

Assisted Peritoneal Dialysis: What Is It and Who Does It Involve?

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Together with the obvious increase of elderly patients with end-stage renal disease (ESRD), utilization of peritoneal dialysis (PD) has declined since the mid-1990s in a number of countries—a decline that is particularly marked in this elderly ESRD population. A major obstacle that affects any dialysis modality in elderly patients is the greater disease burden than is seen in younger patients. However, this factor may be overcome if patients start PD with assistance provided by visiting helpers (nurses or others) or people at home, mostly family members. Assisted PD (aPD) is suitable for, but not limited to, elderly patients who are unable to perform PD for themselves at home. Important considerations of an assisted model of care include frequency of visits, type of health care, and tasks to be performed for the patient at home. Clinical experience worldwide shows that aPD offers acceptable survival for most elderly and disabled patients, with no significant difference in modality-related complications from those seen in self-performed PD. Elderly patients on aPD experience more frequent hospitalizations, with longer hospital stays. Costs of aPD vary from country to country, depending on the frequency of visits and on reimbursement policies. Most authors believe that aPD can be cost-effective when compared with in-center hemodialysis.

Key words

Assisted peritoneal dialysis, outcome, cost effectiveness

Introduction

The demographic changes that have taken place since the end of the 1990s and the substantial increase in the number of people surviving into old age have led to a growing demand for health services for elderly people.

Data from the U.S. Renal Data System indicate that incidence of end-stage renal disease (ESRD) is no longer rising among people below 65 years of age, but it has continued to increase among those 65 years of age and older (1). In the United States, the number of octogenarians and nonagenarians starting dialysis almost doubled from 1996 to 2003 (to 13,577 from 7054). After accounting for population growth, the rate of dialysis initiation increased by 57% for the same period (2). The U.K. Renal Registry shows that the median age of patients starting dialysis has been fairly stable at around 65 years in the recent past, but that the number of “old elderly” patients is increasing (3). In France in 2005, almost 40% of patients starting dialysis were over the age of 75 years (4). Records from the Hong Kong Renal Registry show that, of all peritoneal dialysis (PD) patients ($n = 3321$), 44.1% were 65 years of age or older (5).

Major factors contributing to the rapid growth of the elderly dialysis population are the aging of the overall population, the status of chronic kidney disease as a disease predominantly of elderly people (6), and more liberal acceptance criteria for dialysis (7,8). Also, the frequency of dialysis initiation at a higher glomerular filtration rate has tripled since 2002 (2). The mean glomerular filtration rate at initiation of dialytic therapy increased to 10.5 mL/min in 2002 – 2003 from 8.3 mL/min in 1996. Today, octogenarians and nonagenarians commence dialysis in better condition than ever before. The percentage of anemic elderly patients decreased to 44% from 59%, and a declining trend of patients with congestive heart failure or with four or more comorbid conditions is evident (2). All of the foregoing factors increase the pool of elderly patients who are in good physical and medical condition.

Together with the obvious increase in elderly patients with ESRD, a decline has occurred in the utilization of PD in a number of countries since the mid-1990s—a decline that is particularly marked in

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the elderly ESRD population. In Canada, registry data show that, between 1995 and 2002, the absolute number of patients older than 75 years of age starting hemodialysis (HD) per annum rose 300%, while the number of patients starting PD rose only 40%. As a consequence, the percentage of all ESRD patients over 75 years of age initiating PD fell from 30% to 12% (9). In the United Kingdom, a comparison of modality utilization in individuals under 65 years of age and in those 65 years of age and older showed that, in 2006, 30% and 17% respectively of incident patients were on PD 90 days after initial treatment (10). In contrast, in France, where assisted PD (aPD) using community nurses has been available for years, PD is predominantly a treatment for elderly patients, with approximately 54% of the patients on PD in January 2006 being over 70 years of age (11). Elderly patients are also successfully treated with PD in Hong Kong, where PD is, by law, the first treatment modality. In March 2007, 80% of patients (median age: 62.3 years) were on PD (12). If elderly individuals account for most of the ESRD population, and if utilization of PD has declined over the last decade, does it mean that PD is not being offered to elderly patients who need renal replacement therapy?

