Review Article

Reasons for drop-out of peritoneal dialysis and strategies of prevention: A review

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Abstract

Chronic kidney diseases (CKD) is a disease that has become widespread all around the world and poses a gradually increasing problem; treatment choices are basically dialysis, peritoneum dialysis and kidney transplantation. Eight % of the patients around the world that undergo dialysis treatment have PD treatment. PD is basically the solute diffusion between blood and diffusate in peritoneum capillary, causing ultrafiltration at peritoneal cavity by hypertonic solutions, and finally using peritoneum as a dialysis membrane. PD is an ESRD treatment that is cheap, enabling patients to move freely and that has no survival difference than HD and even has some common points. Interestingly, number of patients that undergo PD has decreased in recent years. Many factors are known to have played a role in that. increase in the number of large-scale dialysis organisations, recurrent peritonitis, transition to HD, increase in the number of patients that undergo transplantation, technical troubles relating to PD catheter, and social and economic condition of the individual can be referred to amongst these factors. In this review, we will endeavour to scrutinise the factors that has affected termination of PD, and strategies of prevention.

Key Words: Peritoneal Dialysis, Reasons for drop-out, strategies of prevention

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Introduction

PD is basically the solute diffusion between blood and diffusate in peritoneum capillary, causing ultrafiltration at peritoneal cavity by hypertonic solutions, and finally using peritoneum as a dialysis membrane (1-3). PD has certain characteristics that renders is superior to hemodialysis (HD) in that it provides fixed biochemical values, contributes to fluid balance, enables more free diet and fluid intake offers more active and free life to the patients as they would not be dependent on the dialysis centre, does not require vascular lead-in and anticoagulation, better controls anaemia, protects residual renal functions, and is relatively cheaper than hemodialysis (2,3). Despite this, PD has certain negative aspects as well. That the patient has difficulties with the treatment, and recurrent peritonitis, catheter outlet infections, technical problems relating to catheter, that liquids to peritoneal cavity contain glucose and a set of metabolic problems can be cited amongst them (4). Despite the aforecited advantages and disadvantages, PD is a treatment that should be preferred to HD in that it protects the remaining renal functions, life cycle of the patient is

superior to that of HD at early stage (5). Despite this, there has been significant decrease in the number of patients that undergo PD treatment recently (6). Consequently, implementation of PD treatment may increase once long lasting and sufficient dialysis and ultrafiltration targets are attained, patients are encouraged to undergo this particular treatment and some technical issues are minimised. In this review, we will endeavour to scrutinise the reasons for termination of PD, and strategies of prevention.

Reasons for Drop-out of Peritoneal Dialysis Treatment

Reasons for termination of PD come under 3 categories, more specifically modality- (method) related issued, system-related issued and patient-related issues.

1. Method-Related Reasons
Peritoneal and Catheter Infections

Peritonitis is the most significant reason that explains transition from Pd to HD. It often occurs in 1 to 2 years as of the beginning of PD. Even though peritonitis attacks do not result in technical failure (TF), it is likely to result in ultrafiltration failure (UFF), and membrane-related issues at later times. Using double codend and system Y has significantly decreased peritonitis attacks recently (7).

Rates of transition from SAPD treatment to HD between 1981 and 1997 have been determined to be 154/1000 patient years in Canadian Organ Replacement Register (CORR) system. When compared to the initial years, the relative risk rates of SAPD treatment incompetence decreased n 1990 and onwards (0,75 vs. 0,83) (8). In another prospective study, switch from PD to HD was reported to be 24.8% for 292 patients from 28 dialysis centers during the term of the study, while switches in year 1 was reported to be 40.2%, followed by 70% in year 2 (9). In the same study, the most common reason for switch to HD was reported to be infection (both catheter and peritonitis-related infections) with 36,9%, followed by volume loading with 18,5%.In randomised studies, frequency of peritonitis attacks were reported to have occurred once every 24,8 months and once every 46,4 months (10). In a study, involving 12 dialysis centers in the U.K., it was reported that patients that underwent APD/SSPD treatment had peritonitis attacks every 18,1 months, and the patients that underwent SAPD had peritonitis attacks every 14,7 months (7). Catheter-related attempts contain modulation and approach modifications in order to reduce peritonitis attacks. In a metaanalysis that contain 37 studies (n= 2822), no meaningful different was found to exist between laparotomi and laparoscopy and catheter insertion in terms of peritonitis attacks (7). On comparing PD catheters with presternal and abdominal laying in terms of peritonitis attacks, it was found that one had an attack every 37,4 months in the case of presternal, and every 20,5 months in the case of abdominal, with no meaningful difference (5).

