Continuous ambulatory peritoneal dialysis in the treatment of diabetics with end stage renal failure

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SUMMARY

From September 1978 to January 31st 1982, 26 diabetics were treated with CAPD. There were 9 insulin dependent (ID) patients with a mean age of 33.4 ± 6.1 and 17 non insulin dependent (NID) patients with a mean age of 60.8 ± 8.4 years.

In 8 patients, CAPD was the initial mode of maintenance therapy. In 18, home IPD was used prior to CAPD, most patients were started on PD when their C_{cr} was in the range of 5-10 ml/min.

Diabetes control was considered satisfactory as long as, blood glucose levels remained in the range of 4-5 to 13.5 mmol/l. Insulin was given i. p. in 12 patients, but other subjects with poor vision choose to continue with twice daily subcutaneous injections as a more suitable schedule than infusing insulin in their bags 4 times a day. Other 4 patients were on Sulfonamides and the remaining 2 with diet alone.

Twelve patients (5 ID, 7 NID) were still on CAPD in February 1982. Other 7 patients were transferred (6 to IPD, 1 to HD) and still alive. Seven patients died, in 4 the death ocurred as the patients were still on CAPD, and in the remaining 3, the patients died after being transferred on IPD.

The vision status was analized in 16 patients treated with CAPD for more than 6 months. In 5 ID patients the vision status remained stable or improved, whereas among NID diabetics a deterioration was noted in 4 over 11 patients.

Twenty-six peritonitis episodes were observed in 14 patients. The peritonitis incidence expressed in terms of one episode per patient treatment months was respectively 1/17.7 in ID and 1/13 in NID- diabetic patient.

In 16 ID patients the percent survival rates were 100, 94 and 86 at one, two and three years. In the 37 NID the cumulative survival at one, two and three years were 87, 58 and 39 %.

Key words: CAPD, CAPD in diabetics.

RESUMEN

Entre septiembre de 1978 y febrero de 1982 se trataron 26 diabéticos en IRT con DPCA. Nueve eran insulindependientes (ID), con una edad media de 33,4 ± 6,1 años y 17 no insulindependientes (NID), con 60,8 ± 8,4 años de edad. En 8 pacientes (2 ID y 6 NID) la DPCA fue el tratamiento inicial, mientras que 18 (7 ID y 11 NID) habían sido tratados previamente con DPI domicialiaria durante tiempos variables (1,3 años en los ID y 0,6 años los NID). La mayoría de los pacientes ingresaron en DP cuando su C_{cr} estaba entre 5 y 10 ml/mm.

El control de la diabetes se consideró satisfactorio si los niveles de glucemia se mantenían entre 4,5 y 13,5 mmol/l.

Se administró insulina i. p. con cada uno de los cuatro cambios diarios en 12 pacientes (4 ID, 8 NID). Otros 8 enfermos con visión muy defectuosa eligieron continuar con dos dosis diarias subcutáneas. Cuatro pacientes más se controlaron con sulfonamidas y los 2 restantes con dieta.

La duración total acumulada de tratamiento es de 31,4 años (11,7 ID y 19,7 NID).

Doce pacientes están aún en DPCA (5 ID, 7 NID), otros 7 continúan vivos después de haber sido transferidos a otras técnicas, 6 DPI y uno a HD.

De los 7 pacientes fallecidos, en 4 (1 ID, 3 NID) la muerte sucedió estando en DPCA, mientras que los 3 restantes (1 ID, 2 NID) tuvo lugar después de pasar a DPI.

La PA se controló bien en todos los pacientes, siendo necesaria medicación antihipertensiva en sólo 3 casos. La anemia mejoró en ambos grupos de pacientes (ID y NID), pasando la Hb de 8,3 ± 1,8 a 10,7 ± 2 g/dl. después de 6 meses de DPCA.

Se asistió a un deterioro de la enfermedad vascular periférica en 10 pacientes, así como a empeoramiento de clínica de angor en 3.

La visión fue evaluada en 16 pacientes tratados durante más de 6 meses en DPCA. En 5 enfermos ID permaneció estable o mejoró. En 4 de los 11 NID hubo deterioro debido al desarrollo de cataratas.

