THE FACTORS AFFECTING THE DROPOUT OF PERITONEAL DIALYSIS IN PATIENTS REFERRED TO A DIALYSIS CENTER IN NORTHWEST IRAN

Mohammadreza Ardalan[1], Mohammadreza Moslemi[1*], Sepideh Zununi Vahed[1], Sahar Heydari[1]

[1*]Kidney Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

*Corresponding author: Mohammadreza Moslemi
Email: moslemi_mohammadreza@yahoo.com

Abstract

Introduction: Peritoneal dialysis (PD) is a type of dialysis that is more affordable than other methods. This study aimed to determine the factors affecting the dropout of PD in patients referred to a dialysis center in northwest Iran.

Material and Methods: This retrospective study was conducted with census sampling on 719 end-stage renal disease (ESRD) patients who underwent PD in Imam Reza hospital in Tabriz between 2001 and 2022. After determining the frequency distribution of factors for dropping out of PD in patients was evaluated.

Results: Most causes of PD dropout were related to death (40.5%), kidney transplantation (27.3%), peritonitis (11.6%), catheter failure (6.8%), insufficient dialysis (5.7%), intolerance (4.6%), renal function reversal (0.6%), severe disease, Probably, they have played an important role in improving the condition of peritoneal dialysis patients during these years. (0.1%), and exit site infection (0.1%) respectively. The duration of PD was longer in people who did not smoke than others (P=0.004). The lowest mean course of PD was from 2006 to 2009 (P=0.009).

Conclusion: Death, kidney transplantation, peritonitis, catheter failure, insufficient dialysis condition, and intolerance are the most common causes of dropout among PD patients. Not tobacco use may help the maintenance (more extended duration usage) of PD in patients. Also, the mean duration of PD in the years 2018 to 2022 was better than previous years, which is probably a sign of improvement in the quality of dialysis center performance.

Keywords: Peritoneal dialysis, end-stage renal disease, hemodialysis, risk factors.

Introduction

End-stage renal disease (ESRD) is one of the kidney diseases that occurs due to chronic kidney disease progression. In ESRD, irreversible kidney changes are linked to systemic changes (1). Despite advances in diagnosis and treatment, the morbidity and mortality rates of ESRD remain a significant public health concern (2). Poor quality of life in patients with ESRD is primarily influenced by a wide range of life dimensions and is associated with an increased risk of mortality and hospitalization (3,4). The increase in the prevalence of ESRD causes more and more countries to lose their financial resources, and it imposes a great financial burden on patients and their families (5). Patients with ESRD may experience life-threatening situations and are treated with various treatment strategies, including renal replacement therapy, hemodialysis, peritoneal dialysis

(PD), and kidney transplantation. Increasing the use of PD is an effective method in treating ESRD, which may provide an opportunity to significantly reduce the overall costs of treating this condition compared to other treatment strategies (5). Notably, waiting for a kidney transplant, PD maintains renal function better than HD and is helpful due to the faster postoperative restoration of diuresis (6). In addition to the fact that the estimated glomerular filtration rate (eGFR) and biochemical test may differ in HD with PD patients, the difference in the survival of the patients is also significant (7, 8). The prevalence of PD utility is lower than that of HD. Studies showed the challenges related to performing PD include repeated periods of peritonitis or infection, insufficient dialysis or failure of ultrafiltration, systemic issues such as lack of dialysis facilities
, as well as personal or social reasons are the main reasons for transferring from PD to HD (9, 10). Inadequate dialysis in PD have attracted a lot of attention, however despite the decrease in the incidence of these problems in recent years, the dropout of PD is still widespread (10). Therefore, more studies are needed to understand the unknown dimensions of PD dropout. This study aims to investigate the prevalence and factors affecting the incidence of PD dropout among a group of ESRD patients

Material and Methods
Study design
This retrospective study was conducted with census sampling on all people with ESRD who underwent PD in Imam Reza hospital in Tabriz between 2001 and 2022. Finally, 719 patients were included in the study, since data collection was conducted based on the information in the file and the period between diagnosing the disease (starting PD) and stopping PD.
In patients, when the available data were ambiguous or more information was needed, a phone call was conducted for the patients. The demographic characteristics (gender, age, marital status, education level at the start of dialysis, and economic level), body mass index (BMI), skill level, vision level, personal health level, family support level, patient's tolerance level, past medical history, smoking, duration of PD, dialysis catheter installation method, and smoking were recorded.
After determining the frequency distribution of factors for dropping out of PD in the studied patients, the relationship between the studied factors and the duration of PD was evaluated. In this research, all provisions of the Declaration of Helsinki and ethical laws approved by the Ministry of Health were observed, and all information related to the patients' files was kept confidential.

Statistical analysis
The data were statistically analyzed using SPSS version 23 software. Quantitative data were reported with mean and standard deviation indicators, and qualitative data were reported with frequency and percentage. After checking the normality of the distribution using the Kolmogorov-Smirnov test, the Mann-Whitney and Kruskal-Wallis tests were conducted to study the relationship between quantitative variables at the levels of qualitative variables, while the chi-square test was conducted to check the connection between qualitative variables. A p-value > 0.05 was considered as a significant level. Spearman's correlation coefficient used to measure the strength and direction of association between two ranked variables in the study.

