Relationship between dialysis adequacy addressed by Kt/V urea values and nutritional status in its effect on components of quality of life in incident peritoneal dialysis patients

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ABSTRACT

**Background:** It is well known that the quality of life of patients with chronic kidney disease can be improved when dialysis is initiated. However, previous studies were conducted in retrospective designs and adhered to a standard target according to clinical guidelines. The study was a prospective design to investigate a longitudinal association between adequacy and nutritional indices and quality of life domains in a cohort of incident PD patients.

**Study design:** A prospective 6-month observational study.

**Setting & Participants:** Eighty incident PD participants who were treated in a hospital-facilitated PD center were enrolled. The period of enrollment was January 2009-June 2010; follow-up until December 2010.

**Predictors:** PD adequacy indices; Kt/V urea, weekly Ccr (WCcr); nutritional index; nPCR, measured at one and 6 months after PD initiation.

**Outcomes & Measurements:** SF-36 health survey questionnaires were used to measure quality of life. Outcomes measured the changes in the domains of SF-36 at 6-month PD therapy.

**Results:** Seventy-seven incident patients who initiated PD for 6 months completed the study. The mean age was 47.3 years old, and the male-to-female ratio was 38 : 39. A cutoff level of baseline peritoneal Kt/V urea of 1.2 was found to have the most influence on SF-36 domains. Patients with baseline peritoneal Kt/V urea < 1.2 had improvement in components of physical functioning and role limitation of physical functioning after a 6-month PD initiation. In contrast, patients with baseline peritoneal Kt/V urea ≥ 1.2 had remarkable improvement in components of general health, physical functioning, role limitation caused by physical problems and bodily pain.
However, the trend of improvement disappeared in patients with baseline nPCR < 1.2.

Baseline renal WCcr did not influence improvement in the SF-36 domains.

**Limitations:** A small cohort in a short observation period.

**Conclusions:** The levels of baseline peritoneal Kt/V urea had different influences on the components of quality of life after PD initiation. In addition, adequate nutrition played a definite role in the maintenance of quality of life in incident PD patients.

**Index words:** peritoneal dialysis, quality of life, SF-36
Introduction

The concept of health-related quality of life (HRQOL) in patients with chronic kidney disease (CKD), including end-stage renal disease (ESRD), has evolved since the inception of renal replacement therapy from simple survival to achieving a sense of well-being [1]. Patients with CKD usually tend to show a reduction in their quality of life (QoL) because of the several restrictions resulting from CKD treatment. Multiple factors, such as the presence of co-morbidities, can be related to the reduction of QoL. Interventions enhancing the clinical conditions and QoL of those patients are paramount, since the latter is directly associated with mortality in that population. The association between the reduction of QoL and preventable and controllable factors including diabetes [2], old age [3], inadequacy of dialysis, inflammation and poor nutrition is still uncertainly demonstrated in previous studies. In addition, studies have shown dialysis initiation improving QoL in ESRD patients [4-8]. However, the association between dialysis adequacy indices or nutritional parameters and QoL assessment is inconsistent. These results may be due to the small samples of patients, non-ESRD-specific assessments, inadequate observation periods, etc.

There are several validated disease-specific HRQoL questionnaires that can be used for the dialysis cohort, such as the World Health Organization Quality of Life Survey (WHOQOL), Short Form Health Survey (SF-36), the Kidney Disease Quality of Life (kDQOL), and the Choices Health Experiences Questionnaire (CHEQ). Peritoneal dialysis (PD) patients who had Kt/V urea above 2.0 have been demonstrated to have higher total SF-36 scores [6], although some argue there is a poor correlation between Kt/V urea and SF-36 scores [8]. There are only two validated native language editions
of questionnaires in Taiwan: the WHOQOL and the SF-36. In Taiwan, SF-36 questionnaires have been reported to be a validated tool in a multi-center study comparing the QoL between PD and hemodialysis patients [9].

In this study, we used the SF-36 to assess QoL in an incident cohort of PD patients. The purpose of the study was to investigate which components of the SF-36 could be improved after PD initiation. In addition, the influences of adequacy indices of PD and nutritional status upon the components of SF-36 were explored.

Materials and Methods

Incident ESRD patients who consulted the PD institution at a medical center in southern Taiwan between January 2009 and June 2010 were enrolled into this prospective study. The inclusion criteria for the incident PD patients included: having received regular PD therapy for at least three months, aged more than 17 years, able to express themselves and having no history of psychiatric disease, and clinically stable with no evidence of chronic or acute infections, inflammatory disorders, malignancy, or anti-inflammatory drug use three months prior to enrollment. The exclusion criteria were as follows: (1) less than 17 years of age; (2) unable to complete the questionnaires by themselves; (3) major clinical events requiring admission; and (4) discontinuation of PD for the following reasons: kidney transplantation, technique failure, death, transfer to hemodialysis, and loss to follow-up. According to the study protocol, all patients completed at least six months of consecutive PD therapy; A total of 77 of 80 clinically stable patients (38 male and 39 female) were finally eligible. The mean age was 47.3 years. All patients were dialyzed using commercially available dialysate (pH 5.2; Dianeal PD solution; Baxter, Singapore) containing 40mmol/L lactate. Forty-five patients received CAPD,
four exchanges every day. Thirty-two patients received automated peritoneal dialysis (APD) therapy.

