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Artificial Kidney and Dialysis

Long-term peritoneal dialysis experience in Portugal

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ABSTRACT: Peritoneal dialysis (PD) penetration varies widely. Since the beginning of this therapy, indications have changed and outcomes have improved. In Portugal, PD still remains clearly underutilized.

The results of a 20 year PD programme were evaluated: 312 cumulative patients, 48±16 years, 27% >60 years old, 27% diabetic, 59% with prior hemodialysis (HD). The main reason for admission was vascular access failure (48.7%). Admission due to patient preference has increased significantly between first and second decades of the programme (33% vs 47% (P<0.001)); 98 patients (31.4%) were treated with automated PD but this prescription increased to 43% of the active patients.

A total of 376 Tenckhoff catheters were surgically implanted, recently by the Popovich-Moncrief technique (77 catheters): the cumulative survival was 82%, 64% and 50% at 1, 3 and 5 years, respectively. A better catheter survival was found in the last decade (85.7%, 69.6%, 54.8% versus 77.3%, 55.5%, 40.2%, at 1, 3 and 5 years, respectively (P=0.007).

The patient and technique cumulative survivals were 91, 74, 55% and 85, 67, 41%, at 1, 3, and 5 years, respectively.

The main drop-out was to hemodialysis (35.8%), followed by death (23.7%), and transplantation (21.5%). Peritonitis and access-related infections caused 35% of the transfer to HD. Cardiovascular events caused 58% of deaths. The median PD retention was 35.5 months. The rate of peritonitis has decreased to one episode /30 patient months. Hospital admission has also decreased to 4.8 days/ patient year.

This is a first report on long-term PD experience in Portugal. It has been an effective modality of renal replacement therapy, reflected by the growing patient preference in our PD programme. Experience, knowledge and new technical solutions have improved the outcomes. (Int J Artif Organs 2006; 29:)

KEY WORDS: Peritoneal dialysis, Outcomes, Survival

INTRODUCTION

Since its early stages, peritoneal dialysis has developed new connectology systems, new therapy protocols and new dialysis solutions. Increasing experience and investigation in the field of peritoneal dialysis has enabled nephrologists to propose PD as a good alternative and, usually, a better first option modality of chronic renal therapy (1).

The theoretical advantages were confirmed in several population studies (2) and debate about outcomes and costs (3) have clearly shown that this therapy should be part of an integrated therapy, side by side with hemodialysis and transplantation (4, 5). In reality, therapy allocation to PD or HD varies widely. The extreme disparity of PD prevalence in a single country and among other countries can not be explained by medical factors(6-9). In Portugal, paralleling other European countries, although medical knowledge about the role and benefits of PD has grown, there is still a minority of

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patients who are allowed to do PD, less than 4% of the total dialysed patients. Besides cultural and scientific bias, hospitals and doctors usually face organizational, structural and logistic difficulties to implement a programme (10).

Our programme has been developing in Hospital Geral Santo Antonio since late 1985. Over two decades, the efforts of a team of doctors, nurses and surgeons has managed to overcome significant structural deficiencies. This programme remains the most representative PD modality in Portugal. We analyse here the results of a cohort of patients enrolled in the programme during these past 20 years.

PATIENTS AND METHODS

This study was conducted to evaluate the patients' characteristics, rates of PD transfer to hemodialysis, technique failure, and mortality among 312 cumulative incident dialysis patients. Adults who initiated dialysis between October 1985 and May 2005 were included.

In the very first years PD patients were admitted to the Unit as a rescue therapy when hemodialysis was not feasible due to vascular exhaustion or cardiopathy. The rate of peritonitis was high. With cumulative experience, better results were able to persuade our colleagues to expose their patients to the modality. Therefore more patients had the opportunity to choose the therapy according to their preference. In the last few years a pre-dialysis visit was developed to timely refer patients and offer them a panel of renal therapies. Counselling is done by a nurse and a doctor.

Our aim was also to analyze data on 376 chronic peritoneal dialysis (CPD) catheters implanted between 1985 and 2005 in adult patients enrolled in our PD programme by comparing two different time periods 1985-1995 and 1996-2005.