Discussion

Reasons for assisted PD

Although no consensus has been reached concerning the optimal mode of renal replacement therapy for elderly patients with ESRD, an increasing number of nephrologists agree that chronic PD at home offers many advantages for those patients, including independence from hospitals, simplicity of access, good control of hypertension, better cardiovascular stability (less hypotension and fewer arrhythmias), and slow solute removal. Also, there is no convincing evidence that elderly patients on PD have more modality-related complications or a lesser quality of life than younger patients do.

One of the major obstacles for PD in elderly patients is a greater disease burden—including vascular disease, impaired vision, deafness, poor mobility, arthritis, and cognitive problems—than is found in younger patients. In addition, elderly patients are often socially isolated, depressed, and financially insecure (3). In a study by Oliver *et al.* of 137 patients with a median age of 73 years, 25% were visually impaired,

20% were immobile, and 17% had reduced hearing (13). A recent review indicated that up to 70% of dialysis patients over the age of 55 years have moderate-to-severe (but undiagnosed) cognitive impairment (14). All these factors affect any dialysis modality and not exclusively PD. However, these factors may be overcome if patients start PD with assistance provided by visiting nurses or other individuals at home.

For whom is aPD suitable?

Assisted PD is suitable for, but not limited to, elderly patients who are unable to perform PD by themselves, including connecting to and disconnecting from a cycler, setting up the machine, or performing continuous ambulatory PD (CAPD) exchanges. In addition, aPD may involve monitoring (glucose, dry weight, and blood pressure control), injections of erythropoietin, record-keeping, and even treatment of peritonitis.

Assisted PD can be provided by family members, paid home-care nurses, visiting health care professionals, and staff in rehabilitation centers, retirement homes, nursing homes, and chronic-care dialysis units.

The first CAPD experience with home-care nurses was based on the reports by French investigators (15). From 1977, when PD was introduced in France, any patients who could not perform their own PD treatment could be assisted by a private nurse (15). Such nurses provide these elderly patients with comfortable and safe home dialysis without reliance on family members. Also, the low rate of infection and hospitalization and the avoidance of transportation back and forth to the hospital for this high-risk population leads to significant savings that counteract the increase in costs from the nurses' salaries. Verger *et al.* reported that 56% of French PD patients need some degree of assistance at home, and among them, 41% are aided by private nurses who are paid by the French National Health Service (11,16). Most of these patients are on assisted CAPD; only 23% are on assisted automated PD (aAPD). More recently, Verger *et al.* reported a trend toward increased aAPD in France because of the increasing lack of hospital nurses. To optimize the results obtained by using private nurses, they recommended that, whenever possible, regular home visits should also be made by the hospital nurses to help the private nurses (or family members) maintain knowledge about, and practice in, PD exchanges (17).

The aPD program run from Sunnybrook Hospital in Toronto, Ontario, Canada, uses registered nurses. These nurses can assess a patient's medical condition, determine volume status and assist in solution selection, perform medication reviews, and educate patients and their families (18). Authors from Denmark presented a single center's experience with aAPD. Their program included 64 patients, and assistance and care were delivered by 52 briefly trained visiting nurses or nursing home staff (19). All health care in Denmark is publicly financed, and so far, no special financing of this program has been required. The caregivers visit the aAPD patients at home twice daily. A longer visit in the morning involves disconnecting the patient from the cyclor and setting up the cyclor for the next night; a shorter visit in the evening involves connecting the patient to the cyclor (19). The same authors reported that late-referred dialysis patients ("unplanned start") can also be successfully treated with aAPD (20). Those patients may start their PD from within a few hours to a few days after catheter insertion. Those results agreed with previous findings that use of a PD catheter immediately after insertion does not affect long-term PD technique survival or patient survival and that PD is a safe and feasible modality for unplanned start of dialysis in late-referred elderly patients (21,22).

Assistance by a family member to perform PD in elderly patients is a well-known approach. French authors reported that about 7% of PD is family-assisted (16). Of all aPD patients, 8% were family assisted (17). Data from Sunnybrook Health Sciences Centre shows that approximately 53% of aPD is performed by spouses and family members (23). A family member may be successfully involved in the treatment of nonagenarians with favorable results (24).

More and more elderly people will live in nursing homes in the future. In nursing homes, PD offers many advantages compared with HD and allows for flexibility in exchange schedules for patients and staff. In this regard, automated PD or nightly PD keeps the patient's daytime free for nursing home activities, increases socialization, and enables better rehabilitation that improves quality of life (25,26).

