Clinical Outcome After Transfer from Peritoneal Dialysis to Hemodialysis

Guidelines for the clinical care and management of intra-abdominal complications in patients transferred from peritoneal dialysis (PD) to hemodialysis (HD) are not well established. In this study, we analyzed the indications for transfer, presence of abdominal complications, and clinical outcome on HD of 26 patients who were followed up between 1996 and 2004. Laboratory and radiology data for the patients (computerized tomographic and ultrasonographic examinations performed during the transfer and annually thereafter) were collected retrospectively. The indications for transfer from PD to HD were peritonitis (19%), mechanical problems (39%), and ultrafiltration failure (42%). At the time of transfer, 11 patients had no intra-abdominal complications, 8 had intra-abdominal loculated fluid collection, and 7 had intra-abdominal free fluid. One year after transfer, intra-abdominal fluid collection was observed in 6 patients, 3 of whom received percutaneous drainage. Patients who had intra-abdominal complications at the time of transfer exhibited significantly lower albumin (p < 0.01), higher levels of C-reactive protein (p < 0.02), and erythropoietin resistance at the time of transfer (p < 0.0001). During the first year after transfer, we observed a tendency toward an increase in albumin and a decrease in C-reactive protein level in the group that had complications, and yet nutritional interventions were still necessary in that group.

A high ratio of intra-abdominal problems, which have adverse nutritional and inflammatory impacts, are seen after patients are transferred from peritoneal dialysis.

Key words
Intra-abdominal complications, hemodialysis (HD)

Introduction
Hemodialysis (HD) and peritoneal dialysis (PD) are two distinct renal replacement modalities, and each has its own advantages and disadvantages (1). Better preservation of residual renal function, lower risk of infection with hepatitis B and C, better outcome after transplantation, preservation of vascular access, and lower costs are arguments for promoting PD as a preferred initial treatment (2–4).

In the first 5 years of dialysis therapy, there is no difference in patient survival between PD and HD. However the PD drop-out rate attributable to technique problems is rather high and only a limited number of patients remain on PD for more than 5 years (2). Few data are available in the literature concerning patient outcome after transfer from PD to HD, and knowledge about the management of PD-related complications after transfer is rather limited (5).

Lack of specific information about the rate and consequences of intra-abdominal complications in transferred patients mean that clinical care guidelines and management protocols are not well established. In this study, we aimed to identify risk factors that influence the clinical outcome of patients during the first year after transfer from PD to HD. We looked at indications for transfer, presence of intra-abdominal complications, and medical and interventional treatment delivered in these patients.

Patients and methods
Our study included 26 patients (14 men, 12 women) who had been followed for at least 6 months on PD and who, between 1996 and 2004, were being transferred to HD at our institution.

Follow-up data were recorded during last year on PD before transfer to HD, at the time of transfer, and during the first year after transfer from PD to HD. We collected peritoneal fluid evaluation results and demographic, laboratory, and radiology data retrospectively. Demographic data included age, sex, and cause
of end-stage renal disease. We retrieved laboratory data [whole blood count, urea, creatinine, calcium, phosphorus, uric acid, C-reactive protein (CRP), parathyroid hormone (PTH), serum iron, ferritin] and weekly erythropoietin (EPO) requirement from patient records. Nutrition data for all patients were retrieved from records, and administration of enteral or parenteral nutritional support was recorded.

As a part of our follow-up protocol, biochemical and microbiologic evaluation of peritoneal fluid is performed in each patient before transfer from PD to HD. All patients undergo abdominal ultrasonography at the time of transfer to HD. If ultrasonography detects intra-abdominal complications (intra-abdominal loculated fluid collection, free fluid, or peritoneal thickening), findings are confirmed with abdominal computed tomography.

Because of the possibility of infection or pressure to vital organs, our protocol requires percutaneous drainage in patients with intra-abdominal loculated fluid collection or ascites. A history of the percutaneous drainage is collected for each patient.

Serum albumin levels were measured by the quantitative colorimetric method. A colorimetric method was used to measure serum calcium and phosphorus levels (Synchron CX-7 auto-analyzer: Beckman Coulter, Fullerton, CA, U.S.A.). Serum levels of total cholesterol, high-density lipoprotein, low-density lipoprotein, and triglycerides were measured by a direct quantitative colorimetric method (Human Gesellschaft für Biochemica und Diagnostica, Wiesbaden, Germany). Levels of CRP were determined using the turbidimetric latex agglutination method (BioSystems SA, Barcelona, Spain). Intact PTH levels were measured using the Active DSL-8000 intact-PTH immunoradiometric assay kit (Diagnostic Systems Laboratories, Webster, TX, U.S.A.). Other biochemical parameters were measured using standard laboratory methods.