2. Ultrafiltration Failure and Liquid Loading

Failure to maintain liquid in the body sufficiently and in a well-balanced manner is another incompetence of PD treatment. This can be explained for a couple of reasons such as UF failure, reduced residual renal function (RRF), too much salt and water intake. The actual UF incompetence is attributable to 4 hours of 4,25% dextrose and net UF below 400 ml (5). As a reason for technical incompetence, the prevalence of UF incompetence ranges between 1,7% and 13,7% (4). In a study conducted in the Netherlands, technical incompetence has been defined at the rate of 64% after 2 years (11). Urine volume, systolic blood pressure and peritoneal UF have become independent predictors for this. In a study conducted in Japan, the most common reason for quitting PD after 6 years was reported to be UF incompetence (12). SAPD was the primary treatment in both studies, and no icodextrin was used. However, when compared to the year 2002 and onwards, decrease in preferring the PD treatment compared to previous years has been interesting recently (18).

Table 1. Reasons for Drop-out of Peritoneal Dialysis

MODALITY-RELATED REASONS
Infections Peritonitis Tunel infection, outlet infection **Insufficient Dialysis** Failure to attain KT/V or CrCl targets **Ultrafiltration Incompetence** Failure to attain dry weight Persistent volume loading Mechanical problems **Catheter Issues** Infections Mechanical Complication
SYSTEM-RELATED REASONS
Lack of infrastructure Patient has insufficient educational background and information for PD Lack of PD solution supplier in place of migration Centre effect Lack of expert personnel Absence of dialysis facilities
PATIENT-RELATED REASONS
Fatigue and exhaustion Social reasons (familial and occupational reasons etc.) Geographical reasons: travel distance Absence of RRF Malnutrition and/or excessive loss of proteins Abdominal surgery or hernia Palsy and severe diseases that prevent use of hands Diabetic complications: Severe neuropathy or blindness Inspiratory problems, chronic cough
OTHER
Death Kidney transplantation

Long-term exposure to hypertonic solutions change transport properties of peritoneum membrane. Medium or low transport properties are, however, converted to high permeability, which, in turn, increases needs for high dextrose solutions. As a result, RRF decreases and tendency of liquid loading increases. Liquid loading may be derived from other reasons, in addition to membrane dysfunction.

Reasons including unfollowed diet, excessive sodium consumption and liquid intake, insufficient dialysis prescribing, RRF loss are amongst the common reason for insufficient liquid control (5,19).

3. Catheter Function Disorder

Mechanical complications for PD catheter is another reason for PD failure and switch to HD. The most common reasons for function disorder are the catheter translocation, and occlusion as omentum is wrapped up in catheter. Early and proper intervention may save many catheters though (14).

2. System-Related Issues

When compared to some countries like Canada, and the U.K., HD is relatively more acceptable as a treatment in USA (14). For this reason, PD prevalence is quite high in Australia, New Zealand, China, and Canada (ranging between 20 and 30%) (15). PD constitutes 80% of the dialysis population in Hong Kong where2 year-treatment survival rate of PD is reported to be 82% (16). In addition, high rate of success in Hong Kong can be explained by repayment policies, and probably genetic factors, and many numbers of PD patients and expert personnel (16). For instance, duration of Pd training is only 4 to 5 days, and many operations such as putting and removing catheter are performed by nephrologists, which, in turn, reduces surgical consultations and enables an opportunity for timely treatment.

