
**THE USE OF CAPD IN THE MANAGEMENT OF
RENAL FAILURE IN DIABETICS**

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Introduction

Continuous Ambulatory Peritoneal Dialysis (CAPD) was originally introduced by Popovich et al. in 1976, and since its introduction, it has offered better management of diabetic patients with End-Stage Renal Failure. In this context CAPD offers several medical advantages which include, steady-state control of uraemia, easier control of hypertension, stable cardiovascular status without rapid fluid shifts, and good tight control of blood sugar achieved by the intraperitoneal administration of insulin. Social advantages include, freedom from machine and electrical outlets, thereby enabling patients to travel extensively, no need to learn complex machinery and training time can be reduced to 10 - 15 days.

In this project, four studies were conducted. The aims of the studies were to:

Study

Epidemiology

- A Investigate the trend in the incidence of chronic renal failure, and to establish, the frequency of the various causes of chronic renal failure, the stage of renal failure, and the method of treatment
- B Investigate the trend in the incidence of diabetic nephropathy as a cause of chronic renal failure and obtain an idea of the demographic characteristics of patients suffering from diabetic nephropathy.
- C Investigate and perform a retrospective record analysis of a group of diabetic patients and determine the rate and extent of diabetic nephropathy, and obtain an idea of the demographic characteristics of these patients.

Study 2

- A
 - i) Determine patient and technique survival of patients with End-Stage Renal Failure (ESRF) newly treated by CAPD
 - ii) Determine the frequency and causes of complications, particularly peritonitis and catheter-related difficulties

iii) Evaluate the inpatient and outpatient support facilities required

B Predict the time at which ESRF will develop in a group of patients, and treatment planned in advance.

Study 3

A Assess the quality of life of patients currently and previously on CAPD, and the impact which renal failure and subsequently CAPD on them, both psychologically and socially.

Study 4

A Perform a cost-effectiveness study on the use of CAPD.

Methodology

Study 1

Epidemiology

Part A: The list of the number of patients suffering from chronic renal failure was obtained from the Renal Failure Registers kept at the Medical Out-Patients and at the Medical Ward M6. In addition the patients' confidential files kept at the Medical Records were reviewed to obtain necessary information on these patients such as age, sex, cause of chronic renal failure, year of onset of chronic renal failure, the method of treatment, together with the levels of Serum Creatinine and Blood Urea, investigated at several different points in the course of renal failure.

Part B: The patients diagnosed as suffering from diabetic nephropathy took part in this study. For each patient two files were reviewed: the Confidential File kept at the Medical Records, and the Diabetic file which is kept at the Diabetic clinic. Information collected from both files included: age, sex, year and age at onset of diabetes, duration of diabetic nephropathy till the end of December 1991, and levels of Serum Creatinine and Blood Urea investigated at several different points in the course of diabetes.

Part C: A group of 300 patients suffering from diabetes mellitus (Type I and Type II) were selected at random from the daily intake of patients at the Diabetic Clinic at St. Luke's Hospital during the period June to September 1991. When these patients visited the clinic, blood samples were taken to determine the levels of Serum Creatinine and Blood Urea. In addition the Confidential File and the Diabetic File were reviewed to obtain necessary information on them such as age, sex, year and age at onset of diabetes, duration of diabetes to date, the type of diabetes, and levels of Serum Creatinine and Blood Urea investigated at several different points in the course of renal failure.

Study 2

Clinical Aspects

Part A: All patients who have used CAPD in Malta (n=6) took part in this study. The patients' confidential files were reviewed to obtain certain information such as age, sex, year at initiation of CAPD till the end of December 1991, primary renal disease, reasons for choice of CAPD, complicating factors at start of therapy survival on CAPD, number and duration of hospital admissions and complications of CAPD including peritonitis.

Part B: The results of a number of patients (n=36, 14 males, 15 females) having a serum creatinine higher than 200 μ mol/L but smaller than 440 μ mol/L (end-stage renal failure) were taken to plot a graph of the inverse of serum creatinine (1/Cr) versus time (months) for each patients. The predicted time at which the patient would require treatment by CAPD for ESRF was determined by extrapolation at a serum creatinine of 440 μ mol/L. Observations were made only when serum creatinine levels were >200 μ mol/L; below this value, small fluctuations in creatinine produce large changes in 1/Cr.

Study 3

Quality of life of patients on CAPD

Home visits were carried out three times on 3 successive months, and the patient interviewed together with his family, a process which took on average one and a half hours. In the case of patients who died while on the technique, their relatives were interviewed to obtain as much information as necessary on the quality of life of the patients.

Study 4

The results obtained in Study 2 were translated in financial considerations; these included the cost of the technique and of the antibiotics required for treatment of peritonitis; and of the hospital admissions of each patient.

Results

Study 1

Part A: The 87 patients studied included 59.8% (n=52) males and 40.2% (n=35) females. The trend in the incidence of chronic renal failure over the period 1982 - 1991 is given in Table 1.