Statistical analysis
All statistical analyses were conducted using the SPSS software program (SPSS, Chicago, IL, U.S.A.). Variables were compared using the Student t-test. During follow-up, laboratory data for patients on PD and HD were analyzed at successive 6-month intervals using ANOVA for repeated measures. We grouped the patients according to presence of intra-abdominal complications at the time of transfer to HD and at 1 year of follow-up. The groups were compared using the Mann–Whitney U-test. Values are expressed as mean ± standard deviation, and values of p less than 0.05 are considered statistically significant.

Results
Mean patient age at the time of transfer from PD to HD was 47.8 ± 13.5 years. The group included 14 men (53.8%) and 12 women (46.2%). Mean duration of renal failure was 8.5 ± 4.1 years (range: 3 – 19 years). The causes of renal failure were diabetes mellitus (15.4%), hypertension (15.4%), glomerulonephritis (15.4%), urolithiasis/pyelonephritis (11.5%), and amyloidosis (7.7%). In 34.6% of patients, the cause of renal failure was unknown (Table I).

Duration of PD was 30.8 ± 22.4 months, and the follow-up period after transfer from PD to HD was 30.8 ± 22.4 months. In our patients, the indications for transfer from PD to HD were peritonitis [n = 5 (19%)], mechanical problems [n = 10 (39%)], and ultrafiltration failure [n = 11 (42%)]. Causes of peritonitis were Staphylococcus aureus (2 patients), Pseudomonas aeruginosa (1 patient), methicillin-resistant S. epidermidis (1 patient), and tuberculosis (1 patient).

Data at the time of transfer from PD to HD
At the time of transfer from PD to HD, 11 patients (42.3%) had no intra-abdominal complications, 8 (30.8%) had intra-abdominal loculated fluid collection or ascites. A history of the percutaneous drainage is collected for each patient.

<table>
<thead>
<tr>
<th>Cause</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes mellitus</td>
<td>4 (15.4)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>4 (15.4)</td>
</tr>
<tr>
<td>Glomerulonephritis</td>
<td>4 (15.4)</td>
</tr>
<tr>
<td>Amyloidosis</td>
<td>2 (7.7)</td>
</tr>
<tr>
<td>Urolithiasis</td>
<td>2 (7.7)</td>
</tr>
<tr>
<td>Chronic pyelonephritis</td>
<td>1 (3.8)</td>
</tr>
<tr>
<td>Undetermined</td>
<td>9 (34.6)</td>
</tr>
</tbody>
</table>

TABLE I Causes of end-stage renal disease in the study patients
Mean age was similar in the groups with and without intra-abdominal complications (52.9 ± 13.6 years vs. 44.5 ± 13.6 years, \( p = 0.14 \)). The group of patients with intra-abdominal complications contained more women (10 of 15 vs. 2 of 11, \( p = 0.02 \)) and had been treated for a longer time with PD (10.6 ± 3.2 months vs. 25.9 ± 6.7 months, \( p = 0.01 \)). These patients exhibited significantly lower serum albumin levels (4.09 ± 0.33 g/dL vs. 3.51 ± 0.32 g/dL, \( p < 0.01 \)), higher CRP levels (11.7 ± 11.1 mg/L vs. 53.9 ± 83.4 mg/L, \( p < 0.02 \)), and greater EPO resistance (2545.5 ± 2696.8 U/week vs. 9866.7 ± 3335.2 U/week, \( p < 0.0001 \)) at the time of transfer (Table II). High CRP levels (>15 mg/dL) were detected in 11 patients (73.3%) with complications and 3 patients (27.2%) without complications at the time of transfer.

**First year follow-up data**

In the first year of follow-up on HD, 1 patient died from pancreatitis-related sepsis 10 months after transfer. Recurrent pancreatitis complicated with peritonitis was the indication for transfer in this patient.

Percutaneous drainage from intra-abdominal fluid was performed in 7 of the 15 patients (46.6%) with complications (5 with loculated fluid collection, 2 with intra-abdominal free fluid) in the first month after transfer to HD. Multiple percutaneous drainages were performed in 3 patients with loculated fluid collection; the last drainage was performed in the sixth month after transfer in these patients. According to the data at the end of the first year of follow-up, intra-abdominal fluid collection was observed in 6 patients (4 with loculated fluid collection, 2 with intra-abdominal free fluid). In 3 of these patients, percutaneous drainage was performed.