Hubo un total de 26 episodios de peritonitis, 8 en 5 ID y 18 en 9 NID. La incidencia de peritonitis fue de un episodio cada 17,7 meses de tratamiento en pacientes ID y 1/13 en los NID.

Dado que la mayoría habían sido tratados con DPI previa, el cálculo de supervivencia actuarial se ha hecho incluyendo todos los tiempos de tratamiento con DP (total DPCA + total DPI). De este modo la supervivencia en 16 pacientes ID es de 100, 94 y 86 % a 1, 2 y 3 años, respectivamente. En el caso de los NID resulta de 87, 58 y 39 % en los mismos intervalos.

Palabras clave: DPCA, DPCA en diabéticos.

INTRODUCTION

The treatment of end stage renal failure (ESRF) in diabetic patients is hampered by the multiorgan involvement including retinopathy, neuropathy, peripheral vascular disease, coronary artery disease and cardiomyopathy typically associated with diabetic nephropathy.

From 1968 to 1973, the poor results obtained in a limited number of diabetics treated with haemodialysis (HD) encouraged us to assess the value of intermittent peritoneal dialysis (IPD) in this population with two main objectives:

1. To ensure long term survival and adequate dialysis with a slow progression and/or an improvement of diabetic retinopathy.
2. To develop home dialysis amongst this group of disabled patients.

Since September 1978, CAPD was made available in our area [1]. This new dialysis mode was proposed to all our diabetic patients, including those previously treated with home IPD. This paper reports the experience acquired over three and a half year period in treating diabetics with CAPD, emphasizing the progression of diabetic complications, the metabolic control of diabetes and the prevention of peritonitis.

PATIENTS AND METHODS

Patients

From September 1978 to January 31st, 1982, 26 diabetics were treated with CAPD. There were 9 insulin dependent (ID) patients (5 males and 4 females) with a mean age of 33.4 ± 6.1 years and 17 non insulin dependent (NID) patients (7 males, 10 females) with a mean age of 60.8 ± 8.4 years. Patients, both in ID and NID groups were identified according to the World Health Organisation criteria for diabetes mellitus [2] as shown in Table I.

TABLE I

CRITERIA FOR THE SELECTION OF DIABETES MELLITUS (WHO, 1980)

Clinical, biological and/or etiological data	Insulin dependent diabetes	Non insulin dependent diabetes
Proneness to ketosis	+	0
Age at presentation (years)	< 30	> 30
Delay for starting insulin treatment after onset (years)	< 2	> 2
Obesity	0	+
Heredity	±	+
Plasma insulin	↓	N or ↑
HL-A group	+	0
Islet cell antibody	+	0

TABLE II

CARDIOVASCULAR STATUS AT START OF PD IN 9 INSULIN DEPENDENT (ID) AND IN 17 NON INSULIN DEPENDENT (NID) DIABETICS

	ID	NID
Total number of patients	9	17
Prior myocardial infarction	1	1
Angor pectoris	2	8
Congestive cardiac failure	1	7
EKG		
ST segment abnormal	3	7
Left ventricular hypertrophy	5	9
Arrhythmias	2	9
Prior cerebrovascular accident	0	3
Vascular bruits	2	10
Lower limbs arteritis	2	8

In 8 patients (2 ID, 6 NID) CAPD was the initial mode of maintenance therapy; in 18 patient (7 ID, 11 NID) home IPD was used prior to CAPD with a mean duration per patient of 1.3 ± 1.3 years in ID patients and 0.6 ± 0.6 in NID patients.

Table II compares the cardiovascular status of the 9 ID pa-

tients versus the 17 NID before starting CAPD: there was a greater frequency of cardiac and peripheral vascular disease among NID patients.

Most patients were started on maintenance dialysis (IPD and/or CAPD) when their creatinine clearance was in the range of 5-10 ml/min. with creatininemia around 650-800 µmol/l. Despite our attempt to start dialysis early, many subjects were referred to us with uncontrolled hypertension and severe extracellular volume (ECV) overload.

Dialysis technique

A double dacron cuff Tenckhoff catheter was implanted surgically according to our technique [3]. The CAPD technique described in detail elsewhere [4,5] was similar to that used in non diabetic patients. The dialysate exchange schedules included 4 exchanges per day.

