CONTINUOUS AMBULATORY PERITONEAL DIALYSIS – A PRELIMINARY REPORT ON 7 PATIENTS*

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INTRODUCTION

Continuous ambulatory peritoneal dialysis (CAPD) was first described. [1] However, it was only after Oreopoulos [2] and co-workers modified and introduced their technique in 1978, did CAPD gain wide acceptance. Since then, it has established itself as a modality of therapy for patients with end-stage renal disease around the world, but mainly in the developed countries. [3,4] Its popularity is due to the simplicity of the technique and the freedom from machines as required in haemodialysis.

Brief Description of Technique

A Tenckhoff catheter is initially inserted into the peritoneal cavity by a microlaparotomy, and the other end is brought through a skin exit via a subcutaneous tunnel. Dialysate is infused into and delivered out of the peritoneal cavity via this catheter at regular intervals daily.

The patient requires, on the average, 4 exchanges (2 litres each) per day. This involves running out the dialysate which has been dwelling in the peritoneal cavity over the previous 5-6 hours; changing on to a new bag of dialysate in an aseptic manner; and then running the fluid in and allowing it to dwell till the next exchange. The empty bag, meanwhile, is folded and worn round the waist allowing the patient full ambulation.

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Patients

From November 1980 up to June 1982 we had put 7 patients on CAPD at the University Hospital, Kuala Lumpur. There were 6 females and 1 male with age ranging from 30 to 52 years. All had advanced chronic renal failure at presentation and the primary renal disease was not determined. However, none had evidence that the renal failure was secondary to a systemic disorder.

These 7 patients had followed up from one to 15 months, a total of 42 patients-months.

RESULTS AND DISCUSSION

Blood urea

Blood urea levels were very high when these patients presented. All of them had had one or more intermittent peritoneal dialysis before they finally went on CAPD. The blood urea had since remained within very acceptable ranges. The patients are not on any dietary protein restriction. In fact, they were recommended to take 1.5 - 2.0 gm protein/kg/day (Fig. 1).

Serum creatinine

The peritoneal clearance for creatinine is less efficient than with urea. Nonetheless, the serum creatinine levels showed a pattern similar to that of blood urea (Fig. 2).

Serum sodium

Serum sodium remained within normal range. The patients were not salt restricted, although

* *Based on a paper presented at the 2nd Combined Scientific Meeting of the Malaysian Colleges of Physicians and Surgeons, June 1981.*

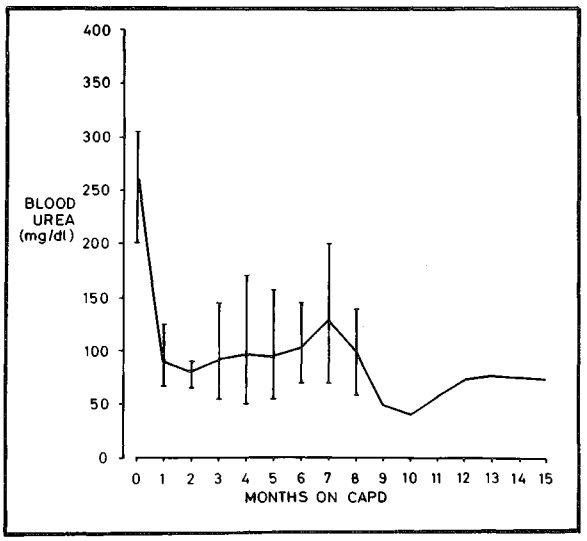

Fig. 1 Blood urea on CAPD. The vertical bars indicate the range of blood urea for the group. Only one patient has had more than 7 months CAPD.

