Experience with Chronic Haemodialysis in Johannesburg

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SUMMARY

Since 1966 the treatment for patients with end-stage renal disease in Johannesburg has primarily been renal transplantation. This has required an adequate programme of regular dialysis. All patients were treated at the central hospital or at two small satellite units. A total of 158 patients, mean age 34,2 years (88 males) have been dialysed. The mean duration on dialysis prior to transplantation was 5,6 months (range 1 week - 23 months). The commonest cause of renal failure in males was chronic glomerulonephritis (63%), whereas in females it was analgesic nephropathy (39%).

Twenty-seven patients (17%) died while on dialysis, including 6 who had had unsuccessful transplantations. Renal osteodystrophy was diagnosed in 30% of the patients. Hepatitis has been endemic among both patients and staff. Nephrectomies were done in 106 patients. Ten patients had operations for peptic ulcer and 5 parathyroidectomies were performed. The number of patients unsuccessfully transplanted, or who died, was less than the number of new patients requiring treatment. In addition, an increasing proportion of patients have become 'relatively untransplantable'. This has led to overloading of facilities.

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The treatment for patients with end-stage renal disease in Johannesburg is transplantation. Accordingly, the haemodialysis programme is orientated towards renal transplantation rather than long-term dialysis. Our experience with long-term peritoneal dialysis has been reported.[1] Regular haemodialysis (RHD) began in 1966 and since then facilities have expanded so that in 1973 there were 7 beds in the Johannesburg Hospital, 2 at the attached Non-European Hospital and 1 each at satellite units at the Discoverer's Memorial[2] and Krugersdorp Hospitals. The total number of patients treated on RHD at any one time increased from 2 in 1966 to 26 patients in 1973. This article presents the experience at the Johannesburg Hospital and satellite centres from January 1966 until 30 June 1973.

Together with the independent unit at the H. F. Verwoerd Hospital in Pretoria, our unit treats patients mostly from the Transvaal, but also a number from Portugal, the Portuguese territories of Southern Africa, Rhodesia and the rest of the Republic of South Africa. The unit caters mainly for the White population, but 8 Blacks have been treated at the allied Non-European Hospital. Furman recently published an analysis of the dialysis facilities in this country.[3]

When transplantation was started in 1966 the criteria for selection were rigid and strict: no patient older than 45 years was considered, and any patient with systemic disease was excluded. Over the years these criteria have become less stringent; the age limit has been extended to 60 years, and patients with disease affecting other organs have also been accepted. However, diseases such as severe diabetes mellitus, diffuse vascular disease or collagen disorders are usually contra-indications.

PATIENTS

Between January 1966 and 30 June 1973 a total of 158 patients were dialysed. The age and sex distribution are shown in Table I. The majority were between 20 and 49 years. The mean age of patients treated until 1971 was 32,9 years, whereas by 1973 it was 34,2 years, reflecting the increase in patients aged 50 - 59 years accepted for transplantation.

The different causes of renal failure in the group are shown in Table II. As has been found in most other centres, chronic glomerulonephritis accounted for the largest number (49%) and occurred more commonly in males. A striking feature was the high incidence (20% of all cases) of analgesic nephropathy, which was the commonest cause of renal failure in females (39%). As pre-

TABLE I. AGE AND SEX DISTRIBUTION OF THE PATIENTS

	Age (years)					
	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59	Total
Male	8	18	29	23	10	88
Female	6	16	31	14	3	70
Total	14	34	60	37	13	158

TABLE II. CAUSES OF RENAL FAILURE IN THE PATIENTS

	No.	Male	Female	%
Glomerulonephritis	77	55	22	49
Analgesic nephropathy	32	5	27	20
Pyelonephritis	19	4	15	12
Congenital	10	7	3	7
Polycystic	9	8	1	5
Hypertension	4	3	1	3
Miscellaneous	7	6	1	4
Total	158			

TABLE III. NUMBER OF PATIENTS DIALYSED AND DURATION OF THEIR DIALYSIS

	Duration on dialysis (months)					
	0 - 3	4 - 6	7 - 9	10 - 12	13 - 15	16+
No. of patients	78	34	17	8	2	19
% of total	49	22	11	5	1	12

Mean duration = 6,8 months.

viously reported,[4,5] 7% of the patients seen in the Renal Unit of the Johannesburg Hospital over the period January 1963 to December 1970 were diagnosed as having renal disease due to analgesic abuse. Under the heading 'congenital' are included hypoplastic, dysplastic, medullary sponge kidney and 3 patients with the megacystis-megaureter syndrome. The miscellaneous group includes 1 patient with cystinuria, 1 with renal tuberculosis, 1 with bilateral renal artery occlusion after trauma, 1 with cortical necrosis and 3 with hereditary nephropathy.

