Singapore Med J 2009; 50 (2) : 185

Comparison of outcome and quality of life: haemodialysis versus peritoneal dialysis patients

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ABSTRACT

Introduction: Ever since peritoneal dialysis (PD) was introduced as a form of renal replacement therapy, its efficacy and complications have been compared with that of haemodialysis (HD). The aim of this study was to determine the efficacy and outcome of PD in comparison to HD in our region.

Methods: We compared 60 patients on PD with 60 matched patients on HD in Tabriz's Sina Hospital during the period 2004–2006. The technique, patients' survival and quality of life were compared by means of a health-related quality-of-life questionnaire (GHQ-28).

Results: There was no significant difference in the mean age and duration of dialysis between patients on PD and HD. Survival of diabetic patients was better with HD than PD, but in non-diabetic patients, there was no difference in the survival rates between the two groups. Among patients on PD, diabetics had a 25 percent higher mortality rate and non-diabetic patients had a three percent higher mortality rate than their corresponding counterparts on HD. In all four axes of the questionnaire, i.e. psychophysical dysfunction, stress and sleep disorders, social dysfunction and major depression, PD patients had lower scores than HD patients (p-values are less than 0.001, less than 0.001, equal to 0.002 and less than 0.001, respectively), indicating that patients on PD had a better quality of life compared to those on HD.

Conclusion: In this study, technique, patients' survival and their quality of life were better on PD than on HD. However, survival and mortality of diabetic patients on HD were better than those on PD.

Keywords: haemodialysis, peritoneal dialysis, quality of life

Singapore Med J 2009;50(2):185-192

INTRODUCTION

Kidney transplantation is the accepted optimal form of renal replacement therapy that provides patients with end-stage renal disease (ESRD) with the best prognosis for survival and quality of life (QOL).[1-4] Despite this, given the rapid rise in the incidence of ESRD in the United States and other countries,[5-8] and the very long waiting list for transplantation, most patients with ESRD will require some form of dialysis during their lifetime. Ever since peritoneal dialysis (PD) was introduced as a renal replacement therapy in the mid-1970s, its efficacy and complications have been compared with those of haemodialysis (HD). The majority of earlier investigations showed that PD was as effective as HD,[9,10] until some Canadian reports emphasised that PD is better than HD during the earlier years of dialysis.[11] To date, no consensus has been reached regarding which form of dialysis, PD or HD, offers patients a best chance of survival.[12,13] Results from single centre and multicentre studies show conflicting results with respect to the survival benefits of one form of therapy over the other.[14-19] ESRD is a progressive, debilitating, chronic illness that requires nursing and medical interventions that include dialysis, education on lifestyle alterations and dietary and fluid restrictions. The disease also affects body image because of oedema and the presence of arteriovenous fistulae or a central venous catheter. The disease can have an impact on patients' QOL, potentially affecting their physical and mental health, functional status, independence, general well-being, personal relationships and social functioning.[20-24] The aim of this study was the determination of patient and technique survival, and QOL in patients on PD vs. HD. It must be emphasised that patients from both groups were matched according to bias factors in previous studies.

METHODS

We had 60 patients on PD in our hospital (Sina Hospital, Tabriz, Iran) during the period January 2004 to January 2006. We enrolled these patients in comparison with 60 matched, randomly selected patients on HD during these two years as a case-control study. Patients and technique survival, as well as patients' QOL, were compared. For QOL assessment, we used the general health

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Table I. Demographic features of the sample population.

Demographics	Patients on HD		Patients on PD	
	Diabetic	Non-diabetic	Diabetic	Non-diabetic
Age (years)				
Mean ± SD	53.26 ± 4.61	58.32 ± 4.1	48.55 ± 2.79	56.84 ± 3.1
Range	38–65	31–68	26–63	32–64
Total mean ± SD	56.29 ± 3.81		52.21 ± 4.36	
Total range	21–67		28–59	
Gender				
Male	19	11	18	12
Female	16	14	17	13
Dialysis duration (years)				
Mean ± SD	3.11 ± 2.5	3.72 ± 1.4	3.68 ± 2.12	3.57 ± 1.83
Range	2.25–6.5	2.08–15	2.58–5.5	2.5–6

HD: haemodialysis; PD: peritoneal dialysis

Table II. Comparison of the patient and technique survival rates between the diabetic and non-diabetic patients in the haemodialysis and peritoneal dialysis groups.