In a recent study, number of units in USA increased in a period of 9 years between 1996 and 2004 (> 50%) (17). Despite the fact that number of dialysis patients tends to go higher (from 39% to 53%), number of Pd patients did not go higher. It was reported that rate of termination of PD treatment at the centers where PD patients were less (<20-25) were actually higher (5,19). The studies demonstrate that a correlation exists between high technical incompetence and low patient survival at a centre, and fewer number of patients (4,14). As a result, it can be concluded that training and number of expert personnel remain insufficient at a centre where number of patients is fewer (4,14), in other words, experience of sorting out the reason that leads to termination of PD is limited. Number of patients per trainer was less than 5 at 29% of the training programmes in USA. Likewise, nephrology assistants that received PD training at 14% of the training programmes were less than 5%, and only 32% of the PD patients that went to a polyclinic made an attempt to that (4,14). Lack of training and untrained nephrologists might cut back the comfort of Pd treatment, consequently paving the ground for the tendency that gradually more patients switch to HD.

3. Patient-Related Issues

One of the patient-related factors that lead to misuse of PD is the lack of pre-dialysis training. There is a strong relation between using chronic PD as an option for treatment and discussing it with the patients as an option for treatment before undergoing dialysis (4). Living in an area that is distant from the dialysis centre is also one of the significant factors in selecting PD as an option for treatment (14).

In the Dutch Registry study conducted between 1994 and 1999, the researchers found that no correlation existed between the age of the patient and diabetes, where they found that a meaningful correlation existed between TY and advanced age (18). In another study, TY rates were found to be similar with the patients under and over 55 years of age. In the case of the diabetics, technical incompetence was slightly higher, whereas there was no statistical relevance (3). In a prospective study that includes 262 patients, Jaar et. al. (9) reported that rate of termination of PD due to liquid loading problems was 18,2% relevance operations and malnutrition were two of the other reasons for PD incompetence as determined by the study. Even though dialysis was a treatment that enabled patients with irreversible renal disease to live on, it cannot improve the normal living quality. Other underlying diseases might also cause incompetence in using PD.

Strategies of Prevention

1. Peritonitis and Catheter Infections

Better treatment and prevention of peritonitis and catheter infections shall reduce the rate of patients' quitting the PD treatment (4,14). Prophylaxis reduces peritonitis attacks versus catheter outlet infections, and this is done by mupirocin and gentamicin. It was found in a

study that topical gentamicin administration was more effective against gram-negative factors, and were on an equal level against gram-positive ones compared to that of mupirocin administration. At certain centers, APD was found to be correlated with lower technical incompetence and peritonitis, and PD incompetence in some patients might be balanced out once ADP administration becomes widespread. In the aforecited study, binary antibiotics combination (cephalosporin and another antibiotics) was reported to yield better results than single antibiotics. That being said, experience of the centre might also be meaningful for the peritonitis treatment.

2. Ultrafiltration Incompetence and Liquid Loading

Glucose is a standard osmotic agent in Pd solutions, and causes changes in membrane that results in membrane incompetence (4,14). It is indicated that PD is likely to minimise membrane damages if made with more biocompatible solutions that contain no dextrose. In a study wherein over 7000 Japanese patients were examined, drop-out rates were found to be 8.9% for the patients that were administered with icodextrin, whereas the given rate was found to be 14.5% with the patients that were administered with dextrose. It was demonstrated in a recent study that small solute transport increased less in the case of the patients that were administered with ACEI according to the controls, whereas a positive effect was determined upon Pd technical survival. Gene therapy was implemented for the peritoneal fibrosis in animal models, yet there are no studies conducted on human beings for this. RRF protection is crucial for PD patients , and RRF decrease was found to be correlated with technical incompetence associated with all reasons, and with mortality. Even though such effect is likely to volume-related, it is indicated that using biocompatible solutions in combination with less glucose breakdown product helps protection of RRF for a much longer process. To preserve RRF, it is important to avoid using additional radio contrast substance and nephrotoxic agents. As a result, membrane protection and prescribing require due diligence as much as patient training and normovolemia-enabling dead weight do (4,14).