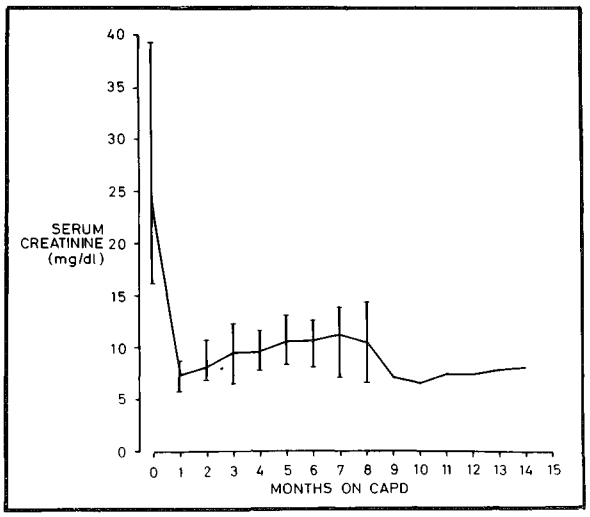

Fig. 2 Serum Creatinine in patients on CAPD.

advised against excessive intake. Neither were they fluid restricted (Fig. 3).

Serum potassium

Serum potassium tended to be on the lower side of normal. No patient was symptomatic and did not require potassium supplement (Fig. 4).

Two patients had developed mild hypokalaemia when the number of exchanges was increased during peritonitis episodes, but the serum potassium returned to satisfactory levels when the

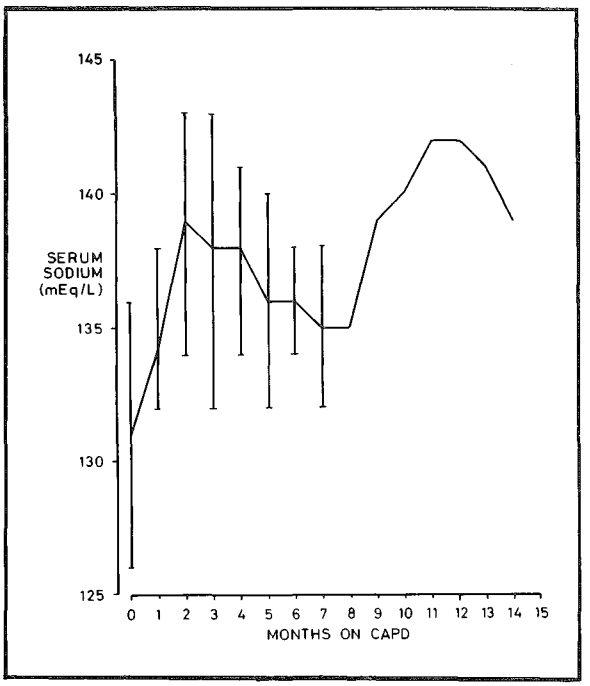

Fig. 3 See text.

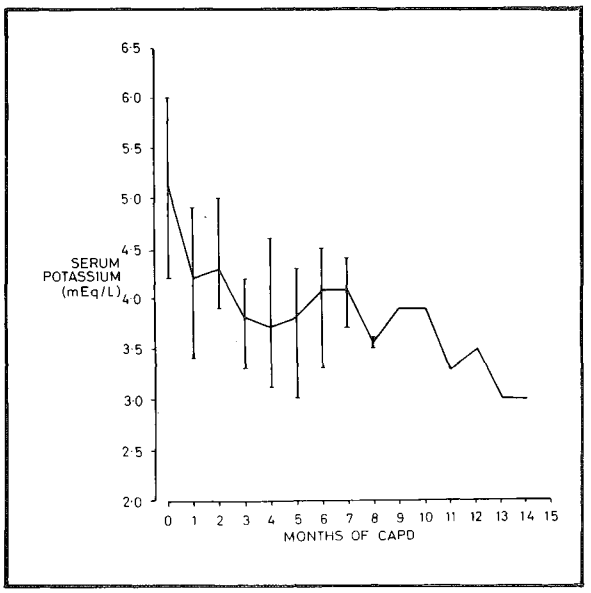

Fig. 4 Serum potassium levels without dietary supplementation or restriction.

number of exchanges was again decreased to 4 per day.

