Peritoneal Dialysis
Past, Present, and Future

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Approximately, 10% to 15% of patients with end-stage renal disease are on peritoneal dialysis (PD) worldwide, with a dramatic difference in the use of PD among various countries. Recent data show a survival benefit of PD over hemodialysis which is maintained up to the 3rd year. The quality of life studied by various models is as good as, if not better than, that in patients on hemodialysis, for at least the first 2 years. In most countries that locally manufacture PD solutions, PD is significantly cheaper than hemodialysis. Several studies have found a better immediate graft function, lower rate of delayed graft function, and lower use of immunosuppressive medication after kidney transplantation in patients previously on PD compared to those on hemodialysis. There is a significantly lower rate of hepatitis C and hepatitis B infections in patients on PD compared to those on hemodialysis. Longer maintenance of residual renal function in PD compared to hemodialysis adds to the lower morbidity and the survival benefit of PD mentioned above. Many developments in the prevention of the causes of technique failure, including measures to prevent serious peritonitis episodes and new biocompatible PD solutions, together with the possible advantages of some types of catheters and implantation techniques, encourage us to believe that we can offer successful long-term PD in the near future. Overall, the new insight into the pathogenesis of peritoneal membrane changes, the response of the industry to this knowledge by producing new biocompatible PD solutions, the decrease in the peritonitis rate and the introduction of assisted PD at home encourages us to believe that the future of PD is indeed bright.

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INTRODUCTION

This review will first briefly look at the history and development of peritoneal dialysis (PD), will discuss the present status of PD worldwide, then will review the major technical aspects and complications of PD, and finally will delineate the position of PD in renal programs caring for patients with end-stage renal disease (ESRD).

HISTORY AND DEVELOPMENT OF PERITONEAL DIALYSIS

The first PD was performed for a uremic patient in 1923 by Georg Ganter at the University of Wurzburg.[1] Although the symptoms were alleviated temporarily, the patient died soon thereafter. Between 1924 and 1938, several medical teams in the United States and Germany performed regularly

repeated (*intermittent*) PD treatment and used the procedure for the short-term replacement of kidney function.[1] Intermittent PD never became popular for management of chronic kidney failure because of the risk of underdialysis, malnutrition, and frequent episodes of peritonitis.[2] However, some dedicated units achieved good results.[3] In 1978, Popovich and colleagues published their first results of continuous ambulatory PD (CAPD).[4] The principles of this mode of PD had been devised 2 years earlier.[2] In 1978, when Oreopoulos and colleagues first described a simplified technique for CAPD using plastic bags, the Toronto Western Hospital Technique for CAPD, PD became accepted as a home-based renal replacement therapy.[5]

PRESENT STATUS OF PERITONEAL DIALYSIS WORLDWIDE

Approximately 10% to 15% of patients with ESRD are on PD worldwide.[6] There is a dramatic difference in patients using PD among various countries, ranging from around 80% of all patients with ESRD in Hong Kong and Mexico and 45% of those in New Zealand to less than 10% in US, Japan, Germany, Chile, and Uruguay.[7] In Iran in early 2008, 6.7% of the patients were on PD and the rate has been increasing during the past few years (personal communication with the Management Center for Transplantation and Special Diseases, Iranian Ministry of Health and Medical Education). A rapidly rising trend of PD is found in many Asian and Eastern European countries. The fastest growth rates are seen in China and India; these countries have had an annual PD growth rate of about 20% during the past few years. In contrast, the rate of PD seems to be decreasing in the North America, many Western European countries, Australia, and New Zealand.[7] The reasons for the rise or fall in PD utilization rates seem to vary from country to country. In Hong Kong for instance, the increase in the utilization and the increasing success of PD has been attributed to patient factors such as smaller body size. Such patients need fewer numbers of daily exchanges leading to greater patient compliance. The lower mortality rate thus achieved depends also on genetic factors as well as lifestyle, dietary habits, and cultural practices.[8] In Hong Kong, reimbursement factors and government policies mandating the use of PD before consideration of hemodialysis have also been important. On the other hand, in some European countries, the decreased PD utilization has been mainly attributed to financial and reimbursement issues related to different types of medical insurance and biases on the part of healthcare professionals against PD due to lack of experience with this technique or financial reasons.[9]

