

MAINTENANCE HEMODIALYSIS—A CLINICAL REVIEW

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INTRODUCTION

The concept of hemodialysis for management of terminal renal failure is not new. Abel in 1913 first described in vivo dialysis where he pointed out that "a method has been devised by which the blood of a living animal may be submitted to dialysis outside the body and again returned to the natural circulation". In 1943 Kolff successfully treated a number of temporary oliguric patients with a rotating drum dialyzer of his own design. However, the first successful application of hemodialysis to the long-term treatment of chronic renal failure was accomplished in 1960 by Scribner and his group in Seattle. Since its inception, this form of treatment has spread throughout the world and it now occupies an important place in the therapeutic armamentarium of any nephrologist in his approach to end stage kidney disease.

It is the purpose of this paper to describe briefly the various aspects of hemodialysis as carried out by one such unit in Israel and to review their clinical experience in a four year period.

PATIENTS

Thirty patients, 7 females and 23 males suffering from end stage renal failure were accepted for maintenance hemodialysis during the years 1965-1969. These patients were taken on a first come first served basis without selection, except for very gross non-suitability e.g. in the presence of systemic diseases like diabetes mellitus, disseminated lupus erythematosus or amyloidosis. Patients with severe psychiatric disturbances were also excluded. All the patients chosen had serum creatinine of more than 10 mgm.% or creatinine clearance less than 5 ml./min. The age of the patients were between 15-62 years as shown in Table I. The basic diseases causing the renal failure is shown in Table II.

TABLE I

AGE OF PATIENTS AT INSTITUTION OF HEMODIALYSIS

Age in Years	No. of Patients
< 20	1
20-29	6
30-39	12
40-49	9
60-62	2
TOTAL	30

TABLE II

DISEASE CAUSING THE CHRONIC RENAL FAILURE

Clinical Diagnosis	No. of Patients	Histological Proof
Glomerulonephritis	10	5
Pyelonephritis	10	7
Pyelonephritis secondary to urologic disorders	5	1
Amyloidosis	1	1
Hypertensive nephrosclerosis	1	1
Polycystic kidneys	2	1
Unknown	1	—

METHOD

Hemodialyses were performed with the Kiil dialyzers twice weekly for 12-14 hours each time, using a gravity central dialysate supply system (Eliahou *et al*, 1968). The procedure was initiated and terminated by specially trained nurses and the physician acts in a supervisory capacity. All

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patients had a surgically created radial arterio-venous fistula as described by Brescia and his associates (Brescia *et al.*, 1966), although the earlier cases initially had external Scribner-Quinton shunts (Quinton *et al.*, 1960). The internal arterio-venous fistulae are preferred to the Teflon-Silastic external shunts in a large number of dialysis centres around the world. It has survived for longer periods of time with fewer complications and is preferred by both patients and staff. If for any reason this is impossible, a saphenous vein autograft is used to bridge the gap between the radial or ulnar artery at the wrist and a large vein just below the antecubital skin crease (Mozes *et al.*, 1970).

Blood was obtained before and after each dialysis for determination of urica, electrolytes and hematocrit. Buffy coat free packed cells were transfused only when the hematocrit fell below 15% or when patients developed symptoms of anemia. As a rule, systemic heparinization was used and this was neutralized by protamine sulphate injections at the end of each procedure. Regional heparinization was utilized only when bleeding was apparent or suspected, in the immediate post-operative period or in patients with proven gastric or duodenal ulcers.

Patients were maintained on a diet that was variable but, as a rule, moderate restriction was placed upon sodium and fluid intake especially those with severe uncontrolled hypertension and weight instability. Medications consisted of various hypotensives and multivitamins. Antibiotics and digoxin were dispensed as the need arose.

RESULTS

Survival Rates

The survival data is shown in Table III. Out of 30 patients observed during this four year period, 11 died giving an overall survival rate of 63%. Meaningful comparisons however are difficult to make with other centres since patient selection, differences in technique and duration of treatment tend to vary from one centre to another. In a recent analysis of 302 patients receiving dialysis treatment of varying duration throughout a seven year period in America, Gottschalk (1967) revealed a cumulative survival rate of 87.0% for the first year, 67.4% for three years and 57.8% for seven years.

In our series survival data is expressed in periods of 6 months each starting from the third month as no deaths occurred in the initial 3 months. It is noted that survival of 9-15 months is easily achieved since only 2 deaths occurred

TABLE III
SURVIVAL DATA

Survival of patients on MHD. Denominator denotes available patients at the indicated period and decreases if the duration of treatment falls short of that period or if the patients were taken out for transplantation.