Associated disease, unrelated to uraemia, was seen in 20% of the patients, and was mainly cardiac in nature, either ischaemic or valvular. Tuberculosis was present in 3 patients, a malignant carcinoid was found in 1, and 2 had diverticular disease. In some patients the associated disease was directly responsible for their deaths, either on dialysis or after transplantation.

Table III shows the total duration on dialysis. The mean duration was 6,8 months, with a range of 1 week to 85 months. However, the mean duration on dialysis prior to transplantation was 5,6 months. This has increased significantly since 1971 when it was 3,8 months, probably because the number of patients accepted for dialysis has increased faster than the number of transplantations performed.

TECHNIQUES OF DIALYSIS

With the exception of one patient who was subsequently transplanted, all patients, including those who are hepatitis B antigen (HBAg) positive, were treated in the various hospital centres. The early dialyses were performed on a single Kolff machine. Later a central system with Kiil dialysers, using initially softened water and later de-ionised water, was installed. During 1972 - 1973 more single-patient machines with coil as well as Kiil dialysers were employed. Of the 158 patients, 86 were dialysed predominantly on Kiil dialysers. Originally these were conventional 1-m^2 units, and patients were dialysed for 14 hours twice a week or 10 hours three times a week. From 1972 onwards a number of Meltec Multipoint 1-m^2 Kiil dialysers were also used, and the duration of dialysis reduced to 11 hours twice a week or 7 hours three times a week. Seventy-two patients have been dialysed mainly on coil dialysers. The coil dialysis times were 6 - 8 hours twice a week, or 5 - 6 hours three times a week. In the earlier years, external shunts were invariably used, but later internal fistulae were preferred, since they provided a satisfactory access to the circulation and usually had a longer life than shunts. Usually these fistulae were constructed before the patient came onto RHD. Patients were taught, where possible, to connect themselves to the dialysers and also to cannulate their fistulae.

The dialysate content was sodium 132 mEq/litre, potassium 2 mEq/litre, calcium 3 mEq/litre, magnesium 1,5 mEq/litre, chloride 105 mEq/litre, acetate 34 mEq/litre and glucose 400 mg/100 ml. In 1973 the potassium concentration was reduced to 1,5 mEq/litre.

All RHD patients were maintained on a high calorie (at least 2 000 calories/day) diet with a protein content of 1 g/kg bodyweight/day. Fluid intake depended on urinary output. Supplementation consisted of vitamin B compound, and ascorbic and folic acids. In addition, all received aluminium hydroxide gel and calcium. Iron was given either orally or parenterally.

RESULTS

Dialysis Deaths

The number and causes of dialysis deaths are shown in Table IV. Twenty-seven patients (17%) died while on dialysis, including 6 who had unsuccessful transplantations

TABLE IV. NUMBER OF PATIENTS AND CAUSES OF DIALYSIS DEATHS

Cardiac	9
Pericarditis	1
Infection	4
Sudden death	4
Hyperkalaemia	2
Postoperative	3
Neurological	2
Cancer	1
Suicide	1
Total	27 (17%)

and were returned to dialysis. The mortality was 11% of those on dialysis in each year. The male to female ratio was the same as for the group as a whole. The commonest immediate cause of death was cardiac failure, sometimes with severe hypertension. The syndrome of severe cardiac failure, pericarditis, malignant hypertension, ascites and progressive wasting was seen in 3 patients. Bilateral nephrectomy was performed as definitive treatment in 1 patient, but the patient died. Another patient in this category was withdrawn from dialysis. One patient died while undergoing pericardial aspiration, and 2 of the infective deaths were due to tuberculosis. In the group labelled 'sudden death', death occurred at home and no autopsy was obtained; of these, 1 patient was known to have ischaemic heart disease. Four postoperative deaths have previously been reported,[3] and include 1 death due to infection. The patient with a malignant carcinoid was withdrawn from the programme within a month of starting dialysis. The mean age at death was not significantly different from the mean age of the total group. Five patients died within a month, 6 between 1 and 3 months, 5 between 4 and 6 months, 6 between 7 and 12 months, 4 between 13 and 24 months, and 2 survived 34 months and 85 months, respectively.

