Improved patient/technique survival and peritonitis rates in patients treated with automated peritoneal dialysis when compared to continuous ambulatory peritoneal dialysis in a Mexican PD center

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Since its introduction in Mexico in 1998, the use of automated peritoneal dialysis (APD) has grown steadily and now 35% of Mexican patients are being treated with it. Peritonitis continues to be the most important infectious cause of drop out in peritoneal dialysis (PD) programs and naturally has an impact on technique survival. The objective of this study was to compare patient and technical survival as well as peritonitis rates in APD vs continuous ambulatory peritoneal dialysis (CAPD) in our hospital PD program. We included all patients who initiated therapy between January 2003 and December 2005. Data at the beginning of therapy, causes of end-stage renal disease, gender, age, dialysis modality, drop out reasons, as well as peritonitis rate and date of presentation of first peritonitis event were collected and analyzed. For Kaplan–Meier survival analysis, patient status (alive, dead, or lost to follow up) at December 2005 was used as the observational end point. Modality differences were analyzed using a Cox regression model. A total of 237 patients were evaluated: 139 on CAPD and 98 on APD. The median age was 62 years on CAPD and 59 years on APD ($P<0.031$), and the percentage of diabetics was, respectively, 77 and 70% ($P=$ NS). The CAPD drop out causes were death (57%), transfer to HD (29%), and other causes (16%), whereas in APD, 62% were due to death, 24% to transfer to HD, and 14% to other causes. APD/CAPD patient survival for year 1, 2, and 3 was 82/62, 62/49, and 56/42%, respectively. In conclusion, both therapies are considered good renal replacement therapy options in our hospital, but APD is the most attractive one as demonstrated by the positive results presented here.

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Automated peritoneal dialysis (APD) has been developed as a therapy option for the treatment of peritoneal dialysis (PD) patients and it has become the modality with the fastest growth in the United States and Europe.[1] In Mexico, APD was introduced in 1998 and until 2002 its use was limited to a small group of patients in the Instituto Mexicano del Seguro Social. During the last few years APD has grown, and today 35% of the PD patients are been treated with this modality.

APD has the advantage of being able to increase the dialysis dose and to improve ultrafiltration, mainly in patients with high transport membrane characteristics. These advantages have been confirmed even for anuric patients as demonstrated in the European Automated Peritoneal Dialysis Outcome Study (EAPOS) study.[2]

The growing demand of better quality of life has also favored the preference of APD as the first choice home therapy for patients with labor activities as well as pediatric patients.[3–5] It has been demonstrated that this modality offers to the patients and relatives a better quality of life and it diminishes the emotional load compared with continuous ambulatory peritoneal dialysis (CAPD);[6] APD favors the possibility of maintaining the family nucleus economic activity, especially in that group of patients who need support for carrying out the dialysis procedures, since the number of exchanges that are carried out during the day in APD are none or are limited and it allows the relatives to carry out their own personal/professional and economical activities in a normal way.

At present, the modality selection for patients in the Instituto Mexicano del Seguro Social depends mainly on the physician in charge of the PD program. Although there are medical indications (e.g., high transporters, pediatric patients) that justify the use of APD, other indications more related to the social aspects and to the preferences of the physician in charge of the program may prevail.

When we consider the advantages of PD in comparison to hemodialysis, home therapy must always be taken into account as one of the main advantages of PD. However, there are patients on CAPD who restrict their home activities when

carrying out four exchanges during the day, which may also affect the activities of the relatives who support them. This could naturally cause anxiety and/or a lack of compliance to treatment, potentially affecting the patient's and family's integral (physical and mental) health. This is a critical point in populations like ours, where the economic contribution of certain individuals is fundamental for the support of their families. It is in this type of situation where APD can be a viable alternative in our Mexican reality, with the advantages of schedule flexibility, allowing the patient and relatives to remain in their daily activities without the interference of the therapy. Although the manual and automated modalities have been considered as equivalent, each one has characteristics that make them different. In the case of APD, the possibility to diminish the dwell time makes it ideal for the management of the high transport patient; however, the duration of the day dwell exchange favors the development of negative ultrafiltration, which may force us to prescribe high concentrations of dextrose with its metabolic consequences and the possibility of long-term glucose exposure of the peritoneal membrane, especially in populations with a high prevalence of diabetes.

