An International Survey of Ultrafiltration in CAPD

SUMMARY

Twenty-nine centers have participated in an international survey to document more clearly the incidence of impaired peritoneal ultrafiltration and factors associated with the problem. Ultrafiltration was significantly lower when certain brands of dialysis fluid were used. These dialysis solutions were also associated with higher rates of dextrose absorption.

INTRODUCTION

In March 1983, nephrologists from France, Canada, and U.S.A. met in Paris to review the problem of ultrafiltration (UF) loss in patients on continuous ambulatory peritoneal dialysis (CAPD) in France. The actuarial risk of losing some ultrafiltration in patients on CAPD in France has been reported to be 10% and 30% at 1 and 2 years respectively.1 One series has documented ultimate transfer to hemodialysis from CAPD because of decreasing UF in 24% of patients.1 Another study from France reported decreases in mean UF with hypertonic 2 L long dwell exchanges from 800-200 ml over 30 months CAPD.2 There are other reports of losses of UF in French patients on CAPD.3

Loss of UF in patients on CAPD in North America has been reported infrequently.4−7 In the U.S.A. CAPD Registry, less than 1.7% of 6,656 patients followed for 5,022 patient years have been transferred because of loss of UF.

Numerous centers are now participating in an international survey of UF to document more clearly areas where the loss of UF is more frequent.8 The first results from this survey has been published, and the second report is in press.8−9 This paper briefly summarizes the highlights of the second report.9

METHODS

Twenty-nine centers participated (France—20, U.S.A.—6, Canada—1, Greece—1, United Kingdom—1). A single exchange measurement was performed in each patient. On the morning of the clinic visit day the abdomen was drained as completely as possible and 2 L of a hypertonic exchange of the brand used by the patient instilled. The time from the end of instillation to the beginning of drainage was to be precisely 4 hours. Patients with a total cycle time exceeding 300 minutes were not included in the analyses.

The fresh bag and port clamp were weighed before instillation and the drain bag and port clamp weighed following drainage. The difference was reported as net UF. A sample of vigorously mixed dialysate was drawn for determination of glucose concentration within 2–4 hours of sampling. All studies were performed at least 10 days after the resolution of any peritonitis.

A form was completed by the participating center for each patient measurement. The timing of the cycle, the brand used, net UF, dialysis fluid, dex-
Ultrafiltration in CAPD

trose concentration, age, sex, date of initiation of CAPD, all brands of dialysis solution used for CAPD before the most recent one, the percent dextrose used, the buffer anion used in the dialysis solution, the number of episodes of peritonitis since starting CAPD, whether treatment of peritonitis included lavage with short cycles and/or acetate containing solutions, and the method for dialysate glucose concentration determination were all listed.

Data was processed by the University of Missouri computer network. Relationships were analyzed by correlations and linear regressions. Mean values were compared by the Student's t test and analysis of variance.

RESULTS

The characteristics of these 317 patients are summarized in Table 1. Table 2 summarizes the results in patients who had been exposed to only one brand of solution. Inflow dextrose concentrations are expressed as the actual concentration in solution. In North America it is customary to label the percent of hydrated dextrose. Concentrations are all expressed here according to the European custom (anhydrous). Drainage (outflow) dextrose concentrations and net UF values were lower (p < 0.001) in brands B and C as compared to brand A. Dextrose concentrations were also reduced in brand D (p < 0.03) as compared to brand A. The lower value of UF in brand D did not reach statistical significance with the small numbers represented.

Some patients were exposed to more than one brand of dialysis fluid. For example, in one center, 23 patients were maintained on an acetate solution until one month before the study, when they were switched to a lactate solution. The test was performed using the acetate solution. The acetate solution was brand B and the lactate solution was a modified brand B. Mean (±SEM) values for this group were 465 ± 67 ml of UF and 702 ± 35 mg/dl for dialysate dextrose concentration. Both means were lower (p < 0.001) than those in the patients using brand A only. Results with brand A were quite similar in Canada, the USA, England, and France.

Table 3 summarizes dextrose absorption rates for brand A in different countries, for brands B and D combined (the acetate solutions) in France, and for brand C (the European lactate) in France. Dextrose absorption was significantly higher in the latter two groups compared to those using brand A.

A number of methods were used to determine glucose concentrations in the different centers. No correlation with choice of method was seen. Significant correlations (p < 0.001) are summarized in Table 4. UF correlated positively with dialysate dextrose but inversely with dextrose absorption, choice of buffer (assigning arbitrarily 1 for lactate, 2 for acetate, and 3 for a combination of acetate and lactate), and with time on CAPD. The inverse correlation with time on CAPD was primarily related to a progressive decrease in UF in patients using non-brand A solutions. There was a positive correlation of the number of peritonitis episodes with time on CAPD. There were no significant correlations of UF or dialysate dextrose concentration with patient age or peritonitis rates. Mean ages, peritonitis rates, and

Table 1. Patient Characteristics (n = 317).

<table>
<thead>
<tr>
<th></th>
<th>Age (yrs)</th>
<th>Time on CAPD (mo)</th>
<th>Episodes of Peritonitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>56 ± 14</td>
<td>16 ± 13</td>
<td>1.5 ± 2.1</td>
</tr>
<tr>
<td>Range</td>
<td>16–81</td>
<td>1–66</td>
<td>0–15</td>
</tr>
</tbody>
</table>

Table 2. Results According to Brand.

<table>
<thead>
<tr>
<th>Brand</th>
<th>Producer</th>
<th>Buffer</th>
<th>N</th>
<th>Inflow Dextrose (mg/dl)</th>
<th>Outflow Dextrose (mg/dl)</th>
<th>Net UF</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Travenol</td>
<td>lactate</td>
<td>220</td>
<td>3860</td>
<td>1073</td>
<td>728</td>
</tr>
<tr>
<td>B</td>
<td>Aguettant</td>
<td>acetate</td>
<td>53</td>
<td>4000</td>
<td>667*</td>
<td>532*</td>
</tr>
<tr>
<td>C</td>
<td>Fresenius</td>
<td>lactate</td>
<td>19</td>
<td>4250</td>
<td>701*</td>
<td>503*</td>
</tr>
<tr>
<td>D</td>
<td>Assistance Publique</td>
<td>acetate</td>
<td>5</td>
<td>4500</td>
<td>807†</td>
<td>548</td>
</tr>
</tbody>
</table>

* p < 0.001 from Brand A.
† p < 0.03 from Brand A.
N = Number of Patients.