Survival rates	HD group (%)	PD group (%)	p-value
Patient survival rate			
Non-diabetic	79.24 ± 3.12	83.19 ± 2.6	NS
Diabetic	75.76 ± 3.54	50.49 ± 4.47	0.001
Total	68.75 ± 1.06	79.25 ± 2.7	0.001
Technique survival rate			
Non-diabetic	80.77 ± 2.71	82.51 ± 2.92	NS
Diabetic	75.23 ± 1.85	67.78 ± 2.23	0.007
Total	77.35 ± 3.18	81.1 ± 2.96	0.028

Data is expressed as mean and standard deviation
HD: haemodialysis; PD: peritoneal dialysis; NS: not significant

questionnaire (GHQ-28) modified by a psychologist for the evaluation of present life-related dysfunction in our region of Iran. Patients were assessed an four axes of QOL that may affect other aspects of their lives: psychophysical dysfunction, stress and sleep disorders, social dysfunction, major depression. Each axis included seven questions with four choices each. The Likert scale was used to score the questionnaire on a scale of 0 to 3. The highest and lowest scores of every axis were 21 and 0; the last summation of these scores was between 84 and 0. A higher score was associated with higher dysfunction. According to the findings of Collins et al, patients initiating PD are generally a healthier population than those initiating HD, so we attempted to adjust for these differences when comparing the outcomes of HD and PD patients.[25]

Patients who had more than a two-year history of dialysis were included in the study, while those whose modality of dialysis had changed were excluded. Statistical analyses were performed using the Statistical Package for Social Sciences version 13.0 (SPSS Inc, Chicago, IL, USA). The results are presented as mean values with standard deviation (SD). Statistical significance between the groups was estimated using an independent sample *t*-test. The results were considered significant when the p-value was < 0.05.

RESULTS

The demographic characteristics of the groups are shown in Table I. The mean age and duration of dialysis of both groups were not significantly different. Due to matching, there was no difference between gender and dialysis duration. The results of patient and technique survival in both groups and their subgroups are presented in Table II. In our study, patients on PD had a lower survival rate when they were diabetic, so in diabetics on PD, mortality was 25% higher than in diabetics on HD ($p < 0.001$). Although the mortality rate of non-diabetic patients on HD was 3.85% higher than those on PD, this difference was not significant. In technique survival, similar to patient survival, diabetic patients on HD were in a better situation than patients on PD ($p = 0.017$) and in non-diabetics; despite the higher rate of technique survival in patients on PD, the difference was not significant. In comparison, the GHQ-28 scores of patients on PD were significantly lower than those of HD patients in all four axes. This demonstrated that PD patients had better QOL than patients on HD. This significant difference was true in both diabetic and non-diabetic patients. PD patients showed greater improvement in all domains of the questionnaire. GHQ-28 scores for all patients, classified on the basis of diabetes mellitus presence, are listed in Table III.

Table III. Quality of life on the basis of the GHQ-28 questionnaire.

Axis	Dialysis type		p-value
	Haemodialysis	Peritoneal dialysis	
Psychophysical dysfunction			
Non-diabetic	17.87 ± 1.35	13.76 ± 2.47	< 0.001
Diabetic	16.68 ± 2.45	13.45 ± 1.97	< 0.001
Total	17.46 ± 2.67	13.57 ± 1.34	< 0.001
Stress and sleep disorder			
Non-diabetic	17.35 ± 2.85	13.74 ± 1.43	< 0.001
Diabetic	16.74 ± 1.24	11.46 ± 2.99	< 0.001
Total	16.64 ± 1.56	12.75 ± 2.13	< 0.001
Social dysfunction			
Non-diabetic	16.58 ± 2.63	13.77 ± 1.75	< 0.001
Diabetic	15.58 ± 1.54	11.65 ± 1.36	< 0.001
Total	1.45 ± 1.38	12.42 ± 1.76	0.002
Major depression			
Non-diabetic	18.42 ± 1.3	14.86 ± 1.24	< 0.001
Diabetic	17.57 ± 1.35	12.85 ± 1.59	< 0.001
Total	18.22 ± 2.03	13.76 ± 2.1	< 0.001
Total score			
Non-diabetic	68.89 ± 1.35	51.87 ± 4.66	< 0.001
Diabetic	66.48 ± 1.93	47.21 ± 2.74	< 0.001
Total	67.06 ± 1.86	50.57 ± 2.1	< 0.001

Data is expressed as the mean and standard deviation.

