

Hospitalizations in Patients Treated Sequentially by Chronic Hemodialysis and Continuous Peritoneal Dialysis

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It is not established whether hospitalizations are more frequent or longer in patients on peritoneal dialysis (PD) or chronic in-center hemodialysis (HD). Comorbidity is a major factor affecting the comparison of hospitalizations. To account for comorbidity, we compared hospitalizations between the PD and HD periods in 16 patients, 8 of whom were treated by PD first (group A), and 8, by HD first (group B).

In group A, causes of renal failure were diabetes (n = 3), primary renal disease (n = 2), systemic disease (n = 2), and hereditary nephropathy (n = 1). Age at onset of PD was 53 ± 11 years; duration of PD, 31 ± 17 months; and duration of HD, 40 ± 33 months. This group had 52 hospitalizations in the PD period and 80 hospitalizations in the HD period. Hospitalization rate (n/patient-year) was 2.5 ± 2.0 during PD and 3.0 ± 3.0 during HD (nonsignificant), and duration of hospitalization (days/patient-year) was 19.6 ± 15.5 during PD and 21.9 ± 17.7 during HD (nonsignificant). The three most common causes of hospitalization were peritonitis (27%), other infections (21%), and cardiovascular disease (14%) in the PD period, and HD access problems

(35%), infections (16%), and cardiovascular disease (12%) in the HD period.

In group B, causes of renal failure were diabetes (n = 4), primary renal disease (n = 3), and hypertension (n = 1). Age at onset of HD was 56 ± 10 years; duration of HD, 41 ± 19 months; and duration of PD, 60 ± 24 months. This group had 82 hospitalizations in the HD period and 76 hospitalizations in the PD period. Hospitalization rate was 3.0 ± 2.4 during HD and 1.9 ± 2.8 during PD (nonsignificant), and duration of hospitalization was 17.3 ± 25.1 during HD and 12.7 ± 21.3 during PD (nonsignificant). The three most common causes of hospitalization were HD access problems (40%), cardiovascular disease (19%), and infections (12%) in the HD period, and other infections (36%), cardiovascular disease (19%), and peritonitis (21%) in the PD period.

In patients changing dialysis modalities, rate and duration of hospitalizations did not vary between HD and PD. The causes of hospitalization were similar in the HD and PD periods regardless of which modality was applied first.

Key words

Morbidity, hospitalization, hemodialysis

Introduction

Hospitalizations are a major indicator of morbidity for patients with end-stage renal disease treated with chronic hemodialysis (HD) or peritoneal dialysis (PD). Early calculations produced an all-cause duration of hospitalization of 19.4 days per patient-year for patients on continuous ambulatory PD (CAPD) and 20.8 days per patient-year for patients on continuous cycling PD (CCPD). Meanwhile, the causes of hospitalization directly attributable to

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CAPD and CCPD complications accounted for 7.7 days and 8.3 days respectively (1).

Comparisons of rates of hospitalization between patients on in-center HD and on PD have produced variable results. Early studies reported higher rates of hospitalization for PD (2). Subsequent analyses showed that the rate of hospitalization decreased in PD patients, approaching the rate in HD patients (3). Improvement in peritonitis rates had a major influence on improvement in hospitalizations among PD patients (4).

Hospitalizations in dialysis patients are greatly affected by the presence and severity of comorbidities (4–6). Attempts to account for the effects of comorbidity on the rate of hospitalization have been undertaken in comparisons between HD and PD (7,8). However, the comparisons of hospitalization rates in those studies were influenced both by differences in the severity of the various comorbidities accounted for and by the comorbidities not accounted for. To correct for this effect of comorbidities, we compared hospitalizations between the HD and PD periods in the same patients treated sequentially by sustained courses of HD and PD.