No. of Patients	Period of Survival (Months)				
	3-9	9-15	15-21	21-27	More than 27
30	30/30	28/30	18/24	7/15	2/13

TABLE IV
CAUSES OF DEATH IN PATIENTS AT 27 MONTHS

Causes of Death	No. of Patients
Sepsis	4
Hyperkalemia	2
Severe hypertension	2
Gastro-intestinal hemorrhage due to acute ulcer	1
Progressive amyloidosis	1
Unknown cause	1

within this period. However, the death rate rises with the passage of time and only 2 patients out of 13 survived more than 27 months. 3 patients underwent successful transplantation. Details of the various causes of death are shown in Table IV. It is pertinent to note that out of 4 patients who died of sepsis 3 did so as a result of external shunt infection which subsequently became generalized. As a result of this unhappy experience, the internal arterio-venous fistula is now adopted as a routine.

An analysis of the patients who died revealed that 6 belonged to the "unsuitable" or "non-ideal" group in that they were elderly, had severe hypertension or repeated episodes of cardiac decompensation. There were a total of 7 such patients treated during this period. Although the role of "playing God" is repugnant to all physicians, we feel that some form of patient selection is necessary, not forgetting, on the other hand, that predictions as to total response of any patient prior to clinical trial remain precarious.

Rehabilitation

The success of long-term dialysis has been measured more critically in terms of rehabilitation. Alleviation of symptoms and occupational re-

habilitation have been the prime criteria. Out of 28 patients who reached the 9-15 month period, 12 patients were fully rehabilitated, 8 patients were partially rehabilitated and the rest were restricted in activity.

Factors Affecting Longevity of Patients

It is difficult to distinguish complications of therapy from those of renal failure per se. However, as both influence the outcome of successful treatment, we have analysed various relevant factors which tend to increase morbidity and mortality rates of our patients.

(a) Hypertension

At the start of treatment, 15 patients had hypertension. 12 of these had moderately raised blood pressure with a diastolic pressure of 90-125 mm. Hg. This group was easily controlled with diet, hypotensive therapy and variations of sodium concentration in the bath fluid. However, the 3 patients who had a consistently high diastolic pressure of over 125 mm. Hg. were more difficult to manage. 2 of them died within 12 months of onset of treatment.

(b) Heart Failure

11 patients suffered from heart failure. 5 were associated with long-standing hypertension and 2 with rheumatic valvulitis. Whereas the cardiac insufficiency was present prior to the onset of hemodialysis in 8, it developed during the period of treatment in 3. In spite of adequate control of symptoms, 5 died within the first year, and a total of 9 died during the period of observation.

(c) Infections

Infections especially in the area of external arterio-venous shunts have been very common and contributed to death in 3 cases. However, with the introduction of internal fistulae only 4 transient bacteraemic episodes were reported, none of which was associated with clinical sepsis or bacterial endocarditis.

5 patients in the group suffered from clinical hepatitis with jaundice and 7 had non-specific symptoms of weakness and high transaminase levels. All of them survived. Only 3 of our nurses out of 25 who worked in the unit during the four year period under study developed transient icteric hepatitis, but with complete recovery.

(d) Peripheral Neuropathy

Incipient peripheral neuropathy of a mild nature occurred in 5 patients. 2 of these had mild subjective symptoms of para-esthesia and 3 had prolonged nerve conduction. None of them was symptomatically disabled and in none was the disease progressive.

(e) Bone Disease

Contrary to reports in the literature (Caner *et al.* 1964; Curtis *et al.* 1966; Kaye *et al.* 1966), no bone disease or gout occurred in our present group of patients, although this was looked for.

(d) Gastro-intestinal Hemorrhage

5 patients developed gastro-intestinal hemorrhage. 2 had severe bleeding episodes and necessitated surgical intervention. The remaining 3 had mild episodes of bleeding without causing major clinical deterioration.

COMMENTS

Since its inception 10 years ago, maintenance hemodialysis is now recognised as an effective method in restoring patients with end stage kidney disease to a "useful form of existence". The technique of hemodialysis as employed by a unit in Israel is described. The survival and rehabilitation data, mortality and morbidity factors over a four year period are presented. It is felt that to achieve optimal results, patient selection and routine use of internal arterio-venous fistulae are important.

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