Examination of Survival After Transfer from Peritoneal Dialysis to Hemodialysis

Data on survival after transfer from peritoneal dialysis (PD) to hemodialysis (HD) is conflicting. We reviewed two decades of outcomes in a PD program to examine short-term survival after transfer from PD to HD. Of 379 patients on PD, 33% transferred to HD. The reasons for transfer were PD-related infections (34%), uremia or failure to thrive (26%), PD catheter problems or loss of mechanical skills (15%), dementia or unable to train (7%), noncompliant with PD (7%), other (10%, including gastrointestinal complications, hernia, encapsulating peritoneal sclerosis, preference, loss of ultrafiltration), and cardiac (2%). All of those transferring for “other” reasons survived 6 months, and as did all except 1 who transferred for uremia ($p = 0.035$). Overall survival was 92% at 3 months and 85% at 6 months. Using multivariate logistic regression analysis, only score on the Charlson comorbidity index at PD start was a risk factor for dying in the first 6 months on HD: for each 1 point increase in CCI score, the hazard ratio for death was 1.4 (95% confidence interval: 1.16 to 1.74; $p = 0.005$).

To summarize, starting a patient on PD and waiting until uremia to transfer to HD does not have a negative impact on survival. In a program with relatively low PD-related infectious complications, such complications accounted for only one third of transfers to HD.

Key words
Hemodialysis, transfer, mortality, peritonitis

Introduction
Data on the survival of peritoneal dialysis (PD) patients who require transfer to hemodialysis (HD) are conflicting (1–3). Van Biesen et al. (1) found that transfer of PD patients to HD, referred to by the authors as an “integrative care approach,” was associated with improved survival not only in contrast to survival in patients who remained on PD, but also in contrast to those who had started on HD and remained on HD. Those results were attributed at least in part to better preservation of residual kidney function with PD as opposed to HD (1). Contrasting with that earlier study, Szeto et al. (2) from Hong Kong found that 61% of the 197 patients transferring from PD to HD died after transfer, a mortality twice as high as that for the 30% of patients who started on HD and stayed on HD. Most of the deaths occurred in the first 6 months after transfer. Those apparently conflicting results may be attributable to many factors. Because “PD First” is the national policy in Hong Kong, transfer to HD may be delayed. Whether the transfer is semi-elective and planned (for uremia, for example) or urgent (for intractable peritonitis) may make a difference as well.

We retrospectively examined two decades of prospectively collected data in a dialysis registry to evaluate reasons for transfer and survival at 3 and 6 months after transfer.

Methods
Data were collected prospectively as part of an institutional research board–approved PD registry. All patients who provided informed consent for participation in the registry (only 2 patients refused during the period of the study) and who transferred from PD to HD between January 1, 1991, and December 31, 2010, were included in the cohort. Data collected at the start of PD included a Charlson comorbidity index (CCI) score (4), serum albumin, sex, race (African American versus all others), age, and presence of diabetes mellitus. During the course of dialysis, all information on dialysis-related infections was gathered and entered into a computer database. The reason for transfer from PD to HD was recorded. Follow-up after transfer to HD was continued when possible. The examined outcomes were survival on HD at 3 and 6 months.
We used the chi-square test to examine, by transfer reason, the number of surviving patients at 3 months and at 6 months. Multivariate logistic regression analysis was used to examine associations with mortality. Several models for mortality were examined at 3 months and at 6 months. One used CCI score (which assigns 1 point for each decade over 40 years of age, and 2 points for diabetes and other comorbid conditions with dialysis), race, sex, and reason for transfer. Another used diabetes, age, race, sex, and reason for transfer. A $p$ value less than 0.05 was considered significant. All analyses were carried out using the Stata software application (version 7.0: StataCorp LP, College Station, TX, U.S.A.).

Results

The 379 PD patients in the program over the two decades constituted 560.7 years at risk on PD. During that time, 230 exit-site infections (0.4 episodes per year), 4 exit-site infections combined with tunnel infections (0.007 episodes per year), 25 tunnel infections (0.04 episodes per year at risk) without exit-site infection, and 222 peritonitis episodes (0.40 episodes per year) occurred. During the period of interest, 126 patients (33.2%) transferred to HD, and of those, 120 had known outcomes for 6 months and were included in the analysis. Table I shows demographics for the 120 patients with known outcomes who transferred to HD.

Table II shows the reasons for transfer to HD. Approximately one third of the patients transferred because of PD-related infections (primarily peritonitis). The next most common cause was uremia or failure to thrive. Another 40% transferred for a variety of other causes.

Overall, the 3- and 6-month survivals after transfer to HD were 92% and 85% respectively, but varied by cause. Of the 2 patients who transferred for cardiac reasons, both had died by 6 months, but only 1 patient who transferred because of uremia or failure to thrive died in the first 6 months, and all of the patients transferring for “other causes” were alive at 6 months (Table III).