SURVIVAL ON PERITONEAL DIALYSIS

During the early years of PD, Fenton and coworkers showed that PD gave a definite advantage; for the first 2 years, survival was higher in patients on PD compared to those on hemodialysis.[10] Subsequently, the survival with the two modalities was the same, and after 4 years, it was slightly lower in patients on PD. However, the 2005 Canadian Registry data showed that in an unadjusted population, the benefit of survival with PD may be maintained up to 5 years both in diabetics and nondiabetic patients (Table 1).[11] In the most recent 2007 registry, this benefit was maintained for up to the 3rd year.[12] In a recent report of the United States Renal Data System, the benefit of PD over hemodialysis persists even with adjusted data (Figure 1).[13] The reasons for a comparable or even better survival of patients on PD may include better preservation of residual renal function (RRF) in PD, the "unphysiologic" effect

Table 1. Unadjusted Patient Survival for Incident Dialysis Patients by Incidence, Dialytic Modality, and Diabetic Status, in Canada, Between 1993 and 1997[12]*

Time Interval	Patient Survival, %			
	Hemodialysis		Peritoneal Dialysis	
	Nondiabetic (n = 7367)	Diabetic (n = 3660)	Nondiabetic (n = 2962)	Diabetic (n = 1791)
3 months	94.8	96.3	98.3	98.5
1 year	80.7	79.9	89.2	86.4
3 years	59.9	50.5	66.8	53.6
5 years	44.1	29.0	48.9	31.3

*Patients are censored at the time of their first kidney transplant. Diabetic status is based on primary diagnosis and comorbidity status.

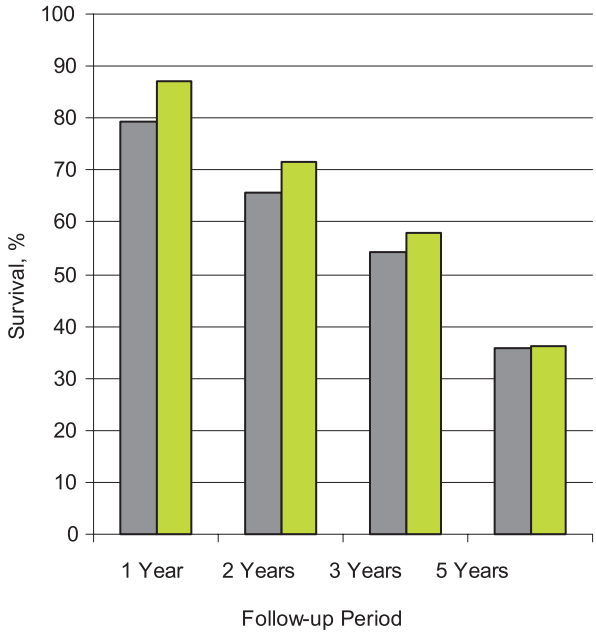

Figure 1. Adjusted survival probabilities-incident patients. Adjusted for age, gender, ethnicity, and primary diagnosis. The United States Renal Data System, 2007 Annual Data Report, Patient Survival Reference Tables (I Tables).[14]

of intermittent hemodialysis, and the increased rates of sudden cardiac death among patients on hemodialysis, especially on Mondays and Tuesdays (after the 2-day interval), again due to intermittent nature of hemodialysis.[14-17]

QUALITY OF LIFE

Quality of life studied by various models in patients maintained on PD is as good as, if not better than, that in patients on hemodialysis, for at least the first 2 years.[18] In 2005, Barendse and colleagues found that, compared to patients on hemodialysis, those on CAPD were significantly more content with the degree of discomfort and pain associated with their treatment and more likely to recommend their treatment to others with ESRD.[19] In another study, Rubin and associates showed that several weeks after initiating dialysis, patients receiving PD rated their care higher than those receiving hemodialysis (85% versus 56%).[20]