Table IV. Relative risks of death: PD compared with HD.

Studies	Year	Type of patient
Studies with no significant difference in risk		
Maiorca et al[10]	1988	All patients
Burton and Walls[12]	1989	All patients
Serkes et al[15]	1990	Non-diabetics
Studies with significant lower risk with PD		
Nelson et al[17]	1992	Diabetics aged < 59 years
Fenton et al[33]	1995	All patients
Studies with higher risk in PD		
Held et al[18]	1994	Diabetics
Disney[8]	1994	All patients
Locatelli et al[30]	1995	All patients

DISCUSSION

Patients suffering from ESRD need renal replacement therapy as a substitute for their own kidneys. Currently, there are three main medical treatment modalities available in Iran and in many other countries: HD, PD and transplantation. Each has its advantages and disadvantages and has a different level of impact on patients' physical, psychological and social health, and each places its own limitations on lifestyle.[26] In our study, patients on PD had a higher mortality rate when they were diabetic, but in non-diabetics there was no reliable difference in mortality rate between HD and PD. Thus, in our areas of study, the survival of patients on PD was better than in European areas. In American and Canadian studies, the mortality rates of patients on PD were 38% and 25%, respectively, higher than in patients on HD.[27,28] According to previous European studies, the mortality rate for patients on PD was 25% higher than for those on HD, but recent studies have revealed that the difference has decreased to 5%.[29]

Locatelli et al have reported that after adjustment for age, gender and established cardiovascular disease (CVD), and after stratification by diabetic status, there is no significant difference between treatments in four-year survival.[30] Burton and Walls compared PD and HD in patient and techniques survival; they showed that these two methods were similar.[29] The results of some of these studies, sorted according to their relative risk of death, are shown in Table IV. In contrast to these studies, there are others that show that PD appears to be associated with a higher mortality rate than HD particularly among those with diabetes mellitus, even after controlling for a large number of risk factors.[31] Ganesh et al also showed that among diabetic patients with PD, the unadjusted mortality risk of PD vs. HD varied over time and was significantly higher for PD patients after 24 months of follow-up.[32] These results were similar to our findings. Previous studies from the US Medicare data for ESRD have shown that for younger patients, PD is associated

Table V. Results of outcomes between HD and PD in relation to patient and technique survival.

Reference	Study period (years)	Patient survival (%)		Technique survival (%)	
		PD	HD	PD	HD
Disney (1992)[8]	3	73	57	–	–
Fenton et al (1997)[33]	5	35	36	–	–
Mallick and el Marasi (1999)[66]	10	30	36	–	–
Held et al (1994)[18]	2	78	78.4	–	–
Maiorca and Cancarini (1994)[10]	10	50	50	95	50
Chrytan et al (1986)[65]	2	80	80	70	70

with a lower risk of death than HD.[33-36]