Clinical State of the Patients

The clinical state of the patients at the start and at the end of dialysis is summarised in Table V. Some degree of hypertension and circulatory volume overload was present in 81% of patients at the beginning of dialysis. However, at the end of the dialysis period both hypertension and overload had been controlled, or at least alleviated significantly, in more than 80% of patients. Although nephrectomy may ease control of hypertension and fluid overload, we have not assessed this factor, as approximately two-thirds of our patients were subjected to nephrectomy, usually soon after starting RHD. Pericarditis present before dialysis was generally controlled by dialysis, but 9 patients developed this after some months of dialysis. The incidence of renal osteodystrophy was assessed clinically, radiologically and on the basis of the serum alkaline phosphatase level. Either alone or together, hyperparathyroidism, osteoporosis, osteomalacia and metastatic calcification (mainly conjunctival) were found in 36 cases, while an elevated alkaline phosphatase level alone was found in 10 cases. This almost certainly underestimates the true incidence of the disease. It is apparent that the incidence was approximately the same before (23%) and after (24%) dialysis. The 3 patients operated upon for hyperparathyroidism presented at the start of RHD and surgery was done prior to transplantation. Three patients developed mild bone disease due to hyperparathyroidism later in the course of dialysis and were not operated upon. Two cases of crippling osteoporosis developed on dialysis. Although there was no significant difference in the incidence of peripheral neuropathy before (27%) or after (31%) dialysis, severe neuropathy at the beginning of dialysis improved in most cases, and the neuropathy that did develop on dialysis was mild.

TABLE V. CLINICAL STATUS OF PATIENTS

Parameter	Predialysis	During dialysis
Hypertension		
Severe	40	2
Moderate	46	22
Mild	42	45
None	30	89
Cardiac failure		
Severe	14	6
Moderate	73	15
Mild	28	46
None	43	91
Pericarditis	28	8
Osteodystrophy	33	36
Neuropathy	42	49

Haematological Features

When RHD started in 1966, frequent blood transfusions were given. The average number of transfusions per patient per month was then 14,3 units. This has steadily decreased until the average number of transfusions per patient per month was 0,5 units for the period 1971 - 1973. This relatively high transfusion rate is partly accounted for by transfusions in patients undergoing nephrectomy, the necessity in the early years to prime the Kolff dialyser with blood, and in some by blood loss due to dialyser leaks. From 1969 until early 1973, the records of 48 consecutive patients who were on RHD and then subsequently transplanted, were analysed with regard to their haemoglobin (Hb), white blood count (WBC) and iron saturation. The mean Hb was 6,1 g/100 ml, the mean WBC 6 900/mm^3 and the mean iron saturation 29%. Two patients had a WBC less than 4 500/mm^3, 1 of whom had mild splenomegaly and was HBAg-positive. Since the beginning of 1973, 4 patients have had leucopenia (WBC less than 4 500/mm^3) associated with clinical splenomegaly. Two have had splenectomy with disappearance of the leucopenia, while the other 2 remained with a relative leucopenia.

Rehabilitation

The degree of rehabilitation was only considered in those patients who had been on dialysis longer than 3 months. For the females, return to their former housewifely duties was considered to be full rehabilitation. Thus, of the 94 patients assessed, 37% were fully rehabilitated, 37% partially so and 26% not at all.

Hepatitis

HBAg testing by radio-immunoassay was instituted at the beginning of 1972. Before this, hepatitis was diagnosed in 5 patients, 2 of whom were subsequently tested and found to be HBAg-positive. In the 18 months since routine testing was started, 11 patients of 62 tested were HBAg-

positive, and 4 of these have since become negative. One patient developed chronic active hepatitis on dialysis. Another patient, subsequent to this analysis, had active hepatitis at autopsy. In general, few of the patients with persistent antigenaemia were clinically ill or showed evidence of continuing liver damage.

Before routine testing, approximately 7 staff members became ill with presumed serum hepatitis. One hundred and nineteen staff members have been assessed serologically at least once since routine testing was introduced, and of these 11 have become ill with proved serum hepatitis and 1 has died. In addition, 3 had serum enzyme changes compatible with subclinical hepatitis and became hepatitis B antibody (HBAb) positive, while a total of 11 are now HBAb-positive. Thus hepatitis is endemic in the dialysis unit.

Major Operations

From 1966 to 1970 it was unit policy to do nephrectomies on all patients before transplantation.[7] Thereafter the indications for nephrectomy have been any renal disease associated with recurrent urinary infection, polycystic disease and the occasional case of uncontrollable hypertension. In all, bilateral or unilateral nephrectomy was performed in 106 of the 158 patients. Ureterectomy was not a routine accompaniment. Pyloroplasty and vagotomy were performed in a total of 10 patients diagnosed as having peptic ulceration. Interestingly, in about half of these patients no ulceration was found at operation. In these the incidence of postoperative complications was high. Of the 5 subtotal parathyroidectomies performed, histological hyperparathyroidism was found in 3. In addition, there were 4 splenectomies, 1 cholecystectomy, and 1 intra-abdominal abscess was drained.