QoL was measured using the Chinese-language version of the 36-item Short Form Health Survey Questionnaire (SF-36, Taiwan Standard Version 1.0), a generic self-report QoL instrument. The SF-36 consists of 36 items, which are assigned to 8 domains, including general health, physical functioning, role limitation due to physical problems, bodily pain, mental health, social functioning, role limitation due to emotional problems, and vitality. The first four domains constitute the physical component scale, and the second four, the mental component scale. Higher scores suggest better QoL.

All patients were asked to complete the SF-36 questionnaire at baseline and six months after PD initiation. Standard P.E.T. was performed in the first month and the 6th month after PD initiation. The clinical characteristics of all patients, including demographic and biochemical data, the PD adequacy indices (renal and peritoneal Kt/V urea, Ccr), and nutritional indices [serum albumin, normalized protein catabolic rate (nPCR)] were collected at baseline and at the 6th month for statistical analysis.

The protocol for the present study was approved by the Committee on Human Research at Kaohsiung Chang Gung Memorial Hospital (CMRPG880091) and conducted in accordance with the Declaration of Helsinki. All participants signed an informed consent form to obtain approval to take part in the study.

Statistical analysis

Using the general linear model, we tried out and determined an applicable Kt/V value to investigate the effect of Kt/V on QoL (Table 1). Based on the selected Kt/V
value, demographic data including age and gender, clinical data including peritoneal urea Kt/V, residual renal urea Kt/V, total Kt/V, peritoneal weekly Ccr, residual renal weekly Ccr, total weekly Ccr, hs-CRP, albumin, GPT, Hb, and nPCR, and the eight multi-item domains of the SF36 were all recorded and grouped, and compared with the Mann-Whitney test, Chi-Square test or likelihood ratio test. Thus, age, peritoneal Kt/V, residual renal WCcr and nPCR were regarded as independent variables to explore the differences in the influence of the SF-36 scores between one month and six months after PD therapy initiation. Statistical analyses were performed using the IBM SPSS Statistics 19 (SPSS Inc. Chicago, IL) program.

Results

Association between baseline peritoneal Kt/V urea values and components of the SF-36

More components of the SF-36 were influenced by peritoneal Kt/V values when the cutoff value was 1.2. General health, physical functioning, role limitation due to physical problems, bodily pain, and vitality were significantly improved when the peritoneal Kt/V value was above 1.2. In contrast, only the general health component improved when the peritoneal Kt/V value was below 1.2 (Table 1).

Baseline patient characteristics stratified by peritoneal Kt/V urea and nPCR

The patients were stratified by cutoff values of peritoneal Kt/V urea 1.2. There were significant differences between the two groups in peritoneal Kt/V urea, total Kt/V urea, and peritoneal weekly Ccr (Table 2). When the patients were stratified by the cutoff value of nPCR 1.2, those with nPCR ≥1.2 had higher total Kt/V urea and WCcr values than those with nPCR <1.2 (Table 3). The components of the SF-36 at baseline
did not differ in the stratified groups in terms of cutoff values of 1.2 of Kt/V urea or nPCR (Tables 2 and 3).

*The influences of baseline peritoneal Kt/V urea, renal WCcr, and nPCR on components of the SF-36 after 6 months of PD*

Those who had baseline peritoneal Kt/V urea < 1.2 demonstrated improvement in physical functioning and role limitations due to physical problems after 6 months of PD therapy. Patients who had baseline peritoneal Kt/V urea ≥ 1.2 showed improvement in general health, physical functioning, role limitation due to physical problems and bodily pain (Table 4). Residual renal function of either < 40 L/week/1.73 m² or ≥ 40 L/week/1.73 m² did not have an impact on components of SF-36 after 6 months of PD therapy. There were negative benefits in all components of the SF-36 after 6 months of PD therapy in those patients with baseline nPCR <1.2 (Table 4).