Recently, Collins et al[36] and Vonesh and Moran[35] reported risks in elderly patients on PD compared with HD, particularly in diabetics. The major concern in these outcome analyses, however, was on the lack of comorbidity adjustments in the US data.[25] The results of Termorshuizen et al's study suggest that the long-term use of PD, especially among elderly patients, is associated with an increase in the mortality rate.[37] Collins et al's findings suggest that the elderly population in the USA treated with PD had worse outcomes than their HD counterparts, even after adjusting for basic patient demographics, the comorbidity index and severity of disease with hospitalisation days.[25] Despite this, independent of age, we found that patients on PD had a higher survival rate than HD patients. Results for patients with and without diabetes mellitus were very similar in Winkelmayer et al's study when they did not control for centre effects.[31] However, when the centre effect was considered, they found that the effects of modality selection on mortality among patients with diabetes mellitus were more pronounced but not present for patients free of diabetes mellitus. This is consistent with previous findings demonstrating that patients with diabetes mellitus had higher mortality when on PD than on HD, but the results were different for non-diabetics.[17,18] Interestingly, the results of the Choices for Healthy Outcomes In Caring for End-stage-renal disease (CHOICE) study reported that the risk of death does not differ between patients undergoing PD and those undergoing HD during the first year of dialysis, and that the risk of death with PD is not uniformly distributed among patients with ESRD. In patients with ESRD who had a better case-mix profile and the highest propensity for initially receiving PD, survival did not differ by the type of dialysis. In subgroups, the relative hazard of death with PD vs. HD was somewhat higher among patients with a history of CVD; however, interaction between the dialysis technique and CVD was not statistically significant in all models, so we should interpret these results with caution.[38] In most published studies, usually performed in western regions, the modality of dialysis did not affect patients' survival [5, 9-11, 39-41] Table V shows the results of some of these studies for technique survival. In contrast to these studies, our results showed that technique survival of diabetic patients on HD was better than for those on PD and in non-diabetics, technique survival was similar in both dialysis modalities. Similar results were obtained from US Renal Data System (USRDS) studies.[5] Like our results, Habach et al demonstrated that hospital admission in patients treated with PD was higher than for those treated with HD after adjusting for race, age, gender and cause of ESRD.[42] Long-term studies of Maiorca et al showed that HD technique survival was better than PD.[14]

HD patients undergo dialysis for four hours in a hospital per session of dialysis; that means they are away from their homes approximately three times per week for several hours.[43] This would have a definite effect on their career plans, employment status, financial situation, self-esteem and level of independence. Those undergoing PD need to learn the aseptic technique in order to perform the procedure at home. According to Galpin, PD patients treat themselves four times per day at home.[44] They often worry about the risk of peritonitis, as well as of incurring adverse effects on their physical and psychosocial well-being because of lower levels of contact with healthcare professionals.[45] Finally, dialysing patients' QOL is affected by these factors. In the USA, Evans et al concluded that in-centre HD and PD patients had similar QOL. The importance of controlling for differences in the patient case-mix when comparing patients on different treatment modalities was strongly emphasised by the authors.[46] A prominent topic in the recent literature is the rationale for wider availability of PD as an initiating chronic dialysis method.[47-52] It is argued that the majority of the patients have no contraindication to either HD or PD,[50] but the risk of death is generally lower for PD during the first year or two years of dialysis[52] and the costs of PD are higher than those associated with HD.[48, 51] It is

Table VI. Quality of life instruments to assess the health outcome in comparative studies.

Study	QOL instrument	Dimensions of QOL assessed	Group	No. of patients
Rozembaum et al (1985)[61]	Karnofsky (modified)	Work, physical activity, sleep, sexual activity, self-assessment of QOL.	HHD CHD IPD CAPD	8 208 24 46
Evans et al (1985)[46]	Karnofsky Index of psychological affect (1) Index of overall life satisfaction (2) Index of well-being (1+ 2)	Physical functioning ability to work. Emotional well-being, life satisfaction.	HHD CHD CAPD	287 347 81
Hart and Evans (1987)[4]	Sickness impact profile	Physical and psychosocial function, sleep and rest, eating, work, home management, recreation and pastimes.	HHD CHD CAPD	287 347 81
Soskolne and and De-Nour (1987)[62]	Non-standardised items list Brief symptom inventory Psychosocial, adjustment to physical illness scale	Physical, psychological, social functioning, general well-being, economic, situation, stressors, satisfaction with health.	HHD CAPD CHD	29 34 63
Bihl et al (1988)[63]	Haemodialysis stressors scale, modified Quality of life index Rating scale	Physical, psychological, social function, general well-being, economic situation, stressors, satisfaction with health.	HD CAPD	18 18
Wolcott and Nissenson (1988)[64]	Karnofsky Global adjustment to illness Simmons self-esteem scale Multidimensional health locus of control Modality-specific stress scale General treatment stress scale Global illness stress on self and others Illness coping patterns Dialysis relations quality scale Social support satisfaction scale Social/leisure activities index Dialysis relationship quality Resources and social supports	Sociodemographic and medical status, Physical, psychological, social, cognitive functions, general well-being.	HD CAPD	33 33
Bremer et al (1989)[3]	Objective measures, not standardised Positive and negative affect scales Affect balance scale Index of general affect Index of well-being Two seven-point adjective pairs Seven-point scales of satisfaction of life Scale of control and scale of sexual performance	Physical, psychological, social, cognitive functions, general well-being, economic self-control, sexual performance.	HHD CHD CHD CAPD	47 105 41 79

QOL: quality of life; HHD: hypertensive heart disease; CHD: coronary heart disease; CAPD: continuous ambulatory peritoneal dialysis.

also suggested that no large differences in QOL have been found between patients starting HD or PD.[50] Despite these findings, we achieved the same results when patients of both groups were matched and had more than a two-year history of dialysis.