COSTS

Although in countries where PD solutions are being imported, the cost of PD may be as high as or even higher than that for hemodialysis, in most of the countries that manufacture PD solutions locally, PD is significantly cheaper than hemodialysis. In 2008, Baboolal and colleagues published a costs analysis report in the United Kingdom and showed that automated PD and CAPD were significantly less expensive than hemodialysis.[21] De Vecchi and Dratwa studied the costs of PD and hemodialysis in different countries according to their healthcare systems, ie, public or mixed public and private. Practically, everywhere the least expensive modalities were home hemodialysis and CAPD.[22] In the Toronto Western Hospital that has total control of the budgets for the various dialysis modalities, the total annual costs of the various forms of dialysis (excluding hospitalizations) were Can $ 26 992 for home PD compared to Can $ 47 779 for in-hospital PD (personal information).

PERITONEAL DIALYSIS AND KIDNEY TRANSPLANTATION

In countries like Iran where kidney transplantation is performed with no waiting lists,[23] and about one-half of patients with ESRD have received a kidney transplant (personal communication with the Management Center for Transplantation and Special Diseases), it would be useful to know how patients who were maintained on PD before transplantation do after transplantation, compared with those maintained on hemodialysis. Several studies that have reviewed the results of transplantation have found similar survival rates between patients on PD and hemodialysis.[24-26] However, Perez Fontan and colleagues found a better immediate graft function (68.5% versus 46.5%, $P < .001$), a lower rate of delayed graft function (22.5% versus 39.5%, $P < .001$), and no graft function (9% versus 14%, $P < .001$) after kidney transplantation in patients previously on PD compared to those on hemodialysis.[27] They also showed a lower use of immunosuppressive medication and a lower incidence of late infections in patients previously on PD. Bleyer and associates found a higher rate of posttransplant oliguria and delayed graft function in patients previously on hemodialysis compared to those on PD.[28] Goldfarb-Rumyantzev and colleagues showed that hemodialysis immediately before transplantation or as a predominant modality of renal replacement therapy during the course of ESRD was associated with an increased risk of graft failure and recipient death.[29] Also, Van Biesen and coworkers reported a better initial graft function (76% versus 50%), and as a result, shorter time to dialysis independence

in patients on PD after kidney transplantation.[30] With regard to early infectious and noninfectious complications and hospitalization, reports on the two modalities showed similar results, except for one study that showed higher frequencies of infections and complications in patients maintained on PD than on hemodialysis.[31]

PERITONEAL DIALYSIS AND VIRAL HEPATITIS

In countries with a high prevalence of hepatitis C infection, PD has a definite edge over HD. Among patients on hemodialysis, the prevalence of hepatitis C increases due to seroconversion for up to 5 years, whereas it remains unchanged in those on PD.[32] In a review of 9 studies, Pereira and Levey showed a significantly higher prevalence of hepatitis C seropositivity in patients on hemodialysis versus those on PD.[33] Also, a study from Brazil showed a significantly higher prevalence of hepatitis C and hepatitis B infection in patients on hemodialysis compared to patients on PD.[34]

TECHNIQUE FAILURE

One of the drawbacks of PD is the high rate of technique failure (Figure 2).[35] Whereas after an initial drop, patients on hemodialysis are maintained on this modality, a large percentage of patients on PD switch from PD to hemodialysis for reasons that include serious or persistent peritoneal infections

