LONG TERM PERITONEAL DIALYSIS IN THE HOME,
THE FIRST ONE AND ONE HALF YEARS*

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Peritoneal dialysis is being used more and more commonly for the treatment of chronic renal insufficiency, but the development of peritoneal infection has been the decisive factor which prevented long term survival in most patients. Reporting on just one patient, evidence is presented in this paper that peritoneal dialysis can be conducted successfully even in the home over a long period of time without the occurrence of peritoneal infection.

The patient, a 32-year old female with endstage pyelonephritis, has been dialysed for one and one-half years now. At the start of regular dialysis treatment in March 1964, her creatinine clearance was 2.8 ml/min. During the initial 6 weeks of her treatment the patient came to the hospital for weekly peritoneal dialysis. During that time she and her husband learned how to handle the equipment, particular emphasis being placed on aseptic techniques. In May 1964 the dialysis equipment was moved to the patient's home where all subsequent dialyses were performed, with the exception of 11 which were done on the clinical research unit, strictly for research purposes.

Following the start of regular dialysis treatment the patient improved steadily and stayed in good health throughout most of the 1 1/2 years. She was able to carry out all the duties of a housewife, and during the summer months enjoyed frequent outdoor activities. The patient's course is summarized in the following two figures.

Predialysis BUN and creatinine values were quite stable. Total serum protein levels showed a steady decline until October 1964 when she received 12.5 grams of albumin intravenously. Subsequently, ascitic fluid removed before the start of dialysis was reinfused intravenously. This was followed by a rise in serum protein levels. With twice weekly peritoneal dialysis, ascites removal and reinfusion were discontinued, but the serum protein did not fall, possibly due to better dialysis.

The peritoneal urea clearance remained stable throughout the 1 1/2 years, the patient's renal creatinine clearance, however, decreased from 2.8 to 0.7 ml/min.

Frequent and prolonged bleeding from the abdominal wall was the only complication directly related to the dialysis treatment. On 2 occasions dialysis had to be discontinued in order to stop the bleeding. The patient received a total of 18 blood transfusions, most of them for replacement of blood losses.

Before the start of dialysis treatment the patient had severe hypertension that was poorly controlled by drug therapy and was complicated by cardiac dilatation and insufficiency. At the time of her first dialysis in March 1964, the patient was practically blind with grade 4 eyeground changes and malignant hypertension. These changes cleared rapidly with dialysis, but hypertension remained a problem.

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Fig. 1. Blood chemistries, serum protein, hematocrit and clearances during one and one-half years of home peritoneal dialysis.

Fig. 2. Clinical complications due to hypertension in relationship to body weight and urine output. In March/April, following a hypertensive crisis, a rapid reduction in blood pressure, blood volume and body weight is associated with acute renal shutdown.
Fluid removal during once-weekly dialysis did not suffice for persistent good blood pressure control. Due to the patient's inability to restrict her sodium and fluid intake, she gained up to 4.5 kg of weight between dialyses, despite a fair urine volume. Antihypertensive drug therapy was either little effective or had to be discontinued because of side effects. Following an episode of acute pulmonary edema and a single grand mal seizure, the patient temporarily became very diet conscientious. At the same time, another drug combination was added to her regimen and twice-weekly dialysis was instituted. Probably all these factors contributed to the subsequent precipitous blood pressure drop which was followed by a period of anuria of 3 weeks' duration. After a limited diuretic phase, urine flow continued at slightly lower levels than previously.

Relative hypotension and low renal perfusion pressures, as well as hypovolemia, probably were operative in causing this acute renal shutdown.

The patient is still on twice-weekly dialysis, and her blood pressure is fairly well controlled at present. She prefers twice weekly dialysis since each run is shorter, and she can sleep through most of the dialysis. It gives her more working hours, a higher degree of well-being, and also, I presume, will let her get away with more frequent dietary indiscretions.

The account of our experience with home dialysis would not be complete without mentioning that the patient's husband went through two depressive phases, severe enough to keep him out of work for several weeks. Also, the 5-year-old son developed voiding difficulties which disappeared promptly when the mother was dialysed in the hospital during a two-weeks study period.

