In 1964 the number of dialysis treatments at our clinic was over 500 and in the present year it is expected to rise by over 80%. The question of space has presented a steadily increasing problem in the last 5 years. The dialysis section, which after rebuilding was ready in 1960, is not sufficient to provide the necessary care of many acute and chronic cases. At present 4 patients can be treated at the same time, since a room kept in reserve is continuously used for the purpose. The treatment rooms are situated on different floors, which makes the work difficult and increases the costs. All the chronic cases have come for treatment in the final stage of the disease and it has often been impossible to carry out the dialyses at sufficiently short intervals. It is only in the last 2 years that we have been able to give 7 patients with arterio-venous shunts satisfactory treatment. The survival time approaches 2 years. A great number of chronic cases suitable for treatment cannot be admitted.

In the building where the clinic is situated at present we shall be allotted seven treatment beds in 1966, which will enable us to carry out at least 2,000 haemodialyses per year. The last stages of the building programme will be completed in 1968, and the clinic will then move to a new hospital block. In addition to two treatment wards with a total of 50 beds we shall then have at our disposal an independently organised dialysis section with 14 beds. A prerequisite for such an extension of the work, with the present shortage of personnel and difficulty in obtaining blood for transfusions, is rational equipment to replace our present artificial kidneys and turn them into museum specimens.

Figure 1 shows a schematic drawing of a treatment unit. An artificial kidney, delivered sterile from the factory, is suspended from a movable arm. The electrolyte solution comes from central tanks and is sucked through the dialyser. Its composition can be modified at the individual bed-heads, as can the negative pressure in the plastic channel which surrounds the cellophane membrane (Alwall, 1963). After single pass through the dialyser the solution traverses a photocell. If any leakage of blood occurs and the solution becomes stained with blood, the tubes connecting the apparatus to the patients are automatically clamped and a warning signal goes to the central control screen. The blood volume of the apparatus is less than 300 ml and the resistance so low that a blood pump is not usually required. A roller pump is available for emergency use.

The cupboard on the wall contains the adjustable device for regulation of the temperature, pressure and composition of the electrolyte solution, which can also be checked by measuring specific gravity. Important data are recorded in diagrams during treatment. If there is any deviation from the expected course signalling lamps are automatically switched on, both on the cupboard and on the central control screen, which will serve seven dialysers in the new building.

Figure 2 is a schematic diagram of the design of the dialysis section in the new block. It was planned in collaboration with an architect, Mr. Stefan Hornyányzy, and is based on
the equipment for haemodialysis described above. Peritoneal dialysis was also allowed for in the plan. The section contains some 20 rooms, cleaning rooms, toilets, etc. covering about 1000 sq. m. The block will contain central units for sterilisation of instruments, etc., bed
making, and a central laboratory for chemical analyses, etc. Consequently we need not take up any space for these purposes but can concentrate on planning the dialysis section with a view to the most rational operation possible.

Patients with chronic renal failure undergoing regular dialysis come from the lift to the dressing rooms and on the way to their treatment room they pass a secretary and a nurse. One treatment unit designed mainly for chronic patients (25) comprises 7 dialysis beds and one central control screen. The other unit consists of two small isolation rooms with one bed each (21 and 22), and a larger room with 5 beds (15). The central control screen serves all seven beds. It is suspended and swings like the viewing screen of radar equipment, so that the nurse need not twist her body and develop back trouble. The supervision is carried out partly by direct observation and partly by television. For the two isolation rooms (21 and 22), designed mainly for severe acute cases, there is not only the aforementioned checking device attached to the dialysis apparatus but also a special equipment for supervision of the patient, of the same type as that commonly used in post operative wards. In the treatment rooms there are refrigerators for the storage of dialysers between treatments on the same patient. The central tanks holding the electrolyte solution (34) are placed close to the rooms for the technical staff. Well designed rooms for preparing trays with the articles required for treatment (14), and for washing instruments etc. after treatment (33) are essential parts of rational planning.

A small operating theatre (18) is designed for the setting up of arteriovenous shunts, etc. As we plan to be able to carry out treatments in two shifts per 24 hours, there will be rooms for the personnel to sleep in (39 and 40). The doctors will have studies for reading and research work, when their time is not occupied by the treatments (36-38). From these studies they will be able to supervise the activities in the treatment rooms on a TV screen. There will also be an examining room (35), as the chronic cases will not pass through the clinic's treatment wards. The acute cases, on the other hand, are brought from the treatment wards to the dialysis units, where they can stay for several days, when necessary.

In conclusion, I should like to mention a matter relating to the financial situation. A calculation in connection with the proposal for an increase in the number of dialysis rooms in the present building from 3 or 4 to 7, better planning of the rooms, and acquisition of the new dialysis equipment showed that the costs of dialysis treatment could be reduced by two-thirds of the present expenditure, and that the costs for personnel could be cut down so that the expenses for the rebuilding and the equipment would be covered in the first year. The training of dialysis assistants to replace hospital nurses and some other personnel will start next year.