Serum albumin

Albumin is constantly lost into the peritoneal

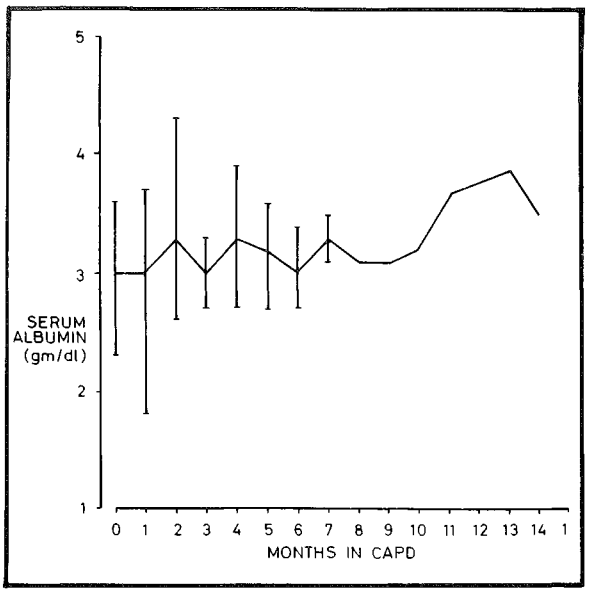

Fig. 5 Improved mean serum albumin in patients on CAPD.

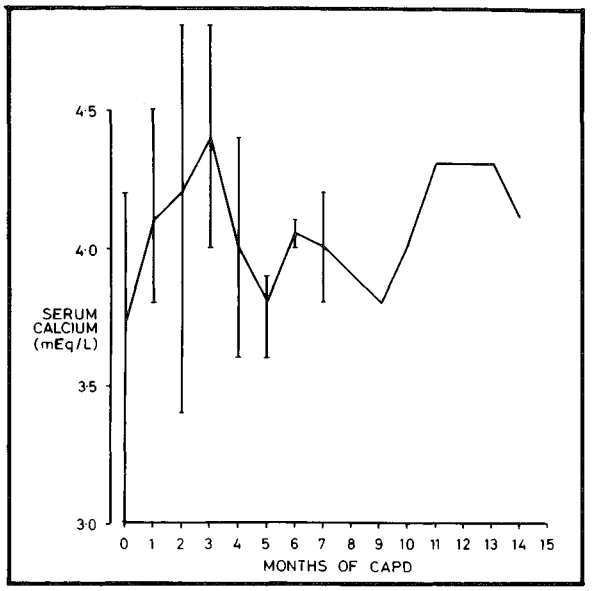

Fig. 6 Improved serum calcium after starting on CAPD.

dialysate and has been reported to range from 4-15 gm/day. [5] However, this has not posed any problem as long as the dietary protein is adequate. The serum albumin in these 7 patients remained at or above 3 gm/dl (Fig. 5).

Serum calcium

The serum calcium (correlating with the serum albumin level) remained within acceptable range. There was an increase compared with pre-CAPD levels, but this was not statistically significant (Fig. 6).

Serum phosphate

Somehow, CAPD does not clear phosphates too well. Most patients will still need oral phosphate binders. However, dosage requirement is lower than with patients who managed conservatively for chronic renal failure (Fig. 7).

The phosphate levels are very acceptable in these cases. The patients are on an average of 2.4 gm of aluminium hydroxide each day.

Serum alkaline phosphatase

The serum alkaline phosphatase has not changed appreciably over the period of study (Fig. 8).

Serum uric acid

Serum uric acid is another parameter monitored.

