Effect of Phosphatidylcholine on Peritoneal Transport and Lymphatic Absorption in a CAPD Patient with Sclerosing Peritonitis

D.G.		Struijk ^b
H.J.		van der Reijden ^a
R.T.		Krediet ^a
G.C.M.		Koomen ^a
L.		Arisz ^a

^aRenal Unit, Department of Medicine, Academic Medical Centre, Amsterdam; ^bFoundation for Home Dialysis Midden-West Nederland, Utrecht, The Netherlands

D.G. Struijk, Renal Unit, Department of Medicine, Academic Medical Centre, Meibergdreef 9, NL-1105 AZ Amsterdam (The Netherlands)

Dear Sir,

Loss of ultrafiltration can occur in continuous ambulatory peritoneal dialysis (CAPD) by alterations of the peritoneal solute transport. Its incidence increases with the duration of peritoneal dialysis. Most frequently it is reported in patients using dialysis fluid containing acetate as a buffer base. Loss of fluid removal capacity may also be caused by increased lymphatic absorption of the abdominal cavity [1]. Recently it has been found that phosphatidylcholine increases peritoneal fluid loss in CAPD patients [2,3]. We report the effects of phosphatidylcholine on peritoneal solute transport, transcapillary ultrafiltration and lymphatic absorption in a CAPD patient with loss of ultrafiltration due to sclerosing peritonitis.

Case Report

A 62-year-old male patient with chronic renal failure caused by analgesic nephropathy was started on hemodialysis in January 1981. In July 1982, he preferred to change this therapy to CAPD. In the following years, he experienced 11 episodes of peritonitis. The second episode occurred in May 1984 and was caused by *Candida tropicalis*. This led to a temporary removal of the catheter. After this episode, his net fluid removal was reduced, and gradually decreased in time. In March 1987, it was reduced to less than 300 ml/24 h despite the use of five exchanges of 2 liters or four exchanges of 3 liters Dianeal® glucose 3.86% solution each day. He refused to change to hemodialysis permanently. We therefore had to perform hemodialysis incidentally, only for ultrafiltration. In this period, he was temporarily treated with phosphatidylcholine intraperitoneally. In September 1987, he died of a myocardial infarction. At autopsy, typical findings of sclerosing peritonitis were seen.

Methods

The studies were done with commercially available dialysate (Dianeal, glucose concentration 1.36%) in the absence of peritonitis. First the abdominal cavity was rinsed twice with 2 liters of dialysate

that was drained immediately after inflow. Then another 2 liters of dialysate (test bag), also containing inulin (Inutest®; 2.5 g/l) and albumin (10 g/l), was instilled for 4 h. Finally, the abdominal cavity was again rinsed twice with 2 liters dialysate. Mass transfer area coefficients (MTC) of urea, lactate, creatinine, glucose, inulin and IgG were calculated using a mathematical model assuming first-order kinetics. The lymphatic absorption was calculated as the difference between the amount of albumin instilled and the total amount recovered (after drainage and in the rinsing bags), divided by the geometrical mean of the dialysate albumin concentration. The theoretical intraperitoneal volume after 4 h, i.e. the volume in the absence of lymphatic absorption, was calculated as the amount of albumin instilled, divided by the albumin concentration of the test bag after drainage. The cumulative transcapillary ultrafiltration after 4 h, defined as the change of the intraperitoneal volume in the absence of lymphatic absorption, was calculated by subtracting the instilled volume and the residual volume from the theoretical intraperitoneal volume after 4 h. The net fluid removal was the difference between cumulative transcapillary ultrafiltration and lymphatic absorption. The residual volume after drainage was calculated from the sum of the albumin contents of the two rinsing bags, divided by the albumin concentration of the test bag. On the first day the test was performed without phosphatidylcholine (Li-postabil®), and on the second day with 125 mg/l added to the test bag. The following days, the patient added the same amount of phosphatidylcholine to the first dialysate bag each day, and the total drainage volume (4 exchanges of 2 liters 3.86% glucose solution) on 2 subsequent days was measured.