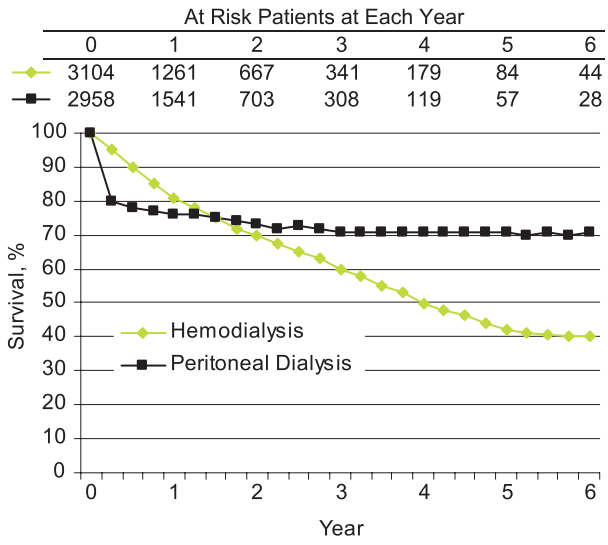

Figure 2. Technique survival in diabetic patients by type of dialysis, Canada, 1981 to 1995. Adapted from the Canadian Organ Replacement Register Annual Report (Includes data 1981-1995).[36]

due to *Staphylococcus aureus*, *Pseudomonas aeruginosa*, or fungi; difficulties with the peritoneal catheter; decline in RRF; and development of uremia, chronic peritoneal membrane changes leading to ultrafiltration failure, and eventually, in some patients, development of encapsulating peritoneal sclerosis (EPS). In addition to the increasing age of new patients with ESRD (the average age of new patients is close to 65 years in the United States and Canada), a large percentage of older patients, ie, those older than 75 years of age, are unable to undergo PD at home without assistance. However, over the last 5 years, many developments in the prevention of these causes of technique failure encourage us to believe that we can offer successful long-term PD in the near future. These developments can be classified as follows:

Reduction in Peritonitis Rates

For years, in most Western countries, the use of double-bag systems has decreased substantially the rate of peritonitis to 1 episode in every 30 to 36 patient-months.[36] In the Eastern Asian countries (China, Korea, and Japan), the peritonitis rate with this system seems to be even lower, as low as 1 episode every 50 or 60 patient-months.[36] However, the decrease in peritonitis rates is mainly due to the decrease in *S epidermidis* infection, whereas the rate of serious peritonitis episodes, ie, those due to *S aureus*, *Pseudomonas aeruginosa*, and fungi, remain as high as before.

Prevention of Serious Peritonitis

Prevention of Staphylococcus Aureus Exit-Site Infections and Peritonitis. Bernardini and colleagues first showed that application of mupirocin at the catheter exit site decreases the exit-site infection due to *S aureus*.[37] Subsequently, Thodis and coworkers[38] confirmed this observation and also showed that even the incidence of peritonitis due to *S aureus* decreased substantially among those who used mupirocin ointment at the exit site. Today, in most centers, this is a routine practice.

Prevention of Gram-Negative Infections. More recently, Bernardini and colleagues showed that the application of gentamicin ointment at the exit site decreased infections not only those due to *S aureus*, but also those due to gram-negative organisms and specifically *Pseudomonas*

aeruginosa.[39] This observation is quite impressive, but unfortunately, it has not yet been confirmed by other investigators. The main concern with this intervention remains the possibility of developing gram-negative organisms resistant to gentamicin. Be that as it may, we are encouraged by the possibility of being able to prevent exit-site infections, and possibly peritonitis, due to gram-negative organisms.

Prevention of Fungal Peritonitis. In a randomized controlled study, Lo and colleagues showed that using oral nystatin in patients on PD who are receiving antibiotics substantially decreases the rate of yeast infections, especially those due to *Candida*.[40] The results of this study were not confirmed by another prospective study at the Toronto Western Hospital,[41] but because of the dramatic effects in the Hong Kong study and lack of any serious complications from the use of nystatin, the official guidelines of the International Society of PD (ISPD) now endorse the simultaneous use of nystatin, whenever a patient on PD is being treated with antibiotics for long periods.[42]