Patients and methods

We performed a retrospective analysis of incident chronic dialysis patients followed in one institution (Raymond G. Murphy VA Medical Center) between 1994 and 2005 (inclusive) and treated sequentially by PD and HD. Patients were included if the uninterrupted follow-up in either the HD or the PD period was at least 6 months. For eligible patients, we reviewed the computerized records for cause and duration of hospitalization. In addition, we collected the following information: age of the patients at first dialysis, cause of renal failure, dialysis modality applied first, duration of the HD and PD periods, and reason for the change in dialysis modality. The follow-up lasted until the patient's death, transplantation, or December 31, 2008.

Annual hospitalization rate in each dialysis period was computed as the number of hospitalizations per patient–year, and annual duration of hospitalization was computed as the number of days per patient–year. Annual rate of hospitalization, duration of hospitalization, and duration of the HD and PD periods (presented as mean \pm standard deviation) were compared between the HD and the PD periods separately

in patients treated first with PD and in those treated first with HD. Comparisons used the two-tailed paired *t*-test and the Wilcoxon signed rank test. The statistical significance of these two different methods of comparison was the same in each comparison.

Results

A total of 16 patients, all men, fulfilled the inclusion criteria and were analyzed for this report. By coincidence, 8 patients were treated with PD first (group A), and the other 8 patients were treated with HD first (group B). The HD was performed 3 times weekly, with each HD session lasting 3.5–4.5 hours. The Kt/V urea in all HD patients was monitored monthly and was below the minimal target of 1.2 (single pool) most of the time in 6 patients of group B with continual HD access problems. In the PD period, 11 subjects were treated with CAPD, and 5, with CCPD. Adequacy indices (creatinine clearance and Kt/V urea) were monitored every 4 months during the PD period and were within the target range (weekly Kt/V urea \geq 2.0) in all patients, including a man who developed frank uremic manifestations (pericarditis) attributed to poor compliance with the dialysis prescription. This patient changed dialysis modality after an episode of severe pancreatitis.

Table I shows the causes of end-stage renal disease, the reasons for changing the dialysis modality, age at first dialysis, duration of the first and second modalities, and total number of admissions per modality. In group A, all 5 patients with “access failure” changed dialysis modality because of persistent or recurrent peritonitis. Vascular access failure, including repeated clotting with exhaustion of access sites or complicated bacteremias (or both), accounted for the change in dialysis modality in 6 of the 8 patients in group B.

Table II shows hospitalizations in the study group. There were no differences between the first and second modality periods in hospitalization rate, overall hospitalization duration, and duration of hospitalization because of complications with the modality used. Complications with the modality used at the time were the most frequent cause of hospitalization in both dialysis periods for group A and in the HD (first modality) period for group B. Both the rate and the duration of hospitalization did not differ between the HD and PD periods in either group. Hospitalizations for cardiac causes and non-modality-related (“other”)

TABLE I Patient characteristics

| Characteristic | Group A (PD first) | Group B (HD first) |
|---------------------------------------|-----------------------|-----------------------|
| Cause of ESRD | | |
| Diabetic nephropathy | 3 | 4 |
| Primary renal disease | 2 | 3 |
| Systemic illness | 2 | 0 |
| Hypertension | 0 | 1 |
| Hereditary illness | 1 | 0 |
| Reason for changing dialysis modality | | |
| Access failure/peritonitis | 5 | 6 |
| Patient choice | 1 | 2 |
| Ultrafiltration failure | 1 | 0 |
| Pancreatitis | 1 | 0 |
| Age at first dialysis (years) | 53±11 | 56±10 |
| Duration of modality 1 (months) | 31±17 | 41±19 |
| Duration of modality 2 (months) | 40±33 | 61±18 |
| Admissions, modality 1 (n) | 52 | 82 |
| Admissions, modality 2 (n) | 80 | 76 |

PD = peritoneal dialysis; HD = hemodialysis; ESRD = end-stage renal disease.

infections were also frequent. Pneumonias and urinary tract infections were frequent causes of infection. Hospitalizations for cerebrovascular accidents, extremity gangrene, and ischemic bowel were grouped together under peripheral vascular causes. The most frequent hospitalizations under the “miscellaneous other” category were for surgery, psychiatric illness, and gastrointestinal bleeding.