Dialysis equipment and procedure

About half an hour before the scheduled dialysis the patient and her husband assemble the dialysis equipment. The home set-up is very simple. It consists of a closed sterile system with dialysate in large containers, a roller pump, a head tank, and a small cycling machine. Outflow is collected in a thoroughly cleaned bottle with a sterile cap. Gravity outflow is facilitated by slight negative pressure on the outflow bottle and by elevating the bed.

On arrival of the physician everything is ready to start dialysis. The intermittent puncture technique was used throughout (Boen et al., 1964). Each time a new catheter was inserted in the lower abdomen at alternating sites. During the first 6 months of the program a No. 14 French trocar was used to introduce the catheter; during the last 12 months the same type of catheter, combined with a sharp stylet, was inserted through a small skin incision. This so-called 'Trocaht' was recently developed by Roberts and Weston and since we have used it no major bleeding episodes and no leakages have occurred.

Whenever possible, ascitic fluid was obtained for culture and protein content before starting dialysis. After making sure that the abdomen drains freely in a steady stream, the physician leaves and the family takes over.

During dialysis the patient has no or only minimal discomfort. She is able to sit up in bed and can turn on her side while asleep. Constant monitoring of the dialysis is not necessary. When the husband is at work, the patient and her 5-year-old son are alone at home with only a telephone at her bedside. On 3 occasions, while the patient was asleep, dialysis fluid accumulated in the abdomen due to kinking of the outflow tube. The patient awoke feeling distended. She corrected the obstruction, and with prolonged outflow all the retained fluid was recovered. Equipment failure has not occurred. At the end of each dialysis the outflow is repeated to make sure the abdomen is empty. The patient then removes the catheter and approximates the wound edges with sterile bandaids, carefully observing a clean technique. Only once has a superficial wound infection occurred. On 55 occasions cultures of ascitic fluid were obtained before the start of dialysis. They were sterile in 47 instances, twice diphtheroids and five times staph. epidermidis were found, but grew on fluid media only. Once
a Streptococcus viridans and at another time a few colonies of Staphylococcus aureus were cultured, but the specimen was considered contaminated, and at no time was there any clinical evidence of peritoneal infection. Subsequent cultures were always found sterile.

Antibiotics were not routinely added to the dialysate. On the rare occasions of prolonged leakage, however, or when the closed system was interrupted during dialysis for replacement, or declotting of a catheter, antibiotics were added as a prophylactic measure.

Dialysate was prepared in 40 liter bottles in our laboratory and shipped in special crates to the patient’s home once a month. Dialysis was carried out once weekly during most of the first year. About 60 liters of dialysate were exchanged over 20 to 22 hours with each dialysis. Since March of this year, twice weekly dialysis is performed, always overnight, each dialysis lasting an average of 15 hours.

More recently, in order to reduce cost of dialysis and to promote ease and availability of this treatment, a bacterial filter system was used to sterilize dialysis fluid. Freshly prepared distilled water is mixed with a self-sterilizing mineral dextrose concentrate and is pumped through a system of bacterial and asbestos filters. Asbestos filters proved necessary to remove
pyrogens. Large quantities of sterile and pyrogen-free dialysate can be prepared in such a manner at low cost and have been used for five months in two patients on chronic peritoneal dialysis. No untoward reactions have occurred.

The total costs of this patient's peritoneal dialysis during the first 12 months amounted to $2640. - Future cost reductions will be possible by the routine use of a small proportioning pump which will allow the patient to manufacture his own dialysate in the home. Equipment amortization and professional fees are not included in our cost calculation. Physician time varied considerably during the 18 months' period, and with the initial frequent bleeding episodes amounted to about 3 hours a week. During the last 6 months, physician time requirements averaged 50 minutes per dialysis.

Conclusions

Long term peritoneal dialysis can safely and efficiently be conducted in the home of selected families. Infection has been avoided by the use of the repeated puncture technique and a closed dialysis system using dialysate in large containers. The good results obtained with this technique in home as well as in hospital dialysis demonstrate the safety and efficiency of this technique and the feasibility of its long term application. The cost of home peritoneal dialysis compares favorably with that of other dialysis systems and will be further reduced by the new methods of dialysate preparation.

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REFERENCE