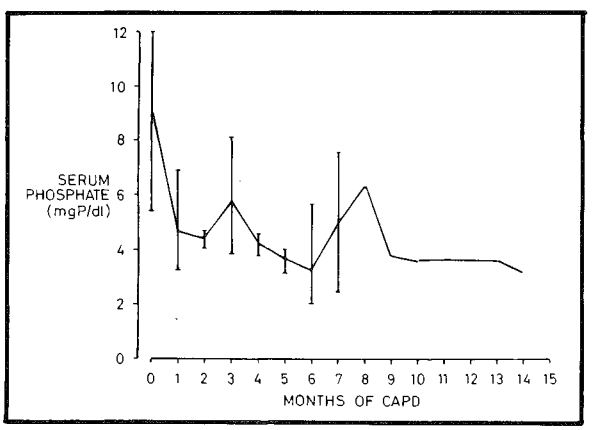

Fig. 7 Improved serum phosphate.

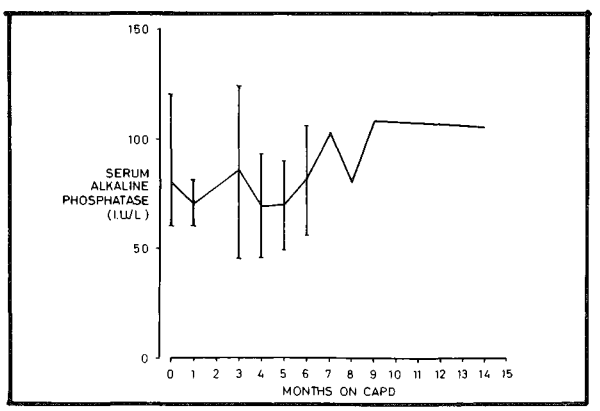

Fig. 8 Serum alkaline phosphates.

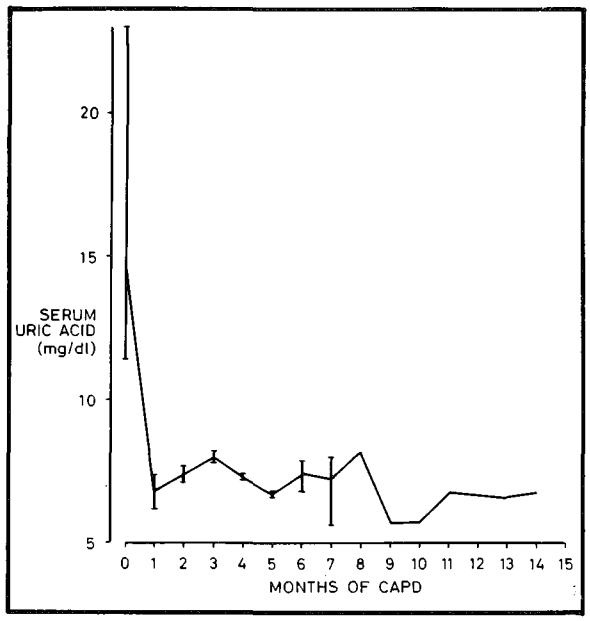

Fig. 9 Serum uric acid in CAPD.

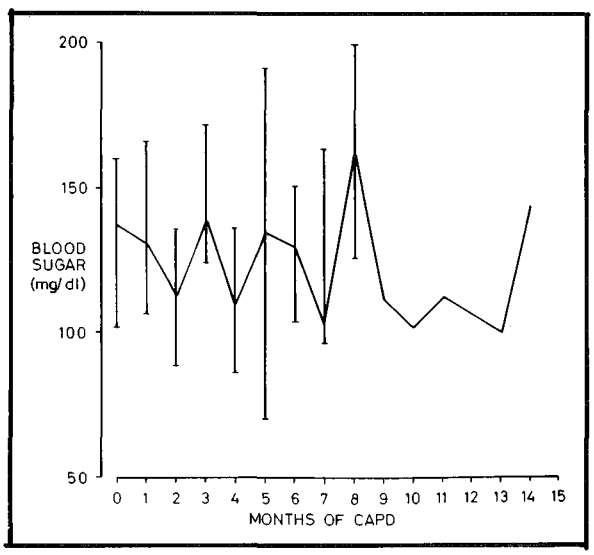

Fig. 10 Blood sugar on 1.5% glucose dialysate.

This has remained at very respectable levels (Fig. 9).