Discussion and conclusions

The main findings of this study are that the rate and duration of hospitalizations did not differ between the PD and HD periods in 16 patients treated sequentially by HD and PD regardless of the dialysis modality applied first, and that complications directly attributable to the dialysis modality accounted for most of the hospital admissions while the patient was on that modality (Table II).

Comparisons of the rate of hospitalization between patients on PD and on in-center HD have produced varying results. Early single-center studies reported higher rates of hospitalization in PD patients (2); later single-center studies reported equal rates of hospitalization between the two dialysis modalities (9). Computations of the rate of hospitalizations from registry data show conflicting findings. A very large retrospective study from the United States Renal Data System (USRDS) registry reported a higher risk of

TABLE II Hospitalizations

| Characteristic | Group A (PD first) | Group B (HD first) |
|------------------------------------|-----------------------|-----------------------|
| Rate (n/pt-yr) | | |
| Modality 1 | 2.5±2.0 | 3.0±2.4 |
| Modality 2 | 3.0±3.0 | 1.9±2.8 |
| p Value | NS | NS |
| Duration (days/pt-yr) | | |
| Modality 1 | 19.6±15.5 | 17.3±25.1 |
| Modality 2 | 21.9±17.7 | 12.7±21.3 |
| p Value | NS | NS |
| Modality complication (days/pt-yr) | | |
| Modality 1 | 8.1±6.7 | 10.2±16.4 |
| Modality 2 | 9.3±10.1 | 5.6±14.2 |
| p Value | NS | NS |
| Cause [n (%)] | | |
| Modality related | Modality 1 14 (27) | 33 (40) |
| Modality 2 | 28 (35) | 16 (21) |
| Other infections | Modality 1 11 (21) | 10 (12) |
| Modality 2 | 13 (16) | 27 (36) |
| Cardiac | Modality 1 7 (14) | 15 (19) |
| Modality 2 | 9 (12) | 19 (25) |
| Peripheral vascular | Modality 1 6 (11) | 5 (6) |
| Modality 2 | 7 (8) | 6 (8) |
| Other | Modality 1 14 (27) | 19 (23) |
| Modality 2 | 23 (28) | 8 (10) |

PD = peritoneal dialysis; HD = hemodialysis; pt-yr = patient-year.

hospitalization for PD patients (7), and a smaller prospective study from Canada found that the method of analysis affected the results. The relative risk of hospitalization for PD patients was lower than that for HD patients if the analysis was based on intent to treat, and higher than that for HD patients if the analysis was based on actual time spent on each modality (8).

Two single-center reports addressed issues that are relevant to the patients presented here. One report suggested that different types of PD are associated with different hospitalization rates (10). In our study, 11 patients were treated by CAPD and 5 by CCPD with additional daytime exchanges. Another study on PD patients reported higher rates of hospitalization in men than in women, and in diabetic patients than in nondiabetic patients (11). All of our patients were men and 7 of the 16 had diabetes.

Finally, we found two other reports of hospitalizations in PD patients treated sequentially with PD and HD, one with 13 subjects (12) and one with 20 subjects (13). All patients in the second report (13)

were dialyzed by HD first. The rate of hospitalizations did not differ between the PD period and the HD period in either study.

The two important limitations of our study are the small number of patients and the change in dialysis modality in a preponderance of the patients because of morbidity. The small number of observations could have allowed type 2 statistical errors to occur. The high morbidity during the first dialysis period could have led to the relatively high rate and duration of hospitalizations in both dialysis periods. A definitive answer to the question of whether the rate and the duration of hospitalizations differ between PD and HD can be provided only by a prospective multicenter study of patients who change modality through personal choice, with approximately half the patients on PD first and the other half on HD first.

Finally, another dialysis modality that should be compared with PD for rates of hospitalizations is home HD. So far, the relatively small studies published have reported lower rates of hospitalization for home HD (14–16). Comparison of home dialysis modalities is another area in which further studies are needed.

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