Biocompatible Solutions. In the past few years, nephrologists have shown a tremendous interest in the new biocompatible PD solutions that have a neutral pH and low glucose-degradation products (GDP) content. Laboratory evidence indicates that the new solutions have a better bacterial-killing action compared with the standard ones.[43,44] Since this observation, registry studies have indicated lower peritonitis rates among patients undergoing dialysis with the new solutions, and 2 non-randomized comparative studies have shown that patients with bicarbonate-based biocompatible solutions had lower peritonitis rates than those on dialysis with standard solutions.[45,46] However, in a prospective controlled study designed to look at the effect of the new dialysis solutions on RRF, those who were on the new solutions did not have significantly different peritonitis rates than those on the standard solution.[47] However, the latter study was not powered to determine the effect of the new solutions on peritonitis and one should wait to see whether these findings are confirmed by others.

Other Areas of Prevention. Non-evidence-based practices of prevention using prophylactic antibiotics have been employed by various centers before catheter implantation, dental work, colonoscopy, and dilation and curettage.

Other Infections. It is important to notice that the overall hospitalization rate due to septicemia is significantly higher in patients on hemodialysis than in those on PD, and the difference has increased during the past decade.[48] Also, the rate of other infections such as pneumonia is lower in patients on PD compared to patients on hemodialysis.[49]

TREATMENT OF PERITONITIS

According to the recent ISPD 2005 recommendations concerning the treatment of peritonitis,[42] one should expect 80% cure rates, 15% to 18% catheter removal, and 2% to 3% deaths. Indications for catheter removal include fungal infections (requiring immediate removal) and persistent peritonitis with *Pseudomonas* or *S aureus* that does not respond to treatment of more than 4 to 7 days, especially if there is simultaneous exit-site infection with the same organism.

PERITONEAL CATHETERS

Complications with these catheters are the Achilles' heel of PD. Unfortunately, many centers do not have access to expert individuals, either nephrologists or surgeons, who are able to implant PD catheters without complications. Furthermore, even in centers which have such access, rapid implantation of peritoneal catheters is not always possible due to restrictions of operating room availability.

Recently, Strippoli and coworkers noted that even though a large number of patients use PD as a modality for renal replacement therapy, we still do not know whether any particular PD catheter design, implantation technique, or modality is more effective than others, because of the limited available prospective controlled trials.[50] Peritoneoscopic implantation seems to be the preferred implantation method.[51,52] Recently, the Missouri group has promoted the use of presternal catheters for patients who have abdominal complications, like stomas. This group has gone further and used presternal catheter almost exclusively in all their new patients.[53] Contrary to catheters that exit at the abdominal wall, the lack of mobility of presternal catheters at the exit site may be a benefit. Finally, some centers have had good results with the Moncrief-Popovich technique of embedded catheters.[54]

Although there are no controlled studies, based

on experience and the literature, we can speculate that double-cuffed catheters lead to lower infection rates than single-cuff catheters do.[55] The type of catheter used makes no difference to peritonitis rates. However, prophylactic use of antibiotics at the time of implantation seems to prevent early peritonitis episodes (within 2 weeks after implantation).[37,38]

RESIDUAL RENAL FUNCTION

Preserving the RRF in patients with ESRD helps them have a more liberal diet and fluid intake; facilitates volume control and total sodium removal; improves total solute, β2-microglobulin, and middle molecule clearance; provides more erythropoietin production and better calcium, phosphorus, and vitamin D homeostasis; and overall, improves the quality of life and increases patient survival.[56,57] Many studies have confirmed the importance of the RRF; the re-analysis of the CANUSA study by Bargman and associates showed that the contribution of RRF is much more important than peritoneal clearance.[56] The Kaplan-Meier survival curves of patients on PD with and without RRF showed significantly higher survival rates in those with preserved the RRF.[58] Thus, we must exert every effort to slow down the rate of decline and avoid insults to the RRF. Several papers have shown that compared to hemodialysis, the decline of the RRF is slower in PD.[14,59-61] However, it does continue, and except for a few patients, most patients on PD become anuric after 2 years.[62]