Table 1: Trend in the incidence of Chronic Renal Failure over the period 1982 - 1991

| Year | New patients diagnosed | Total No. of patients with CRF |
|------|------------------------|--------------------------------|
| 1982 | 8 | 8 |
| 1983 | 2 | 10 |
| 1984 | 6 | 16 |
| 1985 | 15 | 31 |
| 1986 | 17 | 48 |
| 1987 | 9 | 57 |
| 1988 | 6 | 63 |
| 1989 | 8 | 71 |
| 1990 | 9 | 80 |
| 1991 | 7 | 87 |

The causes of chronic renal failure in the patients studied is given in Table 2.

Table 2: Trend in the cause of chronic renal failure during the period 1982 - 1991

| Cause | No. of cases | % Distribution |
|------------------------------------|--------------|----------------|
| Glomerulonephritis | 25 | 28.7 |
| Diabetic nephropathy | 23 | 26.4 |
| Hypertension | 13 | 15.0 |
| Polycystic kidney disease | 8 | 9.2 |
| Miscellaneous and uncertain | 19 | 21.8 |
| Chronic pyelonephritis | 6 | 7.0 |
| Renal stones | 2 | 2.3 |
| Carcinoma bladder | 1 | 1.1 |
| Renal cell carcinoma | 1 | 1.1 |
| Focal segmental glomerulosclerosis | 1 | 1.1 |
| Renal colic | 2 | 2.3 |
| Renal cyst | 1 | 1.1 |
| Uncertain | 5 | 5.8 |

64% (n=56) of the patients were being managed by haemodialysis, 6.9% (n=6) with CAPD, while 9.2% (n=8) had a renal transplant. The rest 19.5% (n=17) were managed by drug therapy.

Part B: During the period 1982 - 1991, 23 patients were diagnosed as suffering from diabetic nephropathy, 8 IDDM and 15 NIDDM. These included 56.5% (n=13) males and 43.5% (n=10) females. The patients had a mean age of 60.7 (range 37 - 79) years. The incidence of diabetic nephropathy is given in Table 3.

Table 3: Year at onset of diabetic nephropathy in the patients studied

| Year | Total | % Distribution |
|------|-------|----------------|
| 1982 | 2 | 8.7 |
| 1983 | 1 | 4.4 |
| 1984 | 1 | 4.4 |
| 1985 | 3 | 13.0 |
| 1986 | 2 | 8.7 |
| 1987 | 4 | 17.4 |
| 1988 | 3 | 13.0 |
| 1989 | 3 | 13.0 |
| 1990 | 3 | 13.0 |
| 1991 | 1 | 4.4 |

Table 4: Stage of renal failure of diabetic nephropathy patients studied

| Creatinine level umol/L | Total | | Males | | Females | |
|----------------------------|-------|-------|-------|-------|---------|-------|
| | No. | % | No. | % | No. | % |
| 133 - 440 | 19 | 82.6% | 11 | 57.9% | 8 | 42.1% |
| >440 | 4 | 17.4% | 2 | 50.0% | 2 | 50.0% |

Part C: During the period June 1991 to September 1991, 300 Diabetic patients (143 males and 157 females) were studied. The patients had a mean age of 60.53 (range 14-86) years. The 300 patients included 20% (n=60) Type I IDDM and 80% (n=240) Type II NIDDM. The renal function of the patients studied is given in Table 5.

Table 5: Renal function of the patients studied

| Serum creatinine level | Total | | Males | | Females | |
|-------------------------|-------|------|-------|---|---------|---|
| | No. | % | No. | % | No. | % |
| Normal serum creatinine | 235 | 78.3 | 116 | | 119 | |
| Elevated S.Creatinine | 65 | 21.3 | 27 | | 38 | |

The age distribution of the whole group of patients had a mean of 62.8 years. The ages ranged from 30 to 83 years. The duration of diabetes had a mean of 21.6 (range 1 - 45) years. The patients included 40% (n=26) IDDM and 60% (n=39) NIDDM. The mean duration of diabetes at the onset of renal failure is 21.48 (range 8 - 41) years. Of the patients studied, 96.9% (n=63) were at the onset of renal failure, while 3.1% (n=2) were at end-stage renal failure.

Study 2

Clinical aspects

Part A: During the period 1988 - 1991, 6 patients started CAPD, median age 50.3 years (range 6 - 65). Patients had a mean duration of treatment of 79.3 weeks (range 24 - 160). As for the primary renal disease, 33.3% (n=2) had glomerulonephritis, 16.7% (n=1) pyelonephritis, 33.3% (n=2) diabetes mellitus and 16.7% (n=1) polycystic kidney disease.

Table 6: Reasons governing choice of therapy and complicating factors at start of therapy

| | Pts. | % |
|---|------|------|
| Reasons governing choice of therapy | | |
| Angina | 1 | 16.7 |
| Myocardial infarction | 1 | 16.7 |
| Heart failure | 2 | 33.3 |
| Cerebrovascular disease | 1 | 16.7 |
| Diabetes mellitus | 2 | 33.3 |
| Renal unit policy | 3 | 50.0 |
| Holding for transplant | 1 | 16.7 |
| Complicating factors at start of therapy | | |
| Angina | 1 | 16.7 |
| Myocardial infarction | 1 | 16.7 |
| Heart failure | 2 | 33.3 |
| Cerebrovascular disease | 2 | 33.3 |
| Diabetes mellitus | 2 | 33.3 |

An individual may have more than one positive reason for choice of therapy. Only the main reason for choice are given.

