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## Timely Transfer of Peritoneal Dialysis Patients to Hemodialysis Improves Survival Rates

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### Introduction

Many renal units offer both hemodialysis (HD) and peritoneal dialysis (PD) as treatment modalities for patients with end stage renal disease (ESRD). In those centers, the choice between both modalities is influenced by a number of medical and non-medical factors. The expected patient survival is one of the major medical factors. The two main renal replacement therapies (RRT) - hemodialysis (HD) and peritoneal dialysis (PD) - have been considered to be antagonistic in most published studies on the clinical outcomes of dialysis patients (1-4). There are many reasons why conflicting results have appeared from both single center and multicenter studies (5). Currently no consensus exists regarding which modality, - PD or HD - offers patients the best chance for survival (4). Recently it has been suggested that the complementary use of both modalities as an integrated care (IC) strategy might improve the survival of end-stage renal disease (ESRD) patients (6, 7). This approach is based on the idea that PD has benefits as an initial dialysis modality for ESRD patients, which is then followed by timely transfer to HD when PD-related complications occur (8, 9). This study aimed to estimate the final clinical outcome of PD patients when they transfer to HD because of complications related to PD.

### Patients and methods

We retrospectively analyzed data from patients who started RRT at our Division of Nephrology during the period 1990-2000, and who survived more than 3 months on their initial modality. A total of 299 patients was included in this study, of whom 134 patients were started on PD and remained in PD (PD group, age  $64 \pm 11$  years, mean  $\pm$  SD), 132 patients were started on HD and continued in HD (HD group, age  $48 \pm 16$  years), and 33 patients started in PD and transferred to HD (IC group, mean age  $55 \pm 15$  years). HD patients who transferred to PD and patients who transferred twice or more between dialysis modalities were not included in this study.

Five-year survival rates were computed by Kaplan-Maier analysis (unadjusted) and Cox regression analysis to correct

for the presence of comorbid factors (adjusted). Survival was calculated as "intention-to-treat survival", whereby death is considered as a final event and patients are censored at the moment of transplantation, for loss of follow-up, or at the end of the 5-year observation period. Comparison of survivals between groups was analyzed with a log-rank test. The comorbid factors that were included in Cox regression analysis, are: age, gender, presence of diabetes mellitus and/or cardiovascular disease, serum hemoglobin, albumin, and creatinine levels, and hypertension (systolic and diastolic arterial pressures). Demographic data and comorbid factors were also analyzed by one-way ANOVA for continuous variables and with chi-square test for dichotomous variables; p values less than 0.05 were considered significant. In tables, data are presented as mean  $\pm$  SD.

### Results

The demographic data and the comorbid factors of the patients in each of the three groups are shown in Table 1. The IC patients were older than HD patients ( $p=0.015$ ) and younger than PD patients ( $p=0.001$ ). There were no significant differences in gender or in the presence of diabetes mellitus and cardiovascular disease. The IC patients exhibited a lower hemoglobin level than PD and HD patients [ $9.3 \pm 1$  vs  $10 \pm 1.3$  g/dL ( $93 \pm 10$  vs  $100 \pm 13$  g/L),  $p=0.01$ ; and  $9.3 \pm 1$  vs  $10 \pm 1.3$  g/dl ( $93 \pm 10$  vs  $100 \pm 13$  g/dL),  $p=0.005$ ; respectively]. The plasma albumin level was significantly higher in IC patients than in PD patients [ $4.3 \pm 0.3$  vs  $3.8 \pm 0.5$  g/dl ( $43 \pm 3$  vs  $38 \pm 5$  g/L),  $p<0.001$ ] but was not different from that in HD patients [ $4.3 \pm 0.3$  vs  $4.4 \pm 0.3$  ( $43 \pm 3$  vs  $44 \pm 3$  g/L),  $p=0.27$ ]. Arterial pressure was significantly higher in IC patients than in PD and HD patients.

The reasons for transfer from PD to HD were peritonitis (61%), ultrafiltration problems (27%), sclerosis (9%), and social problems (3%). The mean PD duration of IC patients was  $36 \pm 16$  months (median 34 months).

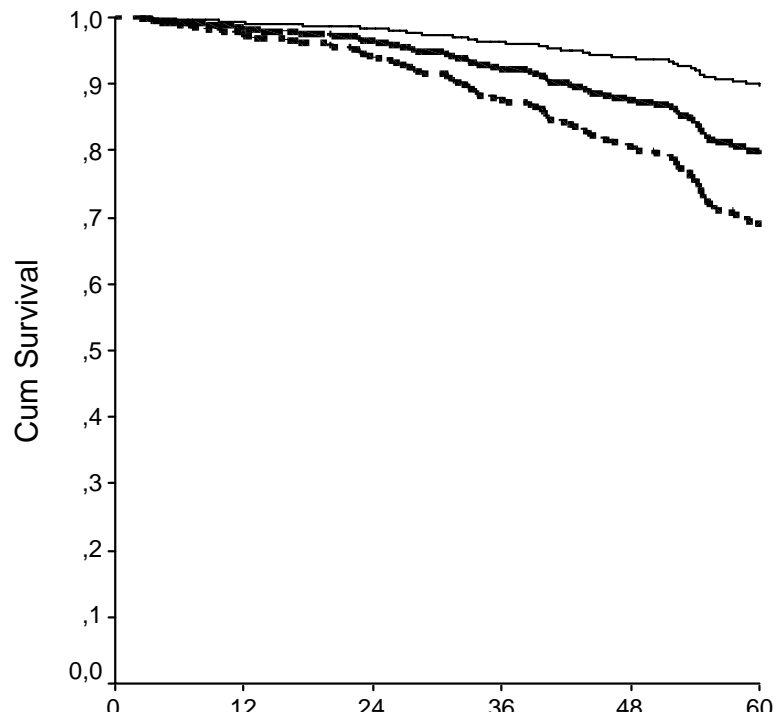
The Kaplan-Maier survival analysis showed that the 5-year survival rate was significantly higher in IC patients than in PD patients (log-rank,  $p<0.00001$ ) but was not different