Recently, 2 papers have shown that the use of either an angiotensin-converting enzyme inhibitor or an angiotensin receptor blocker have slowed the rate of decline of the RRF.[63,64] We recommend the use of an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker in almost all patients on PD; in a recent retrospective analysis of our patients over the past 5 years, we observed a higher survival rate among patients on angiotensin-converting enzyme inhibitor or angiotensin receptor blockers *versus* those not receiving these agents.[65] Volume depletion is one of the important factors that lead to rapid decline in the RRF in patients on PD. Gunal and colleagues have shown that strict fluid control in patients on PD can control the blood pressure, but at the expense of a decline in the RRF.[66] Also, one should avoid the use of nephrotoxic drugs such as aminoglycosides, although the evidence incriminating them is not conclusive.[67] Similarly, albeit no strong evidence, the use of a radiocontrast media in these patients may have a deleterious effect on the RRF.[68,69]

Whereas the initial experience indicated that the new biocompatible solutions may slow the rate of the RRF decline,[46,70] a recent prospective controlled trial by Fan and colleagues[47] indicated that no one solution made a difference in the rate of decline in RRF. Choi and colleagues confirmed this in another prospective controlled study.[71] However, the latter study included many patients who had been on PD for an average of over 60 months and many of them were anuric at the time of the study. Thus, we believe that the role of the new biocompatible solutions with neutral pH in reducing the rate of decline in the RRF has not yet been clarified and we require new prospective controlled studies in incident patients.

LONG-TERM PERITONEAL DAMAGE

After a period of 2 to 3 years, standard PD solutions induce a thickening of the peritoneal membrane due to fibrosis and new vessel formation (*neovascularization*).[72] With time and with the addition of an episode of severe peritonitis, the peritoneal thickening may expand and encapsulate the bowel loops, thus leading to the serious complication of EPS.[73,74]

Loss of the mesothelial layer, as reflected in the decrease in the effluent cancer antigen 125 (CA125), indicates peritoneal damage, whereas the maintenance or even increase of the effluent CA125 in patients using the new biocompatible solutions raises hope that the long-term use of these new solutions may prevent long-term damage to the peritoneal membrane.[71]

The bio-incompatibility of the standard PD solutions is due to their low pH, the presence of GDPs that are generated during the sterilization of glucose at high temperatures, the hyperosmolality, and possibly the presence of lactate. Glucose itself may damage the peritoneal membrane, but may also have adverse systemic effects such as hyperglycemia, insulin resistance, new onset diabetes mellitus, and cardiovascular disease.[75]

Gradually we are clarifying the mechanisms of long-term peritoneal damage. Increased production of VEGF may lead to neovascularization,[76-78] whereas inflammation may increase the production of

transforming growth factor β1 that may itself lead to peritoneal fibrosis.[76] Finally, GDPs may cause cellular damage and increase the production of advanced glycozylation end products.[79] Witowski and coworkers showed that GDPs damage mesothelial cells in culture.[80] Exposure to GDPs resulted in a progressive loss of cell viability as measured by the ability to metabolize the methyl thiazol tetrazolium salt. Considerable alterations in cell morphology were evident after 8 days, and these cells showed a decrease in function by a lower release of interleukin-6 and fibronectin.

Nonglucose low-GDP solutions include icodextrin and amino acids solutions; in addition, the 3 major manufacturers of PD solutions now provide low-GDP glucose solutions in 2-chamber bags, in which glucose is sterilized in a compartment separate from the rest of the ingredients. Evidence of the advantages of low-GDP solutions comes mainly from short-term studies that have shown that CA125, a surrogate marker of mesothelial cell mass and turnover,[81] remains unchanged or even increases with the use of these solutions.[71] These higher effluent CA125 levels may imply that the novel, low-GDP concentration PD fluids may restore healthy mesothelial cell physiology. Regarding the effects of new biocompatible solutions on ultrafiltration, some studies show a decrease and others show an increase in ultrafiltration.[82] We have discussed above the effect of these solutions on the RRF and peritonitis rate. However, we need long-term studies to establish the possible long-term advantages of these new biocompatible solutions, because the damaging effects of the standard solutions on the peritoneal membrane appear only after 2 or 3 years.[83] Only 1 study from Korea, not a prospective or randomized controlled study, showed a better survival in patients using biocompatible low-GDP solutions versus those using standard solutions.[84] The accompanying editorial pointed out the many limitations of this study.[85]