**Discussion**

Small solute clearance measured by Kt/V urea has been known as one of the major determinants of dialysis adequacy. A growing body of evidence has shown a strong link between Kt/V urea and mortality in dialysis populations [10]. Therefore, to reduce the risk of mortality and improve dialysis adequacy, the total (renal + peritoneal) Kt/V urea should not be less than 1.7 for small solute removal, according to the guidelines from KDOQI and ISPD [11,12]. To reach this target, however, patients might suffer from some adverse effects, including hernias from the increased intra-abdominal pressure due to larger volumes of dialysis solution, the increased amount of time needed to perform exchanges, weight gain and other metabolic consequences due to higher glucose exposure. These might in turn not only adversely
affect the willingness to continue PD therapy, but also QoL in incident PD patients. However, there was also a report that a lower target for Kt/V urea was associated with a similar survival rate [13], so we were wondering what the impact of a lower target for Kt/V urea would be on QoL. In our study, we carefully stratified our study subjects by peritoneal Kt/V urea into six groups. Peritoneal Kt/V urea is the major component of total weekly Kt/V urea and is the critical component that the dialysis prescription aims to manipulate. We found that patients with a peritoneal Kt/V urea > 1.2 experienced great improvement in QoL, especially in the domains of general health, physical function and role limitation due to physical problems, at six months after the initiation of PD. Our results suggest that PD on its own has great benefit in improving QoL in patients whose peritoneal Kt/V urea is above 1.2. This result implicates that some domains of QoL components could be improved with a lower target of peritoneal Kt/V urea in 6-month PD therapy. However, the influence of a lower peritoneal Kt/V urea level on long-term QoL and patient survival needs to be further investigated. Another implication from our study was that it might not be that necessary to pursue a higher adequacy target at the expense of worse QoL in the early phase of PD initiation. This manipulation may avoid the early dropout of incident PD patients.

The nPCR, also called the protein equivalent of nitrogen appearance (PNA), can be used to assess dietary protein intake in patients who are in a steady state. It also was adopted as a reference value to adjust the dialysis prescription. When a poor nutrition (e.g., nPCR < 0.8 g/kg per day) or inadequate dialysis (e.g., Kt/V urea <1.2) trend is apparent, the dialysis prescription has to be adjusted to meet the clinical situation. This may require several months of monitoring nPCR and Kt/V urea levels to ascertain that a significant change has occurred. A previous investigation
demonstrated that mortality increased in dialysis patients with a nPNA less than 0.8 g/kg/day or greater than 1.4 g/kg/day [14]. Among patients with nPNA levels between 0.8 and 1.2 g/kg per day, an increase or decrease in protein intake during the first six months was associated with increased or decreased survival over the subsequent 18 months, respectively. Thus, reduced survival is associated with an initially low PCR and decreased protein intake over time. In the present study, the subjects with a baseline nPCR >1.2 g/kg/day had higher renal Kt/V urea and weekly Ccr than those who had nPCR < 1.2 g/kg/day. These patients demonstrated improved SF-36 domains after 6 months of PD therapy. In contrast, patients with nPCR < 1.2 g/kg/day demonstrated decreased scores in SF-36 domains after 6 months of PD therapy. The exact mechanism of the effect of residual renal function on favorable QoL results in subjects with nPCR >1.2 g/kg/day needs to be further investigated. However, this finding implicates a hinge role for nutritional status in QoL improvement with PD initiation. Thus, a strategy to increase the nutritional status is essential in the early phase of PD commencement.

In the past few years, some investigators have focused on the reasons for the early dropout of PD patients. The NECOSAD study demonstrated one of the major reasons for PD dropout in the first three months was the psychosocial effect [15]. A similar result from a single PD center also demonstrated that the psychosocial effect was the major cause of early dropout in the first six months of PD therapy [16]. However, one report showed PD patients did not have significant differences in physical health and social relationships compared between early and late treatment [17]. Furthermore, investigation found the emotional defensiveness would affect the physical and mental components of HRQOL in dialysis patients [18]. It implicated a psychological effect could not be ignored in management of dialysis patients. The incident PD patients
needed an adaptive period to overcome their uncertain psychological status. A complex, time-consuming PD exchange procedure definitively affected their satisfactory response to PD therapy. Our study clearly demonstrated that PD initiation could improve QoL as addressed by the SF-36 items in six-month PD therapy. However, we found a lower peritoneal Kt/V urea value still contributed to a remarkable improvement in QoL. Our assumption was that a more satisfactory PD prescription might lessen the psychosocial burden in incident PD patients, even though it only attained a lower adequacy index. However, this approach did not sacrifice QoL in incident PD patients, based on our results.

In summary, improvement of QoL in incident PD patients can be reached with a minimal level of Kt/V urea in the PD prescription. However, a poor nutritional status will offset the benefits of PD initiation to QoL improvement. In addition, a few aspects of QoL domains in the SF-36 still could be improved in 6-month PD therapy in a cohort with low Kt/V urea levels. The results could be a guide for medical staff to individualize the medical plan for incident PD patients. We concluded that a stepwise PD program was essential for incident PD patients. This gradual approach to PD prescription did not sacrifice QoL in incident PD patients. Moreover, adequate nutritional status was crucial for maintenance of QoL in incident PD patients.

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References


Additional files provided with this submission:

Additional file 1: Final Table.doc, 120K
http://www.biomedcentral.com/imedia/4304128706521043/supp1.doc