Increased Dialysis Efficiency in Tidal Peritoneal Dialysis Compared to Intermittent Peritoneal Dialysis

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Dear Sir,

Intermittent peritoneal dialysis (IPD) is considered superior to hemodialysis in elderly patients with advanced cardiovascular diseases and diabetics with active retinopathy [1]. The main disadvantages of IPD are poor dialysis clearances and inadequate sodium balance resulting in poor blood pressure control and increased mortality on long-term treatment [2, 3]. The technique of IPD comprises three distinctive periods – influx of dialysis solution, dwell and outflow of dialysate and ultrafiltrate. During dialysate outflow and before the next inflow is completed, dialysis is diminished or completely interrupted. To enhance dialysis efficiency, a modified IPD was created in which a constant reserve volume of dialysis fluid remains in the peritoneal cavity on top of which a tidal volume of dialysis solution is exchanged (tidal peritoneal dialysis; TPD) [4, 5]. In the present study, dialysis efficiency and peritoneal protein loss in TPD were investigated in comparison to conventional IPD. The protocol was designed as a sequential crossover study.

Six patients (female 5, male 1) with end-stage renal failure undergoing IPD for a mean of 9 months (range 2–13) took part in the study. All patients were treated with IPD and TPD consecutively 7 times each. Mean dialysate volume (23 liters), dialysis time (7.5 h), dialysate glucose concentration and total filling volume per cycle (1.5 or 2.0 liters) were identical in both forms of peritoneal dialysis. The tidal volume was chosen to be 50% of the total filling volume. Peritoneal clearances in IPD and TPD were calculated by the equation:

$$r, V_{x,D}$$

$$U''T_xP'$$

Table 1. Peritoneal clearances (ml/min/1.73 m²) and ultrafiltration (ml/min) in IPD and TPD, 7.5 h each

Creatinine Urea		Phosphate Potassium UF		
IPD 14.3	17.8	8.45	17.9	3.92
± 2.0	± 1.9	± 0.99	± 1.7	± 0.80
TPD 15.2	19.5	10.50	18.5	4.73
± 1.7	± 3.2	± 1.29*	± 3.0	± 0.92**

Results are expressed as means ± SEM. UF= Ultrafiltration. *p < 0.05; **p < 0.01 vs. IPD (Wilcoxon rank sum test).

where V = volume of dialysate drained in specific time; D = dialysate creatinine concentration; T = time of dialysis, creatinine, urea, phosphate, and potassium were determined by the autoanalyzer technique, peritoneal ultrafiltration was calculated by total dialysate efflux minus dialysate inflow volume. Dialysate total protein was measured by the biuret method [6], dialysate albumin was determined by radial immunodiffusion [7].

TPD was tolerated by all patients without adverse effects. According to the rapid exchange of 50% of the filling volume (tidal volume) in TPD, the mean number of dialysis cycles was 25 compared to 13 in IPD. The increased number of dialysate exchanges in TPD resulted in a shortage of dwell time per cycle from 15 min in IPD to 8 min in TPD.

The most impressing effect of TPD treatment in comparison to IPD was a significant rise in peritoneal ultrafiltration by more than 20% (table 1). Phosphate clearance rose from 8.45 ± 0.99 in IPD to 10.50 ± 1.29 ml/min/1.73 m² ($p < 0.05$) in TPD. Clearance rates of creatinine, urea,

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Table 2. Dialysate protein loss (g/dialysis) in IPD and TPD, 7.5 h each

and potassium tended to increase in TPD without achieving statistical significance (table 1). TPD treatment resulted in an augmented loss of total protein compared to IPD ($p < 0.05$; table 2).

The present data indicate that TPD is an acceptable dialysis therapy providing efficient removal of fluid and adequate peritoneal clearances. The observed increased efficiency of TPD in comparison to conventional IPD may be caused by two factors: (1) the reduction of stagnant dialysate films along the peritoneal membrane by the rapid exchange of the dialysate tidal volume, and (2) the constant dialysate reserve volume intraperitoneally assuring sufficient contact between peritoneal surface area and dialysis solution.

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