ENCAPSULATING PERITONEAL SCLEROSIS

On many occasions, EPS has been a fatal complication of long-term PD.[86] Its estimated prevalence has been reported as between 0.7% in Australia, 2.5% in Japan, and 3.3% in the United Kingdom.[87-89] Its incidence increases with the duration of PD and can reach up to 15% in patients who have been on PD for 10 years or more.[90] As defined by the *ad hoc* committee of the ISPD, this is "a clinical syndrome with persistent, intermittent, or recurrent presence of intestinal obstruction with or without the existence of inflammation parameters and the existence of peritoneal thickening, sclerosis, calcifications, and encapsulation confirmed by macroscopic inspection or radiological findings.[91]" According to the "2-hit theory" of the pathogenesis of EPS, it requires the development of peritoneal damage (mesothelial layer damage, along with thickening, fibrosis and neovascularization of the peritoneal membrane [first "hit"]) on which a serious infection episode (second "hit") is superimposed to produce the extensive lesions characteristic of EPS.[92] Recently, it has been shown that EPS develops after PD is stopped because of transplantation or transfer to hemodialysis, suggesting that the continuation of PD may exert a protective role.[93] Also, the profibrotic effect of calcineurin inhibitors may contribute to the development of the EPS after kidney transplantation.[93]

Encapsulating peritoneal sclerosis is difficult to treat, although Kawanishi and colleagues in Japan have introduced a successful surgical adhesion lysis.[94] Nonetheless, they reported 30% to 40% recurrence.[94] Also, anecdotal case reports indicate that tamoxifen alone or with steroids may have a beneficial effect.[95] Duman and colleagues showed that everolimus (a derivative of sirolimus) may reverse the lesions of experimentally induced EPS in animal models.[96]

INTEGRATED CARE

Home dialysis has many advantages for the patients and the community; recently a new approach to new patients emphasizes the benefits of home dialysis and instead of asking them to choose between PD and hemodialysis, they should be asked to choose between home dialysis and in-center dialysis. With the advances in home hemodialysis, patients who choose dialysis at home can either go on home hemodialysis or home PD. Those who want to go home but they cannot perform the procedure by themselves can do so with assistance by a visiting nurse.[97] At the University Health Network, this policy has led to a high percentage of patients being treated at home (Table 2).[98]

Patients can move between home hemodialysis

Table 2. Selection of Various Dialysis Options by Patients Who Started Treatment of Kidney Failure Immediately Following Training by a Specialized Nurse[98]

Patients	Number (%)
All	204
Moved to other centers	102 (50.0)
Remaining in our program	102 (50.0)
In-center hemodialysis	34 (33.3)
Home peritoneal dialysis	42 (41.2)
Home hemodialysis	26 (25.5)

and home PD if they do not do well on one treatment and also they can have kidney transplantation after waiting at home. As mentioned earlier, with increasing age, many elderly patients, especially the very old, have difficulty in doing their own self-dialysis at home and may prefer assisted or in- center dialysis. Figure 3 shows this approach to a new patient with ESRD who requires renal replacement therapy.

ASSISTED PERITONEAL DIALYSIS

This approach is indicated for patients who are willing to enjoy their independence at home, but are unable to do so, and also for new patients who are overwhelmed with the thought of doing PD at home and for patients who require care at a nursing home.[97] According to Oliver and colleagues who have promoted this model of assisted PD in Toronto, with the availability of home care assistance, 75% of their new patients chose PD.[99] A visiting nurse connects the patient with the cycler in the evening and disconnects him/her from the machine in the morning. It is interestingly that 25% of these patients eventually "graduated" either partially (ie, require only 1 visit per day) or completely, to take over their own dialysis. Despite the additional cost of the nursing visit, the average cost of assisted PD in Oliver's program was lower than that of in-center hemodialysis by Can $ 12 000 per patient-year. Experience from France indicates that the peritonitis rate among patients on assisted PD is similar to that among non-assisted patients.[100] Patients on assisted PD had 1.4 hospitalizations per year and spent 29.5 hospital days per year. One-year technique survival was 81%.