Using multivariate analysis, only the CCI score (which combines age and comorbidity, including diabetes) obtained at the start of PD was an independent risk factor for dying after transfer to HD. Each increase of 1 point in CCI score was associated with a hazard ratio (HR) for death of 1.49 (95% confidence interval: 1.14 to 1.94; $p = 0.003$) at 3 months, and of 1.4 (95% confidence interval: 1.16 to 1.74; $p = 0.005$) at 6 months.

Discussion

Peritoneal dialysis–related infections accounted for only 34% of the transfers to HD in our cohort. That proportion was lower than has been reported in other papers in the literature: Van Biesen et al. found that 50% of the transfers from PD to HD were attributable...
Survival After Transfer from PD to HD

to PD-related infections, and Szeto et al. reported that 71% of transfers were attributable to peritonitis and catheter removal (1,2). The total proportion of patients transferring from PD to HD was higher in our program, at 33% of those on PD, which contrasts with 16% (32 of 194) in the Van Biesen study and 14% (197 of 1402) in the Szeto et al. report (1,2).

In our program, patients are therefore more likely to transfer to HD, but less likely to do so because of infection-related complications, for which we have rather low rates. We feel that this approach is consistent with the integrated care approach proposed by Van Biesen et al., who found the best survival for those who started on PD and transferred to HD, compared with those who remained on PD (especially past 48 months) and those who started on HD and stayed on HD (1). A recent review pointed out the many advantages of such a “PD First” approach, including preservation of residual kidney function and vascular access sites, an early survival advantage for a start on PD for many subgroups, falling peritonitis rates on PD in contrast to rising bacterial episodes in HD, improved patient satisfaction and convenience on PD, and cost savings of approximately $20,000 per year for PD compared with HD (5).

We note that 6-month post-transfer survival was excellent (98%) for PD patients who switched for reasons such as uremia, failure to thrive, ultrafiltration failure, gastrointestinal complications, preference, hernia, and encapsulating peritoneal sclerosis. Most of these reasons could be deemed semi-elective transfers. In contrast, 6-month survival was only 80% for those who transferred because of PD-related infections, which represent more urgent transfers and, possibly, sicker patients. Notably, a recent paper examining outcomes of PD patients admitted to an intensive care unit (9.6% of 990 patients on PD) found that two thirds of the patients had peritonitis, 10% died in the ICU, and another 32% died in the subsequent 6 months (6). Of those patients, 50% had a cardiac diagnosis. We earlier found that peritonitis frequency is a risk for death, because those in the highest quartile for peritonitis rate (≥1.25 episodes per year at risk) had much worse survival compared with other patients; cardiovascular deaths were common (7). Peritonitis may represent an inflammatory stimulus that subsequently contributes to a cardiac event.

We found that the only significant risk factor for death after transfer to HD was the CCI score (which includes diabetes and age in the calculation) at the start of PD. That score has previously been well demonstrated to be an important risk factor for death in PD patients, bearing a HR of 1.54 for each 1-point increase in CCI score (4). It is therefore not surprising that it also predicts death after transfer to HD. The HR of 1.54 for death on PD is very similar to the HR of 1.4 for each 1-point increase in CCI score measured at the start of PD, for risk of death 6 months after transfer. The CCI score measured at the start of PD correlates strongly with subsequent CCI scores measured later on during dialysis, and so we feel that it is an accurate reflection of comorbidity (8).

The strengths of the present work include its grounding in careful prospective data collection over many years, including data on infectious complications and reasons for transfer to HD. Its weakness is that it is a report from a single center with a limited number of patients transferring. To further evaluate mortality after transfer to HD from PD by reason for transfer, we feel that an analysis of a large database (such as that maintained by the Australia and New Zealand group) might shed more light on the issue of optimal transfer time.

**Conclusions**

We found that, during a two decades’ experience, one third of our PD patients transferred to HD. Although
PD-related infections were the most common cause for transfer, such transfers were less frequent than had been indicated in other reports in the literature, either because of a ready propensity to transfer to HD, consistent with an integrated care approach that we also use, or because of our relatively low rate of PD-related infectious complications, or both. Mortality varied with the reason for transfer, although the small number of transferees in the present study precluded significant power for an analysis. Not surprisingly, comorbidity measured at the start of PD was a very strong predictor of death after transfer to HD.

Disclosures
The authors have no financial conflicts of interest to declare.

References

Corresponding author:
A. Elizabeth Wyman, University of Pittsburgh School of Medicine, 518 Scaife Hall, Pittsburgh, Pennsylvania 15261 U.S.A.

E-mail:
wyman.anne@medstudent.pitt.edu