3. Catheter Function Disorder

Most of the reasons for catheter malfunctioning such as bladder and bowel obliteration can be remedied by using laxatives and bladder excretory (4,14). If obstruction occurs due to coagulum, it can be solved by injecting heparin saline; if this fails, then tissue plasminogen activator or injection into urokinase catheter can be tried. Being one of the widespread problems, omentum involution and cohesiveness omentopexy might be corrected by interventions such as melting the cohesiveness, appendix resection and colopexia. Radiological imaging might be needed for a swift and early diagnosis of the underlying problem; for instance if catheter is determined to have translocated, it can be laparoscopically corrected successfully. Inserting a presternal catheter may enable PD treatment for those that suffer from colostomy or apparent obesity.

4. System-Related Issues

Optimisation of PD facilities dimensions

For successfully PD programmes; the role of the nurses and number of nurse(S) per patient are known to be of significant (4,14) In this case success increases at the rate o 1/20. Nurses should establish and develop a professional harmony with patients, helping them to feel themselves autonomous. Programmes that cover over 50 patients should be evaluated as optimum. Nurses should participate in training programmes they are invited. In this way, relatively smaller programmes might help for a more effective patient care.

Patient Training and Information

On being told that undergoing dialysis is necessary, patients are often intimidated and react, not wanting to accept that (4,14). Pre-dialysis training should be provided by nephrologists, nurses, dieticians and social workers, and even by a team composed of other dialysis patient a few months in advance of the dialysis. In a notice in Hong Kong, 50% of the patients to whom Pd was recommended were

reluctant to start PD treatment, whereas they accepted it after pre-dialysis training. Another notice from the U.K. demonstrate that nearly 50% of the patients that were provided with information about PD was actually thinking of an HD treatment prior to pre-dialysis training, whereas they chose PD treatment over HD treatment. National pre-SDBY training programme organises a large-scale pre-SDBY training programmes participated by 932 nephrologists throughout USA, and 28 trainers. They provided 15.000 patients with information about renal failure and RRT. 55% of the patients preferred HD while 45% preferred PD after full training. Throughout the pre-dialysis training, it is important for an accomplished PD treatment that patients are provided with effective pre-dialysis training. A good training may lead to last-stage recovery in the case of PD. Peritonitis rates of the patients that were provided with a PD training at home were observed to have decreased. For this reason, pre-dialysis training and information plays a key role in rendering PD a widespread practice.

Physician Training and Information

It is essential to provide nephrology assistants with sufficient information so as to alleviate concerns of the physicians that are reluctant to start PD. Instead of programmes that anticipate a limited vascular route of entry, nephrology assistants should be offered positions at larger PD centers for the purpose of rotation, and trainings should be provided in support of visuals or leaflets, if necessary. Another option is to increase the period of PD training (4,14).

Cost Planning

The fact that governments do not give large dialysis centers a rough time for the payments cause that these large institutions encourage patients in favour of HD (4). For this reason, it is considered that PD usage levels have diminished. Recently the US government strives to impose restrictions on the payments within the framework of a new package (14). Therefore, an increase in the number of patients that undergo PD treatment is targeted.

5. Patient-Related Reasons

Consultations are needed to eliminate patients' tiredness of treatment. Psychosocial supports of nurses and healthcare personnel in the form of home visits might minimise the problems. Assisted PD programmes with the help from the family members and nurses have yielded good results especially in the case of old patients and patients that underwent unplanned PD. In this way, family support is found to be correlated with the increase in PD from 63% to 84%, PD usage level of the patients that resisted Pd treatment increased from 23% to 39% (4). Compliance with a chronic disease in the long run is quite difficult. Although it is not approved by American Food Pharmaceutical Association, it has been demonstrated that dialysate solutions containing amino acid in the case of malnourished patients improved protein anabolism in dialysis patients (14).

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