DISCUSSION

When RHD was started in Johannesburg Hospital for the treatment of end-stage renal failure it was realised that its success depended on a successful renal transplantation programme. Because dialysis facilities were limited, the absence of such a programme would have rapidly led to saturation of the dialysis facilities, and only a few patients would then have been treated. Conversely, successful transplantation required a dialysis unit able to maintain patients until transplantation became possible and to treat those patients in whom transplantation failed. That this approach was correct is supported by the relatively large number of patients treated in a small unit, together with the good results (70%, 5-year actuarial graft survival rate) achieved by transplantation at this hospital. This development differs from that in some other countries, where more dialysis facilities are available, and proportionately more patients are treated by RHD. While RHD is an acceptable form of treatment and sometimes the only treatment that should be offered to certain patients, it is our opinion that the management of patients with terminal renal failure requires facilities for both dialysis and transplantation, and that these forms of treatment are interdependent.

However, it has become apparent that the number of patients presenting for treatment has increased steadily, necessitating more and more provision of space, equipment and trained staff. In Fig. 1 it can be seen that there

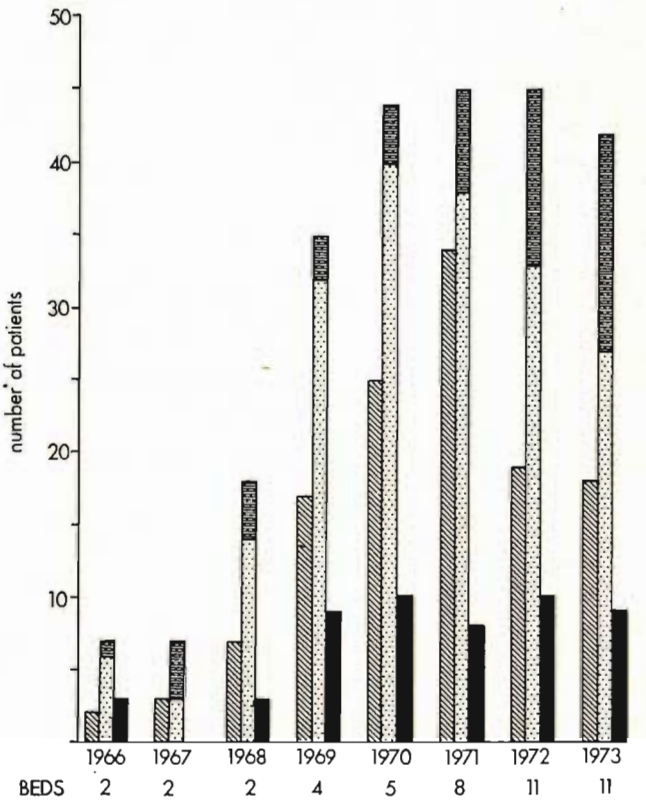

Fig. 1. The stippled area shows the total number of patients treated by haemodialysis in a particular year. The parallel hatched section of the stippled column denotes those patients who are 'relatively untransplantable'. The black column shows the combined dialysis and transplantation deaths, while the cross-hatched column shows the number of transplantations performed in that year. Those who died or had transplantations done in any one year, did not necessarily start dialysis in the same year.

were 2 dialysis beds in 1966 and 11 in 1973 (including 2 small satellite units). Whereas 7 patients were dialysed in 1966, 45 were so treated in 1971 and 1972. The most patients transplanted in any one year was 32 in 1971. The number of patients dying has remained more or less constant during the past 4 years, but the proportion of patients being dialysed who are 'relatively untransplantable' has increased to about 1 in 3 patients in 1973. These are patients who are highly presensitised or who have had an unsuccessful transplantation. To cope with this situation of an increasing patient load, peritoneal dialysis on a regular basis has been used to hold patients until they can have RHD or transplantation. In our experience peritoneal dialysis is an inferior and more costly form of treatment. Clearly, the answer lies in an increase in the number of kidneys donated for transplantation and in an increase of haemodialysis facilities. Planning should provide for haemodialysis of patients awaiting transplantation and for

those who are unsuitable for transplantation but can be rehabilitated by RHD.

Clinically, the pattern of disease seen in this group of patients is similar to that described generally. Of particular note is the number of patients with analgesic nephropathy, especially among females, reflecting the high incidence of this disease seen in the Johannesburg Hospital Renal Unit.[4,5] Hepatitis has been endemic among patients and staff and was generally of a mild form. Eradication of this from a dialysis area requires separate facilities for infected and non-infected patients. Ideally, this will only be achieved when dialysis is done by the patient in his home, out of the hospital environment.

Because of the relatively short period these patients receive RHD before transplantation, it is difficult to compare the results of dialysis with those reported by other units where patients are treated for much longer periods of time. The early mortality rate has been relatively high, but the incidence of serious complications due to renal failure and dialysis is low. As more patients are treated for longer periods it may be possible to predict the long-term course on RHD at this hospital more accurately.

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