Surprisingly, in contrast to Evans et al's and our studies, in a randomised trial of 38 patients starting HD and PD in the period 1997–2000, Korevaar et al in the Netherlands found a small difference in patients' quality-adjusted life year (QALY) scores in the first two years of dialysis, and this difference favoured HD over PD.[53] The CHOICE study of incident patients in the USA during the period 1995–1998 concluded that patients on HD and PD generally had similar health status after the first year but had different assessments of several dimensions of disease-specific QOL.[54] It is important to consider the differences among patients carefully when treatment outcomes are analysed. It is difficult for case-mix adjustments to account adequately for these differences in analysing patients' outcome in relation to the use of HD and PD because patients are differentially selected for renal replacement therapy[55] and we tried to solve this problem. The ideal desired study would be a randomised clinical trial in this field. Korevaar et al attempted the only clinical trial in which patients were randomly assigned to HD and PD, but they were not able to recruit enough patients for an adequately powered study, and noted that after extensive patient education, many patients are likely to develop a preference for a particular modality, making random assignment difficult.[53] Observational studies such as ours therefore remain the primary source of information about patient outcomes associated with HD or PD. Keshaviah et al demonstrated that when the dialysis dose is matched, HD and PD provide comparable two-year survival rates, independent of age, diabetic status and history of CVD,[56] but our patients were

dialysed for more than two years and it was a critical point to include.

The GHQ-28 results obtained from previous studies suggest that patients on PD have a better QOL than patients on HD. Only a few studies found statistically significant differences between groups, and studies in only seven centres were adjusted for patient differences.[57] All these results should be considered with some caution. These studies were cross-sectional in design. This means that comparison was made at one point in time so that the QOL refers to a particular moment and does not permit comparisons of outcomes over time.[58] Longitudinal studies could show how QOL is subject to variation over time, due to ageing, development of complications or changes in comorbidity, or due to the patient's adjustment to his situation. In other studies, PD has an acceptable QOL. In our study, we assessed dimensions of QOL like psychophysical dysfunction, stress and sleep disorders, social dysfunction and major depression. We used a questionnaire for all patients. Studies should be conducted using a specific questionnaire targeting kidney-specific problems and all aspects of patients' lives, not dysfunction-producing conditions. With advanced methods, it seems that PD may be as effective as HD, or better. Remarkable differences are seen between different areas, diabetic and non-diabetic, elderly and young patients.[59] Retrospective studies have revealed that after eight years, a few patients were still on PD. This is because of unique problems associated with PD such as peritonitis, catheter-related problems, insufficient dialysis and psychosocial problems which require a switch to HD.[58] Perhaps longitudinal studies with a long period of follow-up of patients on both modalities may provide different results.

In previous studies, many parameters were evaluated, such as patient survival, technique survival and QOL. Clearly, many different factors other than medical ones, such as physical bias, facilities and financial reimbursement, were involved in the selection of renal replacement therapy.[39-41] Thus, there may be many biases in these studies.[11] Patients' medical and social factors are important in the selection of a dialysis method, so in comparison with HD, a large number of studies showed that they are not helpful enough in the selection of suitable therapeutic methods.[60] Patient and technique survival on PD were better than on HD for non-diabetic patients, but were better in diabetics who were on HD. There are many limitations in terms of equipment, the number of professional personnel and hospital spaces, so PD may be a suitable renal replacement modality in our region and perhaps in other developing countries. In our regional study, it was seen that QOL on PD was better, but such studies have not been performed in various areas in Iran and the results may be different because of the involvement of many factors such as geographical, socioeconomic and cultural factors. We suggest that longitudinal studies would provide more accurate information on the effects of both therapeutic modalities.

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