Does availability of assistance influence modality choice?

The NECOSAD study showed that, although 50% of patients given a choice will choose PD, patients

70 years of age and older were 6 times more likely than those 18 – 40 years of age to choose HD (27). There were many reasons for this result, but the main contributing factors included fear of an inability to learn a new technique, anxiety about doing a home treatment alone, and inability to learn to perform PD because of physical or cognitive problems.

In France, aPD has been available for decades. Even so, the overall use of PD is only 8.7% among all dialysis modalities (28). The community-based home-care assistance program at Sunnybrook Health Sciences Centre in Toronto wanted to determine if availability of home-care assistance would increase the use of PD (13). Use of PD in the incident population resulted from the combined effect of eligibility and choice. The proportion of patients who were considered eligible for PD was significantly higher in regions in which home-care assistance was available than in regions in which it was not (80% vs. 65%, $p = 0.01$). After adjustment for cofactors, patients who had access to home-care assistance were 2.6 times more likely to be considered eligible for PD than were patients who did not have such access ($p = 0.01$). A similar proportion of patients chose PD in regions with and without home-care assistance (59% vs. 58%), but there was a trend toward greater actual use of PD in regions with such assistance (47% vs. 37%, $p = 0.27$). The study authors concluded that providing assistance increases the number of patients who choose PD.

Outcomes

SURVIVAL

Lobbedez *et al.* reported an 83% 1-year survival of aPD patients at their center (29). Technique survival was 85% at 6 months and 58% at 1 year. In the absence of a comparison group and with adjustment for important predictors of mortality, this finding is difficult to interpret, although it is consistent with reports on survival among PD patients in Canada.

Povlsen and Ivarsen showed that the crude 1-year and 2-year survival rates of functionally dependent elderly patients on aAPD were 58% and 48% respectively. After excluding the first 90 days, the 1-year and 2-year survival rates were 66% and 54% respectively (19). There were no significant effects on survival by the main cause of ESRD, sex, age, late referral, need for acute start, social isolation, physical

dependency on help, or residence in a nursing home. Those authors also reported the results of treatment of 99 late-referred elderly patients on aAPD and found that 1-year survival was 77% (20). Among the 99 patients, 58 (58%) needed assistance, and those patients were significantly older. Crude patient and combined patient and technique survival were significantly in favor of the autonomous PD patients. However, after adjusting for significant differences in baseline characteristics, the difference in combined patient and technique survival disappeared. The significant difference in patient survival persisted, with the most probable reason being that the number of patients was relatively small and did not allow for adjustment for all baseline variables. In an Asian group of PD patients, mortality was not affected by the need for assistance with dialysis exchanges (5).

PERITONITIS

Issad *et al.* followed 213 patients older than 75 years of age for an average of 21 months. Among those patients, 12.2% lived in institutions, and 48% were cared for by private nurses at home. Peritonitis and exit-site infection rates were not significantly different between those who received "assisted dialysis" and those doing "self dialysis" (15).

Lobbedez *et al.* reported a high peritonitis rate in aPD patients: 50% of patients had experienced at least 1 episode of peritonitis at 1 year (29). Comparative data from Verger *et al.* revealed that, after adjustment for age, diabetes, and the Charlson comorbidity index, the probability of being peritonitis-free at 2 years was higher for patients assisted by a family member than for those assisted by a private nurse ($69.8\% \pm 5.4\%$ vs. $54.4\% \pm 4.5\%$, $p = 0.04$). That finding was explained by the fact that family members care, with a high degree of a personal involvement, for only a single patient. The difference disappeared when nurses from the training center regularly visited PD patients in their homes in the presence of their helper, whether private nurse or family member (17).

In the publication from Oliver *et al.*, the time between peritonitis episodes was 24.9 months in the group of patients who received self-care PD and 28.2 months in the aPD group (13). Povlsen and Ivarsen observed a peritonitis rate of 1 episode every 25.3 treatment-months for aAPD patients as compared with 1 episode in every 30.6 treatment-months for

the rest of their PD population (19). In the study of 328 patients by Li *et al.*, the probability of a 12-month peritonitis-free period was 76.6% in patients more than 65 years of age and 76.5% in the rest ($p =$ non-significant). Those authors observed no significant difference in the peritonitis-free period between patients doing self-care and those receiving aPD (30).