Statistics

Continuous symmetrically distributed data is expressed as mean± standard deviation. Asymmetrically distributed data is expressed as median and range. Categorical data are expressed as absolute number and percentages. Chi-square test and the Mann-Whitney test were used accordingly to evaluate differences between the patients admitted in the first and last decades.

Life tables were used to analyse actuarial patients and technique survival. For patient survival, an as-treated analysis was performed, in which only death occurring during or shortly after hemodialysis transfer was taken into account. Therefore, death within 30 days after transfer to HD was attributed to peritoneal dialysis. Survival times were censored at the following events: switch to HD, transplantation, loss to follow-up, recovery of renal function.

For technique survival switch to HD was considered the final event and all other observations were censored (death, transplantation, loss to follow-up, recovery of renal function).

Both death and transfer to HD were events for the analysis of the combined patient and technique survival.

Follow-up was censored at the time of transplantation, transfer to HD, patient withdrawal or at 31 May 2005.

Causes of transfer to HD were grouped into broad categories as follows: infection (peritonitis and exit site infections), catheter problem, inadequate dialysis (dose/ultrafiltration failure/fluid management issues), psychosocial (psychological, insufficient support and loss of auto dialysis capacity), surgical complications not related to PD (acute abdomen).

The Kaplan Meier method was used to compare actuarial survivals between the cohorts.

Statistical analysis was performed using SPSS 13.0 for Windows operating system. A p value less than 0.05 was considered statistically significant.

Peritonitis and hospitalization rates were evaluated.

RESULTS

Patient characteristics

Since October 1985 up to 31 January 2005, 312 cumulative patients were admitted to our PD programme (Fig. 1). At entry the average age of the patients was 48 years old (range 15 to 83), 27% were older than 60, 37% male, 27% diabetic,17% presented ischemic heart disease, 59% were previously treated with hemodialysis (HD) or renal transplantation for a median time of 28.8 months (Tab. I); 29% patients were anuric at the start of PD. The main reason for admission was vascular access failure (48.7%); patient preference occurred in 41.7%, and has increased significantly between the first and second decades of the programme (33% *vs* 47% (P<0.001)). Fifty

-five patients were on active treatment by January 2005.

Comparisons of patient characteristics between the first and second decades of PD programme are presented in Table II.

CAPD systems

The first CAPD system used was a spike system, but, since1990, it has changed to Y-set systems and twin bag disconnecting systems. The introduction of Y-set systems system, incorporating the flush- before- fill procedure was clearly associated with a drop in peritonitis rate (Fig. 5).

Catheters and implantation technique

Straight double cuffed Tenckhoff catheters were used until 1993, implanted surgically (11) by surgeons. Since then, the catheter adopted was the double cuffed coiled Tenckhoff catheter, implanted by Seldinger technique (11), after antibiotic prophylaxis. After two post-implantation complications due to intestinal perforation, the implantation technique was reviewed and it is consistently being done by mini-laparotomy (11). Five Missouri catheters were electively implanted in obese patients with a high risk for leaking.

TABLE I - GENERAL DEMOGRAPHICS OF THE TOTAL ENROLLED POPULATION

Patients (N, total)	312
Age at entry (M±SD, years)	48±15.9
Gender (N(%), male)	116 (37.2%)
Admission due to patient preference (N (%))	130 (41.7%)
Time of previous renal therapy (median (range), months)	30.36 (91.1)
Diabetes (N (%), yes)	84 (26.9%)
APD (N (%))	98 (31.4%)

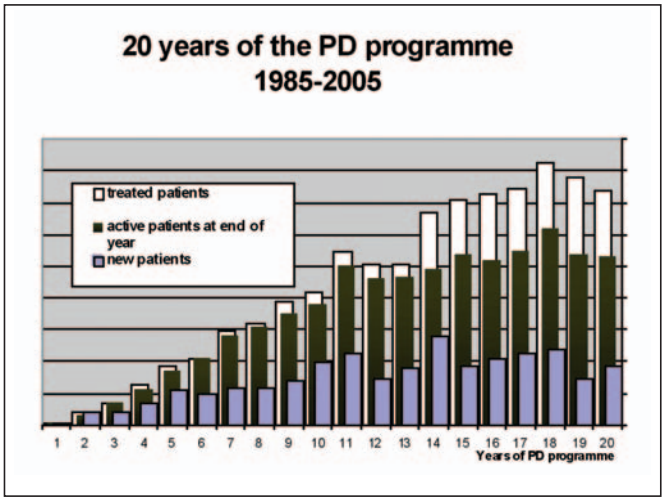

Fig. 1 - *The activity of the PD programme over 20 years.*

In the last decade, nephrologists have become committed to the procedure, using the Moncrief-Popovich technique (12).