Management of diabetes mellitus

Blood glucose levels were measured with a paper reagent (Dextrostix ® Ames Corp., Elkart, Indiana, USA) and read with an electronic device (Eyetone ®, Ames Corp., USA) three times daily, i. e. before breakfast, lunch and dinner, and in case of malaise. Diabetes control was considered satisfactory as long as blood glucose levels remained in the range of 4.5 to 13.5 mmol/l.

Insulin was given intraperitoneally in 12 patients (4 ID, 8 NID) but 8 other subjects (5 ID, 3 NID) with poor vision choose to continue with twice daily subcutaneous insulin injections as a more suitable schedule than infusing insulin in their bags 4 times a day.

A satisfactory diabetes control was obtained with sulfonamides in 4 NID patients whereas 2 other NID patients were doing well with diet alone.

Patient survival

As most diabetics were treated with home IPD of various durations prior to the initiation of CAPD, actuarial survival rates were calculated by including the complete therapeutic sequence (i. e. total CAPD plus total IPD durations) of each patient. The present cumulative survival was calculated according to the method of life table analysis [6]. From this calculation, both ID and NID patients were considered as two separate groups as their mean ages were significantly different; also ID and NID patients treated exclusively with IPD were included in each group (16 ID, and 37 NID).

RESULTS

Outcome

The 26 diabetics admitted in the programme received CAPD for a cumulative treatment duration of 31.4 years with 11.7 years in ID and 19.7 NID patients respectively. As shown in Table III, 12 patients (5 ID, 7 NID) were still on CAPD of 1st February 1982. Among 10 transferred patients, 7 were still alive, 6 on IPD (2 ID, 4 NID), and one on HD. Seven patients (2 ID, 5 NID) died; in 4 patients (1 ID, 3 NID), the death occurred as the patient was still on CAPD, and in the remaining 3, the patients (1 ID, 2 NID) died after being transferred on IPD.

Clinical results

A rapid deterioration in glomerular filtration rate was observed during the first few weeks on maintenance

TABLE III

THERAPEUTIC SEQUENCES AND OUTCOME IN 26 DIABETICS TREATED WITH CAPD

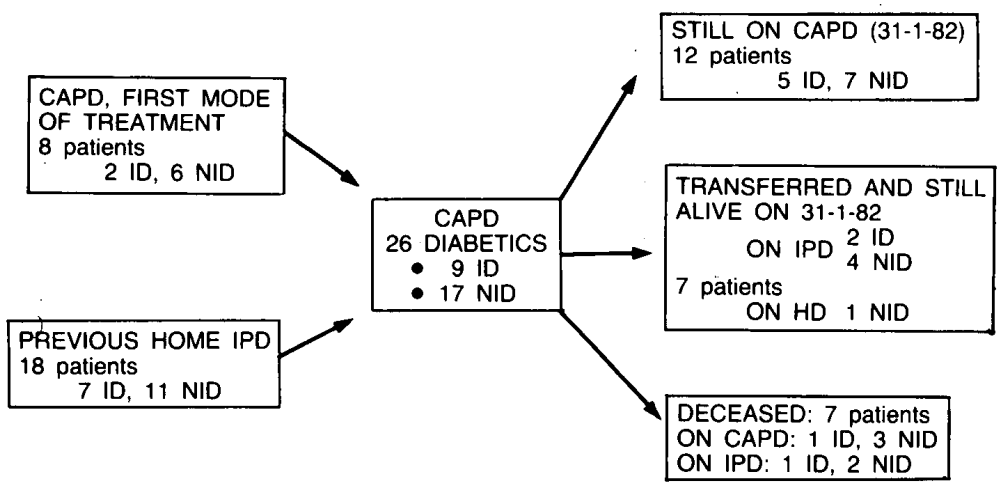

TABLE IV

CARDIOVASCULAR COMPLICATIONS DURING CAPD IN 26 PATIENTS

	ID	NID
Total number of patients	9	17
Deterioration of severe peripheral vascular disease	2	8
Distal gangrene of toes	2	4
Amputation required	1	3
Dementia	0	3
Cerebrovascular accident	1	1
Increase in severity of angina pectoris	1	2

PD, particularly when correction of severe ECV excess was needed. At the last control, the endogenous creatinine clearance was less than 1 ml/min. in 16 patients (8 ID, 8 NID), between 1 and 3 ml/min. in 6 patients (1 ID, 5 NID) and over 3 ml/min. in 1 NID.