Almost all of the patients with complications were maintained on enteral nutritional supplementation. In addition, 6 received intradialytic parenteral nutrition for 3 – 6 months. During the first year after transfer, medical, nutritional, and radiologic interventions were still necessary in 3 patients who experienced persistent intra-abdominal problems.

During the first year on HD, the group of patients with complications showed tendencies toward an increase in albumin, a decrease in CRP level, and a decrease in EPO dose, but significant differences remained between the two patient groups (albumin: 4.03 ± 0.33 g/dL vs. 3.64 ± 0.32 g/dL, \( p < 0.02 \); CRP: 40.38 ± 54.41 mg/L vs. 15.31 ± 19.19 mg/L, \( p < 0.05 \)).

**TABLE II** Laboratory data of patients at the time of transfer and during the first year of follow-up

<table>
<thead>
<tr>
<th>Complications</th>
<th>With ( (n = 15) )</th>
<th>Without ( (n = 11) )</th>
<th>( p ) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>At time of transfer</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albumin (g/dL)</td>
<td>3.51 ± 0.32</td>
<td>4.09 ± 0.33</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>CRP (mg/L)</td>
<td>53.9 ± 83.4</td>
<td>11.7 ± 11.1</td>
<td>&lt;0.02</td>
</tr>
<tr>
<td>EPO dose (U/week)</td>
<td>9866.7 ± 3335.2</td>
<td>2545.5 ± 2696.8</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>At the first year on hemodialysis</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albumin (g/dL)</td>
<td>3.64 ± 0.32</td>
<td>4.03 ± 0.33</td>
<td>&lt;0.02</td>
</tr>
<tr>
<td>CRP (mg/L)</td>
<td>40.38 ± 54.41</td>
<td>15.31 ± 19.19</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>EPO dose (U/week)</td>
<td>9600.0 ± 2529.8</td>
<td>2909.1 ± 2427.1</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

CRP = C-reactive protein; EPO = erythropoietin.
15.31 ± 19.19 mg/L vs. 40.38 ± 54.41 mg/L, p < 0.05; weekly EPO dose: 2909.1 ± 2427.1 U vs 9600.0 ± 2529.8 U, p < 0.0001; Table II). At the end of the first year on HD, CRP levels were still high in 9 patients who had had complications and in 3 patients who had had no complications.

**Discussion**

Most studies have suggested a survival advantage for PD, at least during the first 2 years of dialysis (6–8), but some studies have reported no difference in the survival of patients on PD as compared with patients on HD (9–11). Some authors argue that PD is beneficial in the first 4 – 5 years of treatment, and imply that, after this period, patients should be transferred to HD (1,12). Van Biesen et al. (5) demonstrated that such an approach might be beneficial, finding improved survival among patients who started on PD and then transferred to HD (as compared with those who remained on PD) when residual renal function declined or other serious PD-related complications arose. On the other hand, when PD-related complications occur, the mortality rate rises significantly (8).

In the present study, we analyzed transfer indications, presence of abdominal complications, and clinical outcome in patients transferred from PD to HD at our center. Adequacy or ultrafiltration problems (42%) were the most common indications for transfer in our patients. Mechanical problems and peritonitis were the next most frequent indications. Contrary to the results of Van Biesen et al. (5), the frequency of peritonitis in our patients at transfer was fairly low (19% vs. 50%).

Our study notes a relatively high percentage of intra-abdominal problems in patients terminating PD. These problems were more frequent in patients whose therapy was terminated because of peritonitis. Spontaneous resolution of ascites or loculated fluid collection occurred in half of the patients by 1 year of follow-up. On the other hand, the other 50% underwent percutaneous drainage of loculated fluid collections or free fluid in case infection or signs of pressure should develop. These patients exhibited high CRP levels, EPO resistance, and signs of malnutrition. However, considering all of the patients, we observed improvement in general status throughout the first year on HD: they had better nutritional status and a reduction in inflammatory parameters. Still, despite the overall improvement, significant differences in albumin and CRP levels and in EPO requirement remained at the end of the first follow-up year between the patients with and without intra-abdominal complications.

**Conclusions**

Presence of intra-abdominal complications was associated with additional morbidity in patients who were transferred from PD to HD. As a probable source of infection, these complications pose an increased risk of inflammation and malnutrition. Percutaneous drainage should be performed when concomitant infection or signs of pressure are present. By the end of the first year on HD, most of these problems had resolved either spontaneously or after intervention. The first year after transfer is therefore very important for these patients. A multidisciplinary approach and good follow-up are needed for improved outcomes.

**References**


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