We will have to perform further studies to establish the costs, rate of complications, peritonitis rates, and hospitalization rates for patients on assisted PD along with measures of their quality of life on assisted PD.

WHAT IS THE RIGHT PLACE OF PERITONEAL DIALYSIS IN RENAL REPLACEMENT THERAPY?

Two hundred and forty nephrologists were asked the question under 2 scenarios. In the first scenario, they were asked to consider only survival, wellness, and quality of life of patients with ESRD. Responders answered that under this scenario 33% of the patients should be on PD and 12% on home hemodialysis. However, under the second scenario, where costs were a major concern, the responders believed that 40% of the patients should be on home PD and 16% on home hemodialysis.[101]

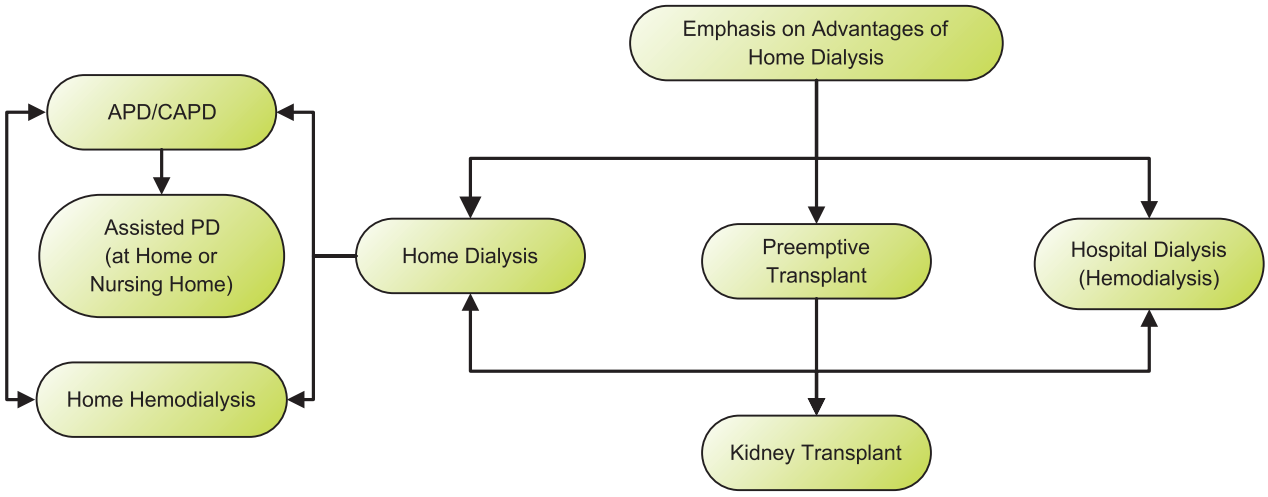

Figure 3. Integrated end-stage renal disease care. APD indicates ambulatory peritoneal dialysis; CAPD, continuous ambulatory peritoneal dialysis; and PD, peritoneal dialysis.

WHAT DOES THE FUTURE HOLD FOR PERITONEAL DIALYSIS?

Never before in the past 30 years have we had such an insight into the pathogenesis of peritoneal membrane changes, the importance of the RRF, and the factors responsible for RRF decline and fluid control. Industry has responded to this knowledge by producing new biocompatible PD solutions and the decrease in the peritonitis rate, and the promotion of assisted PD at home encourages us to believe that the future of PD is indeed bright.

CONFLICT OF INTEREST

None declared.

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