PD prescription

All patients were treated with lactate -buffered, conventional dialysis solutions. Icodextrine was introduced in 1997, and it has been electively prescribed in patients with ultrafiltration capacity failure.

In the last two years, low- glucose degradation products (GDPs) two- chambered solutions have been prescribed in new patients, and are being used now in 50% of the patients; 22% use lactate/bicarbonate solutions.

Automated peritoneal dialysis (APD) has also been prescribed since 1998. In the beginning, due to financial constraints, only anuric patients transferred from

TABLE II - COMPARISON OF THE TWO COHORT'S DEMOGRAPHIC CHARACTERISTICS

	First decade (1985-1995)	Second decade (1996-2005)	P
Total	132	180	
Male (N (%))	51 (38.6%)	65 (36.1%)	0.64
Aged (patients >60 years, N (%))	35 (26.5%)	49 (27.2%)	0.88
DM (N (%))	40 (30.3%)	44 (24.4%)	0.24
New to dialysis (N (%))	50 (37.9%)	79 (43.9%)	0.28
PD patient preference (N (%))	44 (33.3%)	86 (47.8%)	0.011
Time of previous renal therapy (median(range), months)	24.7 (91.2)	32.4 (89.6)	0.98
APD (N (%))	14 (10.6%)	84 (46.7%)	<0.001
Transfer to HD (N (%))	54 (40.9%)	49 (39.2%)	0.80

hemodialysis and patients with ultrafiltration capacity failure were allowed to do APD. Later, patient preference and logistic/professional reasons were also indications for APD prescription. Due to similar economic issues, alternative solutions have not been used yet for APD, except electively in patients reporting pain with standard solutions infusion.

Since 1978 a cumulative number of 98 patients (31.4%) were treated with automated PD, but this prescription increased to 43% of the actual active patients.

Adequacy was regularly checked according to international guidelines. Adequest software is being routinely used in the unit with registered levels of 2.1±0.78 total KT/V.

Transfer to hemodialysis

The drop-out included: 107 (35.8%) transferred to hemodialysis, death (23.7%), and transplantation (21.5%). Fifty-five patients were under active treatment by January 2005. Recovery of residual renal function allowed the stopping of PD in 9 patients.

The main reasons for change of modality were peritonitis and access related infections (35% of transfer to HD), followed by inadequate ultrafiltration (25.5%). Figure 2 shows the causes of transfer to HD in the two time periods.

Mortality

The causes of death were classified as cardiovascular, infectious, or various other reasons. Cardiovascular events caused 58% of deaths, followed by infections (20.3%).

The patient cumulative survival was 91, 74 and 55% at 1, 3, and 5 years, respectively (Fig. 3).

Technique failure

The cumulative technique survival was 85, 67 and 41%, at 1, 3, and 5 years, respectively (Fig. 3). The median PD retention time was 35.5 months which is a combined patient and technique survival of 78%, 49% and 23% at 1, 3 and 5 years respectively.

Higher PD retention was observed from the first to the second decade of the programme: median, 29.1 to 37.4 months, however it did not reach statistical significance (P=0.22). In active patients, 16/55 (29%) were on PD for more than 4 years (65.3±10.56 months).