Blood sugar

The dialysate contains a high concentration of glucose. We are, therefore, constantly delivering a high carbohydrate load to these patients. However, the blood sugar (random values) has remained within normal limits (Fig. 10).

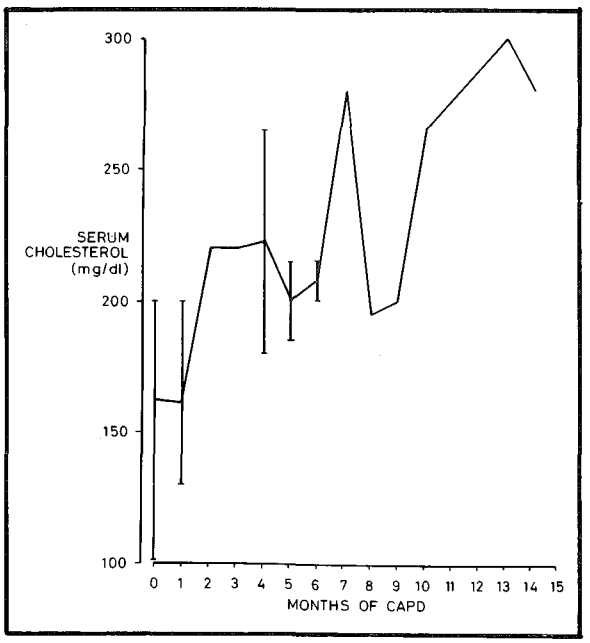

Fig. 11 See text. Explanation of figure as in Fig. 1.

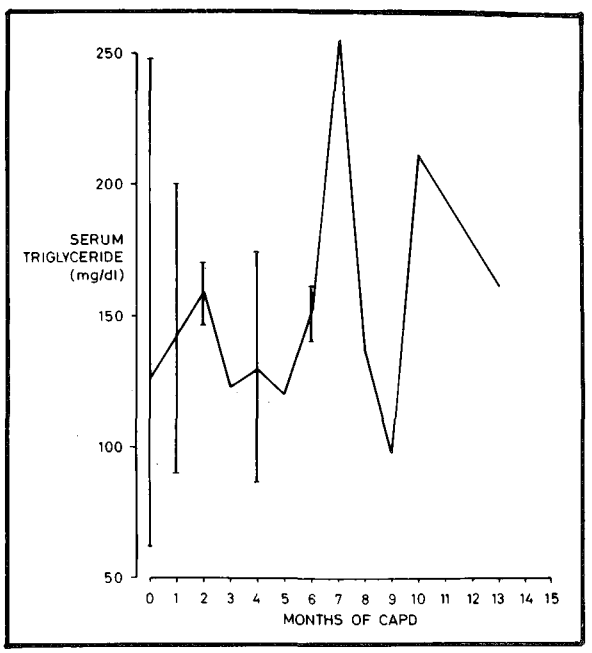

Fig. 12 As in Fig. 9.

Serum triglycerides and cholesterol

The high carbohydrate load has been blamed for the hyperlipidaemia, particularly hypertriglyceridaemia, seen in some of the patients on CAPD for some time. [6,7] So far the serum triglyceride of

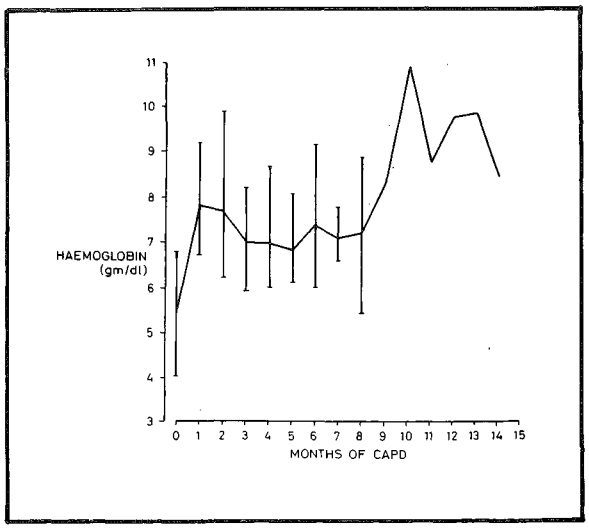

Fig. 13 Haemoglobin level after CAPD treatment.

our patients has remained within normal limits. The serum cholesterol, though, shows a rising trend (Fig. 12).