Blood pressure was well controlled in all patients and antihypertensive drugs were necessary in only 3 patients (1 ID, 2 NID) at a reduced dosage.. Anaemia improved in both ID and NID patients with haemoglobin levels increasing from 8.3 ± 1.8 to 10.7 ± 2.0 g/dl. in 16 patients (5 ID, 11 NID) receiving CAPD for more than 6 months.

As shown in Table IV, a deterioration of peripheral vascular disease was observed in 10 patients, with gangrene requiring amputation of lower limb extremities in 4 (1 ID and 3 NID). An increase of severity of angina pectoris developed in 3 patients while deterioration in patients with cerebrovascular accidents occurred in 5 subjects.

Tables V and VI show the outcome of the retinopathy and of the neuropathy in 16 patients treated with CAPD for more than 6 months. In 5 ID patients, the vision status remained stable or improved, whereas among NID diabetics a deterioration was noted in 4 over 11 patients due to the development of cataract. Peripheral neuropathy improved clearly in two patients (1 ID, 1 NID) with a decrease in paresthesias and an increase in muscular strength and an improvement in motor nerve conduction velocity (MNCV). On the other hand, a deterioration was observed in 5 patients (2 ID, 3 NID) with a loss of deep tendon reflexes and a decrease in mean MNCV.

TABLE V

VISION STATUS IN 16 PATIENTS TREATED FOR MORE THAN 6 MONTHS WITH CAPD

	ID	NID
Total number of patients	9	17
Number of patients on CAPD for more than 6 months	5	11
AT START OF PD		
Blind one eye	2	4
Blind 2 eyes	1	0
Vision both eyes	2	7
OUTCOME ON CAPD		
Subjective assessment		
Improved	1	1
Stable	4	7
Deteriorated	0	3
Ophtalmologic examination		
Improved	2	1
Stable	3	6
Deteriorated	0	4

Peritonitis

As shown in Table VII, 26 peritonitis episodes were observed in 14 patients. Eight episodes (all infectious with positive culture of peritoneal fluid) occurred in 5 ID diabetics (1.6 episodes/patient), and 18 episodes (16 infectious, 2 cryptogenetic) in 9 NID diabetics (2 episodes per patient). The peritonitis incidence expressed in terms of one episode per patient treatment months was respectively 1/17.7 in ID and 1/13 in NID diabetic patients.

Causes of death

The main causes of death are listed in table VIII. Most deaths occurred as a consequence of the severe vascular disease observed in diabetics with ESRF. One a half year after his transfer on IPD, one NID patient died from pulmonary embolism during a bout of infectious peritonitis.

Actuarial survival

The cumulative percent survival of 16 ID and 37 NID admitted in our home is shown of figure 1: in ID patients, the percent survival rates were 100, 94 and 86 at one, two and three years respectively. In NID patients the cumulative survival at one, two and three years were 87, 58 and 39 % respectively.

DISCUSSION

The data presented here on 26 diabetic patients treated with CAPD confirm our earlier observations on the value of maintenance PD in this high risk population [7].

Our patients received CAPD as a part of a maintenance home PD programme where both CAPD and IPD were widely integrated [8]. This original approach was the result of our long term eyperience with IPD, which obtained an extremely low incidence of peritonitis, parti-

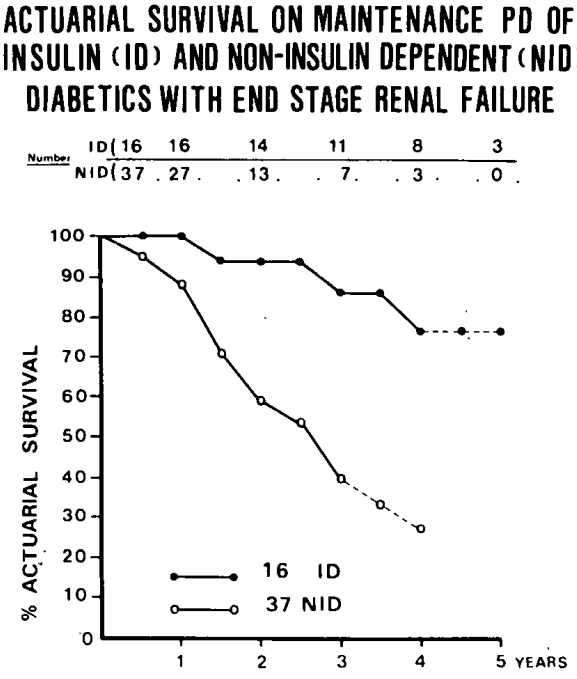

Fig. 1.—*Actuarial survival in 16 ID and 37 NID diabetic patients treated with long term maintenance PD (CAPD and/or IPD).*