Peritonitis represents one of the most important complications in PD and it maybe the most frequent cause of technical failure.[7–10] The frequency varies from program to program and from region to region.[11–13] In spite of a tendency for a reduction in frequency after the implementation of the disconnection systems,[14] factors like age, race, gender, and the dialysis method influence the presentation.[15–17] Some of the related complications are hospitalization, temporary or permanent loss of the catheter, loss of peritoneal membrane function, and, in more serious cases, death.[18] In one report, the presence of peritonitis was an independent risk factor of death, being the cause of death in 15.8% of patients. The reports of peritonitis incidence comparing the automated and manual modalities are contradictory,[19,20] with some in favor of APD and others in favor of CAPD.

The objective of this study was to report the APD and CAPD experience of one single Mexican hospital, especially focused on survival (technique and patient) and peritonitis rates.

RESULTS

The records of 237 patients were analyzed: 139 on CAPD and 98 on APD, with a total of 2566 months at risk; 53% were women and 79% diabetics.

Table 1 | General demographics by modality

	APD	CAPD	*P*
Age, years (median)	59 (25–92)	62 (18–89)	0.031
Diabetic, %	70	77	NS
Gender (M/F), %	54/46	47/53	NS

APD, automated peritoneal dialysis; CAPD, continuous ambulatory peritoneal dialysis; F, female; M, male; NS, not significant.

General demographics and drop out causes are shown in Tables 1 and 2. The median age was 59 years (range 25 to 92 years) on APD and 62 years (range 18 to 89 years) on CAPD ($P<0.031$), the percentage of diabetics was, respectively, 70 and 77% ($P=$NS). The drop out causes on APD were: 18 (62%) due to death, 7 (24%) to transfer to HD, 4 to other causes (14%), whereas on CAPD, 49 (57%) were due to death, 25 (29%) to transfer to HD, and 11 (16%) to other causes. Figures 1 and 2 show technique and patient survival for both modalities: the dotted lines correspond to APD and the continuous lines to CAPD. Patient survival for years 1, 2, and 3 were 82, 62, and 56% for APD and 62, 49, and 42% for CAPD ($P<0.001$), whereas technique survival was 76, 56, and 56% for APD and 65, 47, and 42%, respectively. The only factor related to better survival was PD modality in favor of APD ($P<0.001$), but no other significant differences were found. It is important to note that patients on APD were younger (59 vs 62 years) than patients on CAPD ($P<0.031$).

Peritonitis

During the period of study, 87 patients (43%) presented with 130 peritonitis episodes (102 on CAPD and 28 on APD), the cure rate being of 81% on CAPD and 75% on APD. Twenty-seven patients were transferred to HD, and peritonitis was the cause of death in three cases. From the cultures taken, Gram-positive peritonitis represented 44.8% of the cases and the most frequent organism was *Staphylococcus epidermidis*, followed by *Staphylococcus aureus*. Gram-negative peritonitis represented 26.9% of the cases, with *Pseudomonas aeruginosa* representing 14.8%, followed by Enterobacteriae 10.8%, and fungal peritonitis representing 6.9% of the cases. Negative cultures were reported in 21.4% of the cultures performed. Table 3 shows the causal microorganisms for each therapy modality. Seven events were reported as caused by *Pseudomonas aeruginosa*, with four of them (two in each group) not responding to treatment and the patients being transferred to HD. Regarding fungal peritonitis, nine cases were reported,

Table 2 | Drop out causes

	Modality		
	CAPD	APD	Total
Death	36 63.2%	21 36.8%	57
Transfer to HD for peritonitis	16 59.3%	11 40.7%	27
Lost social security	1 33.3%	2 66.7%	3
Transplant	5 62.5%	3 37.5%	8
Transfer to HD (no peritonitis)	0	2 100.0%	2

APD, automated peritoneal dialysis; CAPD, continuous ambulatory peritoneal dialysis.