**Table 1. Demographic data and comorbid factors**

Parameters	PD	HD	Transfer PD to HD	p Value (PD vs Transfer)	p Value (HD vs Transfer)
N (patients)	134	132	33		
Age (year)	64±11	48 ±16	55 ±15	0.001	0.015
Sex (M/F)	73/61	84/48	20/13	NS	NS
Diabetes (Y/N)	101/33	124/8	28/5	NS	NS
Cardiovascular dis (Y/N)	68/66	86/46	16/17	NS	NS
Hemoglobin (g/dl)	10±1,3	10±1,3	9,3±1	0.010	0.005
Albumin (g/dl)	3,8 ±0,5	4,4±0,3	4,3±0,3	<0.001	NS
Creatinine (mg/dl)	8±2.4	9.7±2	10.2±2.4	<0.001	NS
Systolic AP (mmHg)	145 ±24	137 ±16	137 ±19	0.026	NS
Diastolic AP (mmHg)	82 ±8	70 ±9	70 ±10	<0.001	NS

NOTE. To convert hemoglobin in g/dL to g/L, multiply by 10; albumin in g/dL to g/L, multiply by 10; serum creatinine in mg/dL to µmol/L, multiply by 88.4.

**Figure 1. Cox-regression survival analysis. Solid line, patients started on PD and transferred to HD; dashed line, HD patients; dotted line, PD patients.**



from that in HD patients. Three - and five-year survival rates in the IC, PD, and HD groups were 97% and 81%, 54% and 28%, and 92% and 83%, respectively.

When survival was adjusted for comorbid factors the differences in survival rates between the groups became smaller, but they did not disappear (Figure 1). The mortality risk -

relative to PD patients - for the IC patients and for the HD patients was 0.290 ( $p=0.011$ ) and 0.612 ( $p=0.248$ ), respectively. Others important risk factors were presence of diabetes mellitus ( $RR=1.934$ ,  $p=0.019$ ), presence of cardiovascular disease ( $RR=1.731$ ,  $p=0.019$ ), age ( $RR=1.045$ ,  $p=0.001$ ), hemoglobin level ( $RR=0.787$ ,  $p=0.016$ ), and serum albumin level ( $RR=0.476$ ,  $p=0.015$ ).

### Discussion

Two decades after its introduction, PD is now a well established alternative to HD as a RRT. The literature contains much debate on HD and PD as antagonistic modalities (1-4, 10). Studies comparing survival have shown either the superiority of PD, or HD, or that the two techniques are equivalent. Two clear phases appear in the survival curves: in the first, the residual renal function (RRF) gives PD an advantage, or at least places it at the same level as HD; in the second phase, the reduction in KT/V as RRF declines associates PD with a potential risk (5). The results of the present retrospective study show that patients who started on PD and were subsequently transferred to HD had a higher survival rate than the patients who remained in PD. Similar conclusions have been reported by Van Biesen et al (6, 7, 11). The causes for transferring patients from PD to HD were related to complications of the method of RRT, with peritonitis being the most important in other similar proportional studies (6). According, the Kaplan-Meier analysis revealing that IC patients had higher survival rates than PD patients might be due to the IC patients being younger and having a better nutritional status, as demonstrated by the significantly higher level of serum albumin. It is well known that age and serum albumin level are the main comorbid factors for the survival for patients in RRT (12), as we can also see from this study with Cox regression analysis. But even when survival was adjusted for these factors the differences in survival rates did not disappear.

Using the combination of the two modalities of RRT, starting with PD, has been termed "integrated dialysis care" and has many supporters in recently literature (8, 9, 13-16). There are many theoretical arguments why it is attractive to start patients on PD, and where necessary, to transfer them to HD. First, is well established that PD preserves RRF longer than HD and that this RRF is necessary for obtaining adequate clearances (17). Second, vascular access can become problematic in long-term HD patients, and hence an initial spell of PD can postpone the need for the creation of an arteriovenous fistula. Third, graft function immediately after transplantation is better in PD patients than in HD patients (18). Finally, the risk of hepatitis B and C infection is lower in PD patients than in HD patients (19). Studies have shown that patients on PD have a higher survival rate during the first 6 years of RRT. Collins et al. showed that the survival rate during the first 2 years of dialysis was superior in non diabetic and in young diabetic PD patients (4). Fenton et al. used data from the Canadian Organ Replacement Register to show that the survival advantage for PD is lost after 2 - 3 years (2). The reason for survival during the first 1-3 years of PD is unclear, but retention of RRF is the most

likely reason. Canaud and Mion advocate transferring patients from PD to HD as soon as PD related complications arise (20).

**In conclusion**, we believe that dialysis centers should establish integrated PD/HD programs since the two methods are not competitive but rather are different tools for the treatment and rehabilitation of uremic patients. Our results show that the IC of dialysis patients undergoing RRT improves the survival rates of patients on PD if they are transferred to HD at the appearance of PD related complications.

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