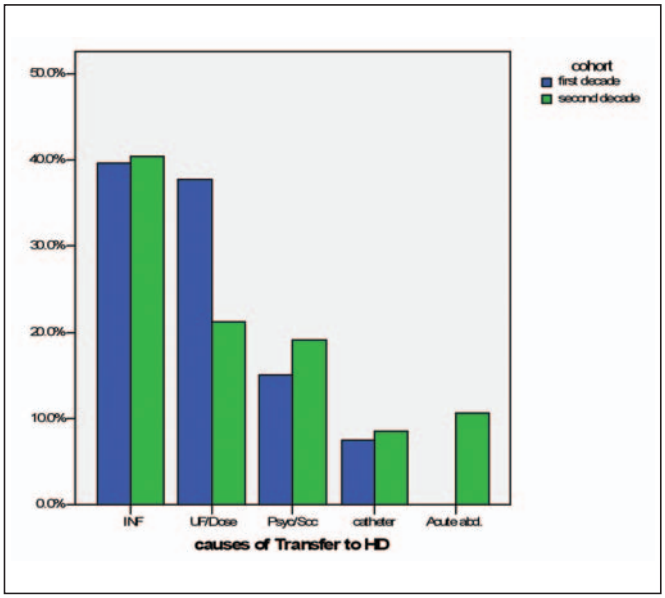

Fig. 2 - *Causes of transfer to HD in the two cohorts (Infection refers to peritonitis and access related infections, UF/Dose refers to inadequate dialysis including ultrafiltration and dose inadequacy); Psyc/soc reasons include burn-out and loss of auto dialysis capacity without assistant helper; Catheter refers to mechanical complications as leak or obstruction; acute abd. refers to non-dialysis related surgical complications).*

Catheter survival

A total of 376 Tenckhoff catheters have been surgically implanted; in the last two years the Popovich-Moncrief technique has been used with 77 catheters.

Kaplan Meier comparison of catheter survival curves in the two decade cohorts are shown in Figure 4. It has improved from 77.3%, 52.3%, 40.2% to 85.7%, 69.6%, 54.8%, at one, three and five years, respectively (Log Rank P=0.007) (Fig. 4).

Rate of peritonitis and hospital admission

The rate of peritonitis has decreased in the last period to 1 episode /30 patient months (Fig. 5).

Hospital admission has also decreased to 4.8 days/ patient year.

DISCUSSION

The evaluation of more recent PD incident cohorts has shown improved patient survival, higher technique success, and an increasing use of cycled-based PD (13).

This review of a 20- year- PD single center programme goes along with such evidence and has allowed us to document better outcomes with the increasing experience of our PD team. Integrated care with pre-dialysis information about the modalities increased optional admission in our center. We have observed that PD is an effective therapy, achieving patient survival and outcomes similar to other single center reports (14-16) and larger European and American PD population studies (17-19) results.

The patient cumulative survival was 91, 74 and 55% at one, three and five years, respectively. These were better results than the global data from the EUA cohort of 30000 patients starting PD in 1999 (82.5% and 57.9% at one and three years respectively) (13) and similar to the Europeans (20).

It is well-known that a number of baseline population characteristics condition global survival rates (2, 21-23), but median age and prevalence of diabetes, as examples, were very similar to other PD centers (24), although lower than in hemodialysis. There is probably a positive selection of patients for PD, mainly because auto-dialysis capacity has been a prerequisite in the majority of our Center's admissions. Besides, according to our recent review (25) residual renal function is still present in many patients, averaging 4 ml/min/1.73 m^2. On the other hand, almost 30% of the patients were anuric when they began PD, and half of the patients were admitted because a vascular access failure and therefore transfer from hemodialysis not only carried associated time on dialysis related comorbidity, but also did not allow the majority of them to benefit from the most important PD advantage in new patients - residual renal function preservation.

Baseline peritoneal transport was not available for analysis because a peritoneal equilibration test was not routinely performed until 1998, when it was than included in a baseline standardized evaluation. Therefore characterization of the global incident patient's peritoneal transport and investigation of its impact on survival (26) was only done in a subgroup of more recent patients (25).

Our study did not aim to investigate comparisons with hemodialysis. But a number of studies allow us to conclude that significant disparity of the prevalence of the two dialysis modalities in our country cannot be explained by medical reasons. As it has been recently highlighted (2), survival differences between HD and PD are not constant but vary substantially according to the underlying cause of ESRD, such as diabetes, age and level of baseline comorbidity. However, except from aged diabetic patients with baseline comorbidity who show lower survivals with PD there is a clear survival advantage for a vast number of uremic patients, who are not allowed an option. Indeed, adjusted mortality rates in non-diabetics with no baseline comorbidity were higher in HD than in PD and a survival advantage was also documented with PD in younger diabetic patients with no baseline comorbidity. Within the group of non-diabetic patients with baseline comorbidity, similar survivals were found with HD and PD. These results are similar to those