Results

There were no differences between the two studies concerning the MTC values of the measured solutes. The effects of phosphatidylcholine on the intraperitoneal water transport are given in table I. With phosphatidylcholine, there was a more than fourfold decrease in lymphatic absorption (85 vs. 368 ml/4 h). This led to a higher net fluid removal, when phosphatidylcholine was administered (56 vs. -170 ml/4 h). The effect of phosphatidylcholine on transcapillary ultrafiltration was only slight. The residual volumes after drainage were similar in the two studies (162 and 147 ml). When phosphatidylcholine

578

Struijk/van der Reijden/Krediet/Koomen/Arisz

Table I. Volume measurements with or without phosphatidyl-choline

Volume kinetics, ml/4 h	Phosphatidylcholine	
without	with	
Transcapillary ultrafiltration	198	141
Lymphatic absorption	368	85
Calculated net fluid removal ¹	-170	5 ₈
Measured net fluid removal ²	-200	50

1 The difference between transcapillary ultrafiltration and lymphatic absorption.

2 The difference between drained volume and instilled volume.

was added to the first bag of 4 exchanges of 2 liters 3.86% glucose, the drained volume was still less than the instilled volume on the 2 days measured (net fluid removal -5 and -35 ml/4 h vs. -40 ml/4 h before giving phosphatidylcholine).

Discussion

In this patient, phosphatidylcholine caused an increase in the net fluid removal as a result of its marked effect on lymphatic absorption. It reduced lymphatic absorption to the lowest value we

ever measured until now [4]. The MTC of the various solutes did not change when the drug was given.

Phosphatidylcholine is synthesized by peritoneal mesenteric tissue [5], and is present in the peritoneal effluent of patients on CAPD. The concentration in dialysate has been reported to be lower in patients with low ultrafiltration [2]. Phosphatidylcholine is a surface-active material that helps to repel water. It has been suggested that phosphatidylcholine restores the physiological properties of the peritoneum, but if this is the mechanism, its effect should lead to alterations in the peritoneal permeability. On the other hand, it could act as a cholinergic drug like neostigmine. In rats, both drugs have been reported to decrease lymphatic absorption, probably by decreasing the size of the subdiaphragmatic lymphatic vessels [6, 7].

As has been reported previously [2, 3], phosphatidylcholine did enhance the net fluid removal in our patient. We found no increase in peritoneal permeability for water or solutes in this patient. Although such effects could be diminished by the patient's sclerosing peritonitis, the impressive effect on lymphatic absorption supports the hypothesis that phosphatidylcholine increases the peritoneal fluid loss by its cholinergic effects on the size of the subdiaphragmatic lymphatic vessels.

We conclude that phosphatidylcholine is a promising drug for increasing the net fluid removal by reducing lymphatic absorption.

References

- Mactier, R.A.; Khanna, R.; Twardowski, Z.J.; Nolph, K.D.: Ultrafiltration failure in continuous ambulatory peritoneal dialysis due to excessive peritoneal cavity lymphatic absorption. *Am. J. Kidney Dis.* 10:461–466 (1987).
- Di Paolo, N.; Buoncristiani, U.; Capotondo, L.; Gaggiotti, E.; De Mia, M.; Rossi, P.; Sansoni, E.; Bertini, M.: Phosphatidylcholine and peritoneal transport during peritoneal dialysis. *Nephron* 44:365–370 (1986).
- Dombros, N.; Balaskas, E.; Savidis, N.; Tourkantonis, A.; So-bolos, K.: Phosphatidylcholine increases ultrafiltration in CAPD patients. *Periton. Dial. Bull.* 7.S24 (1987).
- Krediet, R.T.; Struijk, D.G.; Boeschoten, E.W.; Hoek, F.J.; Arisz, L.: Measurement of intraperitoneal fluid kinetics in CAPD patients by means of autologous haemoglobin. *Neth. J. Med.* 55/281–290(1988)
- Pavlina, T.; Lloyd, J.; Johnson, R.; Dobbie, J.W.: Phosphatidylcholine synthesis by rat peritoneum. *Kidney int.* 55:248 (1988).
- Mactier, R.A.; Khanna, R.; Moore, H.; Twardowski, Z.; Nolph, K.: Phosphatidylcholine enhances the efficiency of peritoneal dialysis by reducing lymphatic reabsorption. *Kidney int.* 55:247 (1988).
- Mactier, R.A.; Khanna, R.; Nolph, K.D.; Twardowski, Z.; Moore, N.: Neostigmine increases ultrafiltration and solute clearances in peritoneal dialysis by reducing lymphatic drainage. *Periton. Dial. Bull.* 7.S50 (1987).