Haemoglobin

The patients were severely anaemic when they presented, and had required blood transfusion just before or at the beginning of CAPD. The haemoglobin level has subsequently remained quite stable at higher values, averaging between 7-8 gm/dl. This is consistent with other studies, [8,9] which have reported a higher haemoglobin level in patients on CAPD compared with those on chronic haemodialysis.

COMPLICATIONS

Mechanical

One patient had dislodgement of her Tenckhoff catheter from the pelvic cavity 3 days after the initiation of CAPD. This obstructed dialysate outflow. It was, however, quite easily repositioned by manipulation with a probe without having to subject the patient to another laparotomy.

Another patient developed a leak of dialysate from the peritoneal cavity via the subcutaneous tunnel. This resulted in infection and he required a second operation to repair the leak (Table I).

Infection

Peritonitis is the most feared complication and is probably the most important limiting factor in CAPD. [5,10] With improved techniques and equipment the incidence of peritonitis has decreased progressively over the years.

TABLE I
COMPLICATIONS OF 7 PATIENTS OVER 42 PATIENTS MONTHS OF CAPD

Complications	Frequency
Mechanical	
Dislodgement of catheter	1
Leakage of dialysate	1
Infection	
Peritonitis (episodes)	5
Tract infection	1
Cardiovascular	
Postural hypotension	1
Accelerated hypertension	1
Miscellaneous	
Incisional hernia	1
Cerebrovascular accident	1
Pregnancy	1

We encountered 5 episodes of peritonitis during our study period. This works out to 1 episode per 8.4 patient-months, comparable with rates reported from other centres. [11,12]

It must be noted that 3 out of these 5 episodes of peritonitis occurred in one single patient. These occurred during the first 6 months she was on CAPD. She has since been infection-free for the past 9 months.

Another patient developed peritonitis secondary to infection of the subcutaneous tract as a result of the dialysate leak mentioned above. The other episode developed in a patient who sustained a stroke and the exchanges had to be performed by her daughters then.

Cardiovascular

Postural hypotension is quite common during the early weeks of CAPD. This is probably consequent to salt and water depletion following improved clearance from CAPD.

Two of the 7 patients had symptomatic postural hypotension which was corrected with increase oral salt and fluid intake.

Accelerated hypertension occurred in 2 patients for inapparent reasons. One resulted in a cerebrovascular accident. In the other, the blood

pressure was promptly controlled with increase of anti-hypertensive drugs.

Miscellaneous

One patient developed an abdominal incisional hernia, after one year on CAPD. This is probably consequent to long-standing increase intra-abdominal pressure. The hernia did not pose any mechanical problem but was subsequently repaired.

With a proper abdominal exercise programme the incidence of hernia should be reduced. One patient developed a cerebrovascular accident with a dense right hemiplegia about a month after the start of CAPD.

Our youngest patient (30-years-old) became pregnant without return of menstrual flow. She was amenorrhoeic for some time already when she first presented with chronic renal failure. The pregnancy had to be terminated for various medical and social reasons. This shows that CAPD does restore some of the endocrine functions that are affected in renal failure.

Outcome and Rehabilitation

There was no death while on CAPD. However, the procedure had to be stopped for various reasons, in the patient who developed a stroke. She was sent home and she died shortly after.

Rehabilitation-wise, only 2 of our 7 patients were working before they became symptomatic of renal failure. Both of them have since returned to their respective jobs.

The other 4 surviving patients are housewives, and, so far, have found no difficult in coping with their house-work.