In reviewing 1065 episodes of peritonitis in 832 chronic PD patients during a 10-year period, Szeto *et al.* did not observe any difference in the distribution of causative micro-organisms between patients over 60 years of age who required assistance with their dialysis exchanges and those who performed self-PD (5). However, the risk of peritonitis relapse was significantly higher in patients who required assistance (9.7% vs. 4.1%, $p = 0.008$).

HOSPITALIZATION

According to Lobbedez *et al.*, a high percentage of aPD patients (79%) were hospitalized during the first year of follow-up, and over the study period of 5 years, the authors reported a hospitalization rate of 0.4 admissions or 3.8 hospital days per patient-month of therapy in the aPD group. Peritonitis was the most frequent cause of hospitalization, accounting for 35 of the 144 hospital stays recorded (29).

The experience of Danish authors showed that, of 30,358 patient-days on aAPD, 3,001 (10%) were spent in hospital, corresponding to 1 admission every 3.1 patient-months. Time of referral, acute start, age, comorbidity, and physical dependence on help were not associated with more-frequent or prolonged hospitalizations (19). These patients had 1 catheter replacement every 26 treatment-months because of dysfunction, leakage, and infection (19).

Oliver *et al.* (13) reported 1.4 hospitalizations and 23.5 hospital days per patient-year for an aPD group and 1.0 hospitalizations and 13.1 hospital days for patients treated by other modalities (self-care PD, in-center HD).

A home-care nurse who assists in the treatment of peritonitis episodes and other complications may contribute to a lower total hospitalization rate (31).

Cost analysis

Peritoneal dialysis has been shown to be less expensive than HD (32). In France before 1993, private nurses were paid €8 per dialysis exchange before increased reimbursement raised the rate to €11.6 (33).

All in all, the cost generated solely by nursing assistance amounted to approximately to €23,400 per patient–year for CAPD with 4 daily exchanges and to approximately €18,200 per patient–year for automated PD. Assistance by a family member is reimbursed to patients at €69 per patient–week. Even with those additional costs, PD is still less expensive than in-center HD (29).

In Belgium, a specific weekly reimbursement rate that does not differentiate between CAPD and automated PD was introduced for aPD in July 2001; it currently amounts to €866 per patient–week (33). This amount is paid directly to the dialysis unit responsible for paying the nurse providing the aPD. Currently, nurses receive €360 per patient per year for CAPD (regardless of the number of exchanges) and €356 per patient per year for automated PD (2 daily visits). In Denmark, home-care nurses are employed by local health authorities and are paid a fixed annual salary (20). In Switzerland, PD assistance at home is paid by various health insurers at the rate of €0 per hour. This amounts to approximately €10,920 per patient–year because 1 hour daily has been considered to be sufficient (33). In Germany, a rate of €15,600 per patient–year is possible, but only for patients who otherwise would be treated with in-center intermittent PD. In the United Kingdom, a rate of approximately €13,000 – €16,000 per patient per year is possible, depending on the geographic location of the patients (33).

The frequency of visits provided is an important determinant of the overall cost of dialysis therapy. According to Oliver and colleagues, who promoted aPD in Toronto, about 25% of patients eventually “graduate” to either partly (that is, they require only 1 daily visit) or completely take over their own dialysis treatment (13). In the first year of dialysis, the mean weekly rate of home-care visits was 5.8, well below the maximum allowable visits of 14 weekly. Those authors believe that aPD can be cost-effective when costs are compared between PD and in-center HD (32).

Conclusions

The worldwide increase in frail elderly patients with ESRD deserves the preparation of plans for their care. These plans should include optimal pre-dialysis care and adequate modality education by a multidisciplinary team to identify barriers to self-care PD and a suitable

program of aPD, with reimbursement for such assistance. The model of nursing assistance at home is the cornerstone of aPD. Important considerations of an assisted model of care include frequency of visits provided, the type of health care provider that will perform the visits, and the tasks that will be performed for the patient at home. With assisted PD, free choice can be offered to patients who cannot perform their own PD exchanges. To optimize the results, regular home visits by hospital nurses from the original training center should be introduced. Nevertheless, larger, longer, and better studies of aPD are warranted, especially concerning the length and frequency of hospitalizations and the cost-effectiveness of such treatment, which have been described as the major obstacles to an aPD program.

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