cularly in insulin dependent (juvenile) diabetics with one episode every 20.9 patient treatment years [9].

The peritoneal infection rate observed among diabetic patients treated with CAPD differed according to the type of diabetes mellitus. In ID diabetics, the incidence of peritonitis was quite similar to that observed in non diabetics patients using our technique [10]. On the other hand, NID patients had a higher peritonitis incidence (one episode every 13 patient treatment months): this difference may be a consequence of older age, a poorer hygiene and unability to maintain sterility during CAPD procedure or of defective immune defences in the NID diabetic patients. However, in both ID and NID subgroups, the peritonitis incidence was much higher than in patients treated with IPD alone where peritoneal infection was virtually eliminated [9]. This striking difference suggests that the continuous bathing of the peritoneum during CAPD interferes with local defence mechanisms against infection as suggested by VAS et al. [11].

In the present series, the sequential use of CAPD and/or IPD in most patients precluded the calculation of actuarial survival in subjects treated exclusively with CAPD. Therefore, it was neceserary to compute the cumulative survival for all ID and NID diabetic patients admitted on maintenance PD, taking as the period of risk exposure the whole time on PD, including CAPD and IPD whatever the sequence. As previously shown, the percent survival at three years remains the highest ever obtained with a dialysis technique in ID diabetic patients; these data support the contention that CAPD and/or IPD may be the best therapeutic alternative in this subgroup, second only to living related transplant [12,13]. In NID diabetic subjects, the 3 year cumulative survival was much

TABLE VI

OUTCOME OF PERIPHERAL NEUROPATHY IN 16 DIABETIC PATIENTS FOLLOWED UP FOR MORE THAN 6 MONTHS ON CAPD

	ID	NID
Total number of patients	9	17
Number of patients on CAPD for more than 6 months	5	11
AT START OF PD		
No neuropathy	0	3
Neuropathy present	5	7
Neuropathy severe	2	2
OUTCOME ON CAPD		
Improved	1	1
Stable	2	6
Deteriorated	2	3

TABLE VII

PERITONITIS INCIDENCE IN 26 DIABETIC PATIENTS RECEIVING CAPD

	ID	NID
Total number of patients	9	17
PATIENTS WITH PERITONITIS	5	9
Number of peritonitis episodes	8	18
Septic	8	16
Sterile	0	2
Cumulative treatment duration (years)	11.7	19.7
Peritonitis episodes incidence (per patient treatment months)	1/17.7	1/13

TABLE VIII

CAUSES OF DEATH AND MODE OF TREATMENT AT TIME OF DEATH

	Number of patients	Death occurring On CAPD	Death occurring On IPD
INSULIN DEPENDENT			
Lower limb gangrene	2	1	1
NON INSULIN DEPENDENT			
Cerebrovascular accident	2	1	1
Discontinuation of CAPD [1]	1	1	
Lower limb gangrene	1	1	
Pulmonary embolism and peritonitis	1		1
TOTAL	7	4	3

[1] Treatment discontinued on the request of the family because of severe cerebrosclerosis (senile dementia).

lower: the older age of the patients and a high incidence of cardiovascular complications before treatment (Table II) were a cause of increased morbidity and mortality. Similarly poor results have been obtained in haemodialysis in diabetic patients of the same age group [14].

In the absence of a control group treated with HD, we cannot conclude at the superiority of maintenance PD over HD; over the years, the results obtained with HD in a large group of diabetics have been improved [14] and further long term benefits might be brought to this high risk population by new dialysis techniques (e. g. post dilutional haemofiltration, bicarbonate dialysis). Meanwhile CAPD should be considered as a reasonable alternative treatment for diabetic patients with ESRF [15].

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