CONCLUSION

CAPD, in our limited experience, has proved to be a satisfactory mode of treatment for patients with end-stage renal failure. Blood chemistries are adequately controlled for at least 15 months, maintaining patients in very satisfactory clinical condition. The continuous dialysis avoids the biochemical fluctuations encountered in chronic haemodialysis or intermittent peritoneal dialysis, thus ensuring continuous well-being of the patients.

It must be stressed that CAPD does not supersede haemodialysis. Worldwide experience with this therapeutic modality is still limited compared with experience with haemodialysis. Nevertheless, CAPD does offer a very adequate therapeutic alternative for patients with end-stage renal disease. Its simplicity is attractive and should prove more practicable in developing countries like ours.

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REFERENCES

[1] Popovich R P, Moncrief J W, Decherd J F, Bomar J B, Pyle W K. The definition of a noval portable/wearable equilibrum peritoneal dialysis technique. Abstracts of the American Society for Artificial Internal Organs 1976; **5**, 64.

[2] Oreopoulus D G, Robson M, Izatt S, Clayton S, de Veber G A. A simple and safe technique for continuous ambulatory peritoneal dialysis (CAPD). Transactions American Society for Artificial Internal Organs 1978; **24**, 484.

[3] Oreopoulos D G, Clayton S, Dombros N, Zellerman G, Katirtzoglou A. Experience with continuous ambulatory peritoneal dialysis (CAPD). Transactions of the American Society for Artificial Internal Organs 1979a; **25**, 95-97.

[4] Oreopoulos D G, Robson M, Faller B, Ogilvie R, Rapoport A, de Veber G A. Continuous ambulatory peritoneal dialysis: a new era in the treatment of chronic renal failure. *Clinical Nephrology* 1979b; **11**, 125-128.

[5] Popovich R P, Moncrief J W, Nolph K D, Ghods A J, Twardowski Z J, Pyle W K. Continuous ambulatory peritoneal dialysis 1978; *Ann Intern Med* 1978; **88**, 449-459.

[6] Nold J M, Kellman B, Jabaz O, Oreopoulos D G. The dietary treatment of patients on continuous ambulatory peritoneal dialysis: practical aspects. *CAPD Proc Int Symp* 1979; *Excerpta Medica Ed. M Legrain* 1980; 229.

[7] Lamiere N, Ringoir S. An overview of peritonitis and other complications of continuous ambulatory peritoneal dialysis. *CAPD ProfcInt Symp* 1979. *Excerpta Medica Ed M Legrain* 1980; p. 229.

[8] Katirtzoglou A, Oreopoulos D G, Dombros N, Pierratos A, Pantazony D. Haematologic state of patients undergoing continuous ambulatory peritoneal dialysis (CAPD) *Kidney International* 1979; **15**, 72.

[9] Thomson N M, Atkins R C, Hooke D, Maydom B, Scott D F. Long term clinical experience in Australia. Peritoneal *Proc. Pan Pacific Symp* 1980 *Churchill Livingstone. Ed.* Ed. Atkins R C, Thomson N M, Farrell P C, p. 93.

[10] Rubin J, Rogers W A, Taylor H M, Everett E D, Prowant B F, Fruto L, Nolph K D. Peritonitis during continuous ambulatory peritoneal dialysis. *Ann Intern Med* 1980; **92**, 7-13.

[11] Lamiere N, de Paepe M, Vanholder R, Verbanck J, Ringoir S. Experience with continuous ambulatory peritoneal dialysis

in Belgium Peritoneal Dialysis. *Proc Pan Pacific Symp* 1980. Churchill Livingstone. Ed Atkins R C, Thomson N M, Farrell P C, p. 104.

[12] Lindholm B, Alvestrand A, Furst P, Tranaeus A, Bergstrom J. Efficacy and clinical experience of CAPD — Stockholm, Sweden. Peritoneal Dialysis. *Proc Pan Pacific Symp* 1980. Churchill Livingstone. Ed. Atkins R C, Thomson N M, Farrell P C, p. 147.