By the end of 1991, 2 patients (33.3%) were still on CAPD, 1 (16.7%) had a renal transplant, while 3 (50%) died (2 of cardiac complications and one of cerebrovascular complications).

The average duration of hospital admissions was 14.9 days per patient-year of therapy. Non-dialysis-related causes of admission (medical, surgical, social) was 9 days/patient-year. There were more admissions for peritonitis and catheter-related difficulties (5 and 2 days/patient-year respectively).

In the 6 CAPD patients there were 10 temporary modality changes, 10 requiring hospital haemodialysis. Individual temporary changes lasted a mean of 20 days (range 5 - 63 days) amounting to an overall duration of 8 days/patient-year of treatment.

The overall peritonitis rate was 1.3 episodes/patient-year. 15 episodes were recorded. There was a cure in 80%, relapse in 13.3, and immediate catheter removal to effect a cure in 6.7%. 33.3% of all patient remained free of peritonitis.

Part B: At the time the patients reached a serum creatinine of 200 $\mu\text{mol/L}$ their mean age was 61.2 (range 25 - 75) years and the mean duration of diabetes was 24.8 (range 14 - 48) years. 15 patients were IDDM (Insulin Dependant Diabetes Mellitus) while 21 patients were NIDDM (Non-Insulin Dependant Diabetes Mellitus). The predicted year in which the patients studied will require CAPD, together with the number in each year is given in Table 7.

Table 7:

| Year | Number of Patients | % |
|------|--------------------|------|
| 1991 | 4 | 11.1 |
| 1992 | 11 | 30.6 |
| 1993 | 7 | 19.4 |
| 1994 | 9 | 25.0 |
| 1995 | 3 | 8.3 |
| 1996 | 2 | 5.6 |

Study 3

Quality of life of patients on CAPD

The patients were suffering from a number of psychological and social problems. The most important included, a feeling of limitation, loss of body image, self-image and self-esteem, sensitivity to what other people say, adherence to the treatment, fear of snagging or pulling the catheter during sleep, fear of infection and feeling of death.

The lifestyle of the patients was one of severe limitation, with the only 'excursion' being the regular visit to the hospital. Passive recreation such as listening to the radio, reading newspapers, watching television or doing some little knitting or sewing in the case of the females were regarded as hobbies. Social participation was almost non-existent and patients were not inclined to participate in clubs or associations. From the families' point of view, a heavy burden was carried by the partner, who in the case of elderly patients, was far from fit, thus requiring a strong commitment. The patient frequently became demanding and irritable in a childish and dependant way, taking the partner's efforts for granted. Fortunately, the majority of families were able to cope.

Study 4:

The costings of a CAPD patient per year per annum is given in Table 8

Table 8: Annual costings of a CAPD patient

| Item | Cost per annum per patient (Lm) |
|---------------------------------|---------------------------------|
| Technique | 3818.70 - 3898.80 *1 |
| Cost per episode of peritonitis | |
| Gram-positive organisms | 60.99 - 388.50 |
| Gram-negative organisms | 105.65 - 496.67 |
| Fungi | 11.34 |
| Cost of hospital admissions | 1434.00 |

*1 Values range depending on whether the patient uses four 1.36% dextrose solutions daily, or three 1.36% dextrose and one 3.8% dextrose.

Thus, the total cost is Lm5,313.69 - Lm5,721.30 in case of Gram-positive organisms, Lm5,357.65 - Lm5,829.47 in case of Gram-negative and Lm5,264.04 - Lm5,344.14 in case of fungal organisms. These values take into account one episode of peritonitis per year and a rate of hospital admissions of 23.9 as determined in Study 2B. Consequently, these values vary according to the number of episodes of peritonitis, the drug combination used, and the number of admissions per year.

Discussion

Results show that diabetic nephropathy is the cause of renal failure in 26.4% of the patients studied. This is a high proportion of patients for whom treatment, although costly, cannot be denied. Study 2 has shown that although CAPD has been established world-wide since 1976, it was only 12 years later that it was introduced in Malta. So far, six patients have used CAPD, with a survival rate of 40%. This is comparable to the early reports from the European Dialysis and Transplant Registry which stated a survival rate of 28% in 1980. In addition patients had an unacceptably high peritonitis rate of 1.3 episodes per patients year when compared to the rate of less than one episode per 24 patient months, on using the 'Y' system. Notwithstanding this, home visits have helped to reduce the psychological and social problems with the patients were experiencing.

Conclusion

This project has highlighted the initial difficulties of CAPD in Malta. The pharmacist's roles, which include providing direct patient care, counselling and support, as an educator, administrator, infection control agent and as a member of the multidisciplinary team will contribute to a higher success of CAPD in Malta. Finally, a booklet to help CAPD patients to master their technique and improve their quality of life while on CAPD, was devised.

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