, Watnick S, Wuerth DB, et al. Depression and its association with peritonitis in long-term peritoneal dialysis patients. Am J Kidney Dis 2003; 42:350-4.
21. Cukor D, Rosenthal DS, Jindal RM, Brown CD, Kimmel PL. Depression is an important contributor to low medication adherence in hemodialyzed patients and transplant recipients. Kidney Int 2009; 75:1223-9.
22. DiMatteo MR, Lepper HS, Croghan TW. Depression is a risk factor for noncompliance with medical treatment: meta-analysis of the effects of anxiety and depression on patient adherence. Arch Intern Med 2000; 160:2101-7.
23. Ko GJ, Kim MG, Yu YM, et al. Association between depression symptoms with inflammation and cardiovascular risk factors in patients undergoing peritoneal dialysis. Nephron Clin Pract 2010; 116:c29-35.
24. Horne R, Weinman J, Hankins M. The beliefs about medicines questionnaire: the development and evaluation of a new method for assessing the cognitive representation of medication. Psychol Health 1999; 14:1-24.
25. Karamanidou C, Clatworthy J, Weinman J, Horne R. A systematic review of the prevalence and determinants of nonadherence to phosphate binding medication in patients with end-stage renal disease. BMC Nephrol 2008; 9:2.
26. National Kidney Foundation. K/DOQI clinical practice guidelines: bone metabolism and disease in chronic kidney disease. Am J Kidney Dis 2003; 42 (Suppl 3):S1-201.
27. Lorig KR, Ritter P, Stewart AL, et al. Chronic disease self-management program: 2-year health status and health care utilization outcomes. Med Care 2001; 39:1217-23.
28. Bandura A. Social Learning Theory. New York: Prentice-Hall; 1977.
29. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand 1983; 67:361-70.
30. Ng TP, Niti M, Tan WC, et al. Depressive symptoms and chronic obstructive pulmonary disease: effect on mortality, hospital readmission, symptom burden, functional status, and quality of life. Arch Intern Med 2007; 167:60-7.
31. Hays RD, Kallich JD, Mapes DL, et al. Kidney disease quality of life short form (KDQOL-SFTM), Version 1.3: A Manual for Use and Scoring. Santa Monica: RAND; 1997.
32. Ware JE, Kosinski M, Keller SD. SF-12: How to score the SF-12 physical and mental health summary scales. 3rd ed. Lincoln: Quality Metric Inc.
33. Thumboo J, Fong KY, Machin D, et al. A community-based study of scaling assumptions and construct validity of the English (UK) and Chinese (HK) SF-36 in Singapore. Qual Life Res 2001; 10:175-88.
34. Lin CC, Liang CC. The relationship between health locus of control and compliance of hemodialysis patients. Kaohsiung J Med Sci 1997; 13:243-54.
35. Lam LW, Twinn SF, Chan SW. Self-reported adherence to a therapeutic regimen among patients undergoing continuous ambulatory peritoneal dialysis. J Adv Nurs 2010; 66:763-73.
36. Chisholm-Burns MA, Spivey CA, Wilks SE. Social support and immunosuppressant therapy adherence among adult renal transplant recipients. Clin Transplant 2010; 24:312-20.