So in this way we hope to be able to contribute to the solution of one of the greatest problems of medical care in this decade, namely to provide, within the framework of personal resources, the renal patients with the care that they are entitled to demand in a well-organised community, where the costs in themselves should not be an obstacle. In Sweden, as earlier in England, an investigation into the renal service has been started. Close international cooperation is necessary, on the technical side as well as on questions of organisation.

REFERENCE

DISCUSSION

The Chairman: The three papers are now open for discussion. Any questions and comments?

Dr. J. L. Funck-Brentano (Paris): I should like to make a brief comment on calcium deposits in patients treated by chronic haemodialysis. On our patients treated by this method, we very seldom have observed calcium deposits in articulations. We have seen calcium deposits in vessel walls, inside the kidney and the lung in three patients only. Since our ophthalmologist, Dr. D. Perrin, looked at the corneal limbus with a slit lamp, she finds calcium deposits in the corneal limbus of many patients.

Fig. 1. The first slide shows you the picture of the limbus as it can be seen with a slit lamp in a patient having no calcium deposit before the treatment by haemodialysis.

Fig. 1. The corneal limbus lightened by a slit lamp. Normal aspect.

Fig. 2. This second slide concerns the same patient 3 months later after a twice a week treatment by haemodialysis. As you can see, calcium deposits can be clearly seen in the limbus of the cornea.

We have carried out a slit lamp examination on the corneae of 7 patients. Two of these had no corneal deposit. One of them had a cataract; she was hypocalcaemic which makes the problem quite different.

The other 5 patients had deposits which sometimes appeared very soon in the course of the treatment, about 6 weeks after the beginning of the haemodialysis in one patient.

I cannot tell you what is the cause of these calcium deposits. The serum calcium level of these patients between the dialysis sessions was normal. In 4 of the 5 patients having calcium deposits in the limbus the calcium level of the plasma at the end of the dialysis session was too high: usually between 105 and 117 mg/l. But even in these patients, the serum calcium, 12 hours later—which means on the next morning—was down to normal levels. I do not
think that to have during 12 hours twice a week, a plasma calcium level up to 105 to 117 mg/litre could be the sole explanation of this phenomenon of calcium deposit in the corneal limbus.

Fig. 2. The corneal limbus lightened by a slit lamp. Calcium deposits can be seen in the corneal limbus.

One of these patients who had a normal serum level of calcium during all the treatment by haemodialysis, had an increase of his serum calcium up to 140 mg/litre after a successful renal transplantation.

Because we thought that this high calcium level was due to hyper-parathyroidism, a parathyroidectomy has been made. Actually, 3 months after this operation, calcium deposit in the cornea seems to decrease.

Dr. H. P. McDonald (New York): In the transition of our dialysis unit from Kolff tanks that we had available to a Kiil system we used a combined Kolff-Kiil system shown in the diagram.

In the past ten months we have done over 500 dialyses successfully with this system utilizing a Kolff tank, rubber tubing to the Kiil dialyser, and negative pressure generated by
simply sticking a rubber hose out of the hospital window and monitoring the negative pressure with a gauge in the dialysate line. The grass along that side of the hospital died but the system has worked very successfully with a minimum of complications.

The advantage of the Kolff-Kiil system shown above is that it is inexpensive to make the transition from Kolff dialysis to Kiil dialysis since the Kolff tanks and heating system that are available can be utilized for the Kiil dialysis. Should an acute dialysis utilizing the Kolff dialysis system be desired, a simple adjustment in the hose renders the Kolff system ready for the acute coil dialysis. Later in the day the Kolff-Kiil system can be re instituted for the treatment of overnight chronic dialysis patients.

The ten month period in which overnight dialyses was performed with the above system was accomplished with two Kolff tanks and four beds of Kiil dialysis performed during each overnight dialysis. At the present time we have moved to a 14 bed central dialysis delivery system using the modified Kiil kidney.

We have only one girl in our program at the present time. She recently won a beauty contest and has been dialysed for over a year.

Dr. D. N. S. Kerr (Newcastle): Just one point about Dr. Drukker's paper. He assumed, I think perhaps a little too easily, that the poorer results of the twin coil were entirely due to the twin coil. I should like to know whether he can provide some further information. I imagine that the twin coil has been used by the people who are changing over from acute dialysis to doing one or two chronic patients, while the Kiil has largely been used by people who are starting a more definite programme. This may account for the poorer results, rather than the difference in dialyser. Can you answer that one?

Dr. W. Drukker (Amsterdam): Mr. Chairman, may I ask Dr. Alberts if he can say something about this question?

Dr. C. Alberts (Amsterdam): I may answer Dr. Kerr that we considered either the Kiil type of dialyser or the Twin coil for regular dialysis treatment. Other types of dialysers were excluded from our report.

Dr. P. Michielsen (Leuven): At the University of Leuven two groups are dialysing chronic patients. One group uses a Kiil kidney and the other group uses Travenol twin coils with the modification presented here at the exhibition. The clinical results are completely identical.

Dr. W. Drukker (Amsterdam): May I ask Dr. Michielsen how long your two groups have been going on?

Dr. P. Michielsen (Leuven): For 2 years.

Dr. W. Drukker (Amsterdam): Two years—nearly the same. This is highly interesting because we both got the impression that the Kiil was much better but your experience is quite important.