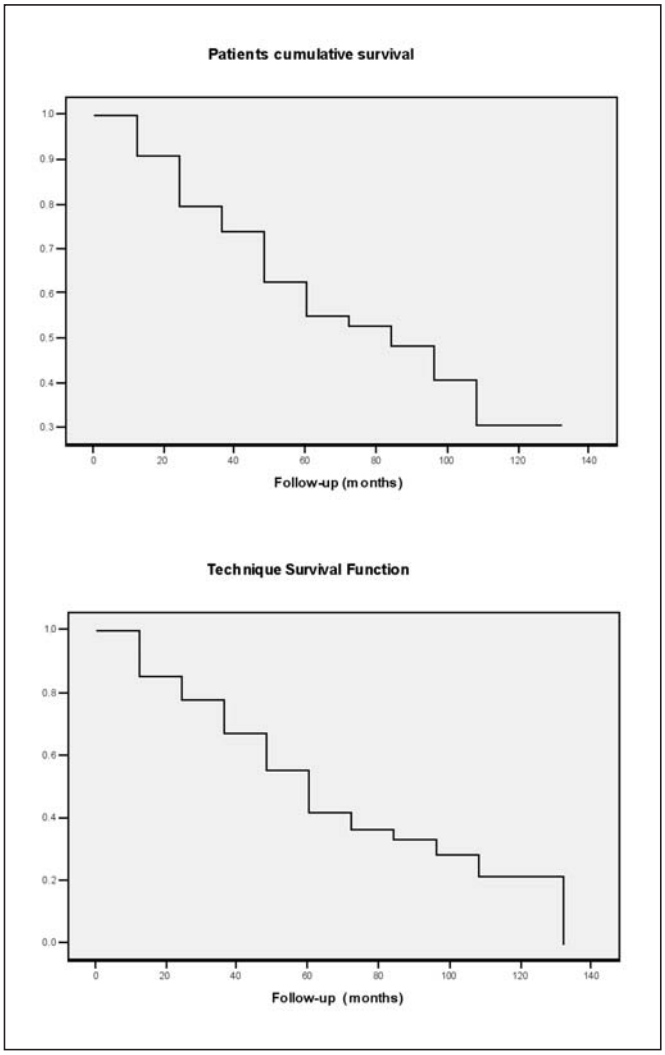

Fig. 3 - *Patient and technique cumulative survivals: median patient survival time was 79,2 months and median technique survival was 52,6 months (switch to HD was considered the final event and all other observations -death, transplantation, loss to follow-up, and recovery of renal function- were censored).*