37. Jin J, Sklar GE, Min Sen Oh V, Chuen Li S. Factors affecting therapeutic compliance: A review from the patient's perspective. Ther Clin Risk Manag 2008; 4:269-86.
38. Bland RJ, Cottrell RR, Guyler LR. Medication Compliance of Hemodialysis Patients and Factors Contributing to Non-Compliance. Dial Transplant 2008; 37:174-8.
39. Griva K, Newman S, Harrison M, et al. Acute neuropsychological changes in hemodialysis and peritoneal dialysis patients. Health Psych 2003; 22:570-8.
40. Griva K, Hansraj S, Thompson D, et al. Neuropsychological performance after kidney transplantation: a comparison between transplant types and in relation to dialysis and normative data. Nephrol Dial Transplant 2004; 19:1866-74.
41. Murray AM. Cognitive impairment in the aging dialysis and chronic kidney disease populations: an occult burden. Adv Chronic Kidney Dis 2008; 15:123-32.
42. Kjeldsen LJ, Bjerrum L, Herborg H, et al. Development of new concepts of non-adherence measurements among users of antihypertensives medicines. Int J Clin Pharm 2011; 33:565-72.
43. Bullington P, Pawola L, Walker R, et al. Identification of medication non-adherence factors in adolescent transplant patients: the patient's viewpoint. Pediatr Transplant 2007; 11:914-21.
44. Small G, Dubois B. A review of compliance to treatment in Alzheimer's disease: potential benefits of a transdermal patch. Curr Med Res Opin 2007; 23:2705-13.
45. Golub SA, Indyk D, Wainberg ML. Reframing HIV adherence as part of the experience of illness. Soc Work Health Care. 2006; 42:167-88.
46. López San Román A, Bermejo F, Carrera E, Pérez-Abad M, Boixeda D. Adherence to treatment in inflammatory bowel disease. Rev Esp Enferm Dig 2005; 97:249-57.
47. Curtin RB, Svarstad BL, Keller TH. Hemodialysis patients' noncompliance with oral medications. ANNA J 1999; 26:307-16.
48. O'Brien ME. Hemodialysis regimen compliance and social environment: a panel analysis. Nurs Res 1980; 29:250-5.
49. Atalay H, Solak Y, Biyik M, et al. Sertraline treatment is associated with an improvement in depression and health-related quality of life in chronic peritoneal dialysis patients. Int Urol Nephrol 2010; 42:527-36.
50. Mittal SK, Ahern L, Flaster E, et al. Self-assessed quality of life in peritoneal dialysis patients. Am J Nephrol 2001; 21:215-20.
51. Griva K, Davenport A, Harrison M, Newman S. An evaluation of illness, treatment perceptions, and depression in hospital- vs. home-based dialysis modalities. J Psychosom Res 2010; 69:363-70.
52. Lopes AA, Bragg J, Young E, et al. Depression as a predictor of mortality and hospitalization among hemodialysis patients in the United States and Europe. Kidney Int 2002; 62:199-207.
53. Lew SQ, Piraino B. Quality of life and psychological issues in peritoneal dialysis patients. Semin Dial 2005; 18:119-23.
54. Sosa-Guerrero S, Gomez NJ. Dealing with end-stage renal disease. Am J Nurs 1997; 97:44-50.
55. Raj DS. Role of APD in compliance with therapy. Semin Dial 2002; 15:434-6.
56. de Wit GA, Merkus MP, Krediet RT, de Charro FT. A comparison of quality of life of patients on automated and continuous ambulatory peritoneal dialysis. Perit Dial Int 2001; 21:306-12.

Striving for Excellence in Teaching



Khoo Teck Puat Advanced Surgery Training Centre

NUS National University of Singapore

Khoo Teck Puat Advanced Surgery Training Centre (ASTC), a regional surgical training hub, is a comprehensive, world-class venue for seminars, workshops and hands-on training in surgical education. Conveniently located at the National University Hospital, its facilities includes a Seminar Hall, Meeting Room, Lecture Room, Simulation Lab, Micro-surgery Lab, as well as Surgery and Minimally Access Research and Training Laboratory (SMART Lab). The SMART Lab is equipped with 10 working stations, with each a replica of a real operating theatre, for surgeons to hone or acquire new surgical skills. ASTC also combines cutting edge technology with educational programmes, and offers numerous courses and workshops across multiple specialities ranging from Neurosurgery to Robotic Surgery. Additional services also include consulting and planning to marketing and managing your event. For more information, please contact ASTC. Tel: 6772 2090 / Email: surtyh@nus.edu.sg / Website: www.astc.sg