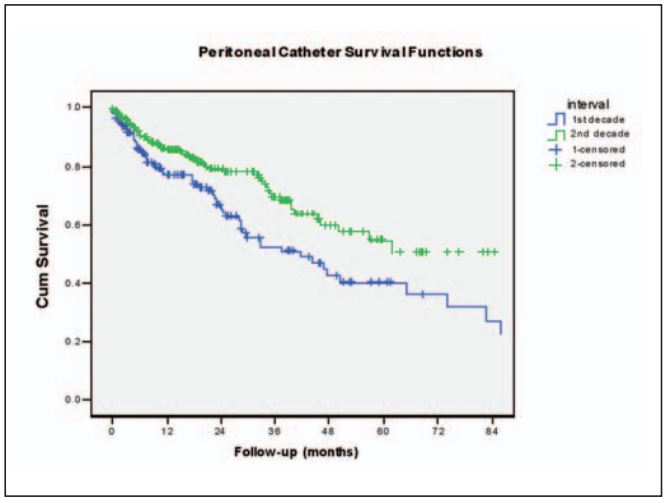

Fig. 4 - *Catheter survival in the two time periods analyzed.*

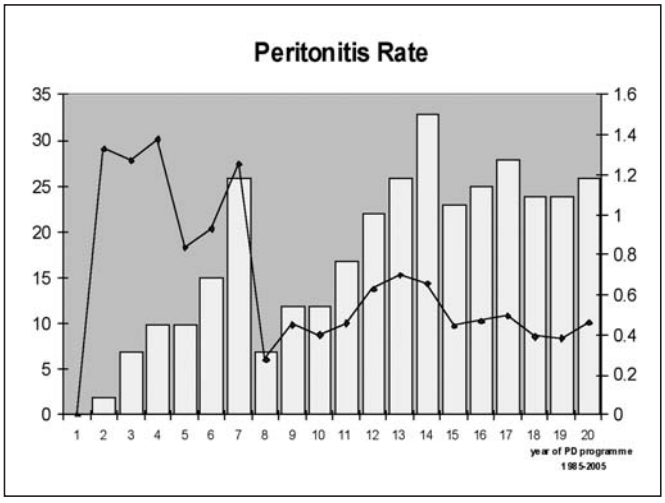

Fig. 5 - *Peritonitis rate.*

of other previous studies (27, 28)

It also appears that patients on the two therapies have different mortality patterns over time which makes survival analysis vulnerable to the length of follow-up (29), favoring PD mainly within the first years of treatment.

Due to lower technique survival, PD retention is lower than in HD, but global survival, in an intention-to-treat analysis, may still be able to show higher survival for patients beginning PD as the first modality of chronic renal dialysis (30).

Favorable costs analysis has also been shown even considering transfer to hemodialysis (31): compared to "hemodialysis, no switch" subgroup, both "peritoneal dialysis, no switch" and "peritoneal dialysis, with at least one switch" showed a significantly lower expenditure. After adjusting for patient characteristics, annual Medicare expenditure was still significantly lower for patients with peritoneal dialysis as an initial modality. There is no published report on PD costs in Portugal, and it was also out of the scope of this descriptive review. However, it is known that the overall structure of health care, and particularly of renal care, in an individual country, is an important determinant of the under-use of PD (32, 33). In Portugal the healthcare system is mainly public, but private hemodialysis clinics entirely assure chronic renal therapy to the vast majority of patients. Reduction of PD fluids and disposables costs could possibly make PD more financially attractive to private investors.

Similarly to what happens in other countries, this also explains the discrepancy between dialysis allocations in Portugal with under use of PD.

Considering other outcomes such as hospitalization rate, 14% higher hospital admission rates per patient a year with PD, in the United States, has been reported in an earlier study (34). But there are large differences in dialysis practice conditioning high variability in hospitalization rates. In our center we have observed a decreasing rate of admissions, also because we implemented an effective strategy of catheter implantation, training and peritonitis treatment on an ambulatory regime. Besides we, as others, (35) also believe that the time the physician spends with the patient influences the quality of care.

Peritonitis rate has also been decreasing, and is in agreement with international guidelines (36).

Along with technique advances, improvement of catheter connectology and the use of adjusted treatment protocols have allowed such favorable evolution.

Mirroring this, more effective infection control was obtained. Due to the cumulative team-acquired knowledge, catheter survival has also improved from the first to the second decade. Significant quality improvement was possibly due to the articulation with a surgical theater for the procedures, allowing planned catheter interventions and avoiding the use of the Emergency Room. Besides, we attribute an important role to the nephrologists' involvement in the catheter implantation: two key factors, skill and commitment have certainly grown.

Technique survival is, however, still PD's Achille's heel: cumulative death-censored technique survival was 85, 67 and 41%, at 1, 3, and 5 years, respectively with median PD retention of only 3 years. We still aim for a lower rate of peritonitis and catheter related infections, possibly achievable through the implementation of domiciliary nurse support and more prophylactic strategies. A lower rate of transfer to HD due to inadequate dialysis has occurred in late decade: the use of APD and icodextrine surely had a role. Investigation of more biocompatible solutions and optimization of APD, also reducing its costs may help to further increase PD retention. An opportune transfer to HD, supported by integrated care, should however be borne in mind, to not compromise global patient survival (37).

We can then conclude that our center reflects worldwide PD trends: advances in PD have resulted in improved patient outcomes but these largely depend on our center's experience and degree of specialization in PD (35, 38).

An educational intervention, during pre-dialysis visits increases the proportion of patients who intend to initiate dialysis with self-care dialysis (39, 40).

An integrated approach to the treatment of uremia and team commitment to patient care has also improved the results (35).

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