Results
This research investigated 719 patients with a mean age of 51.81 ± 18.70 years. Most people were female (363, 50.5%) and others were male (356, 49.5%). Most patients, 74.40% were married and 25.60% were single. Regarding the education and economic status of the patients, most people (29.8%) were illiterate, and the economic situation of 82.6% of the patients was mean.

Table 1. Mean and standard deviation of personal characteristics of PD in the studied patients.

Variables	Mean±SD	Min	Max
Age (Year)	51.18±81.70	1	93
Weight (Kg)	64.15±63.32	6	115
Height (Cm)	163.12±72.72	54	189
BMI (kg/m^2)	23.4±92.67	9.88	39.96
Duration of PD (month)	26.25±0.46	0	149

BMI; Body mass index, PD; peritoneal dialysis.

In this study, the patients' mean weight was 64.63±15.32 kg, the mean height was 163.72±12.72 cm, and the mean BMI was 23.4±92.67. The mean period of PD in patients was reported as 26.00±25.46 months (Table 1).

Table 2. Frequency distribution of reasons for dropping out of PD in the studied patients

Reasons for Drop-out PD	Frequency	Percentage
Peritonitis	83	11.6
Exit site infection	1	0.1
Underdialysis	41	5.7
Severe disease	1	0.1
Intolerance	33	4.6
Renal function reversal	4	0.6
Death	291	40.5
Transplant	196	27.3
Catheter failure	49	6.8
Other	17	2.4

Regarding the causes of PD dropout among all the studied patients, the findings of Table 2 showed that the most causes of PD dropout were related to death (40.5 %) and the least related to exit site infection and severe diseases (0.1 %).

Table 3. Mean and standard deviation of duration of PD according to demographic variables

Variables		Number (%)	Mean±SD	P-value (Mann-Whitney and Kruskal-Wallis tests)
Gender	Male	356(49.5)	25.24±24.69	0.380
	Female	363(50.5)	26.74±26.20	
Marital status	Single	184(25.6)	26.99±25.56	0.294
	Married	535(74.4)	25.65±25.44	
Education status	Illiterate	214(29.8)	23.84±22.41	0.421
	Ability to read and write	55(7.6)	29.53±30.04	
	Primary school	130(18.1)	27.61±26.60	
	Middle school	106(14.7)	25.68±29.15	
	High school	127(17.7)	28.28±24.04	
	Academic education	87(12.1)	23.66±24.83	
Economic situation	Poor	99(13.8)	22.81±23.76	0.236
	Average	594(82.6)	26.65±25.77	
	Good	26 (3.6)	23.32±24.30	

According to the findings of Table 3, among gender (P=0.380), marital status (P=0.249), education (P=0.421), and economic status (P=0.236) with the duration of PD, no significant relationship was observed.

Table 4. Mean and standard deviation of the duration of PD according to skill level, vision level, personal health level, family support level, and tolerance level.

Variables		Number (%)	Mean±SD	P-value (Mann-Whitney and Kruskal-Wallis tests)
Skill	Appropriate	216(30)	24.61±24.22	0.464
	Medium	421(58.6)	27.18±26.72	
	Inappropriate	82(11.4)	23.61±21.70	
Visual ability	Appropriate	312(43.4)	24.45±23.71	0.368
	Medium	340(47.3)	27.06±27.12	
	Inappropriate	67(9.3)	27.85±24.61	
Personal health	Appropriate	185 (25.7)	25.03±24.98	0.376
	Medium	514 (71.5)	26.56±25.80	
	Inappropriate	20 (2.8)	20.60±20.74	
Family support	Appropriate	296 (41.2)	26.20±25.04	0.332
	Medium	401 (55.8)	26.22±26.02	
	Inappropriate	22 (3.1)	19.32±20.42	
Tolerance	Appropriate	226 (31.4)	25.03±25.47	0.608
	Medium	470 (65.5)	26.53±25.58	
	Inappropriate	22 (3.1)	25.14±23.94	

According to the findings of Table 4, there was no significant relationship between skill level (P=0.464), visual ability (P=0.368), personal health level (P=0.376), family support level (P=0.332), tolerance level (P=0.608) with duration of PD.

Table 5. Mean and standard deviation of the duration of PD according to past medical history, smoking, catheter method, and different periodical. *p<0.05 is significant

Variables		Number (%)	Mean±SD	P-value (Mann-Whitney and Kruskal-Wallis tests)
Past medical history	Coronary artery disease	46(6.4)	30.75±30.66	0.374
	Diabetes Meletus	56(7.8)	24.96±25.75	
	Cancer	4(0.6)	33.25±33.45	
	Hypertension	353(49.1)	27.61±26.36	
	Chronic obstructive pulmonary disease	5(0.7)	19±20.21	
	Congestive heart failure	37(5.1)	19.53±19.68	
Smoking	No	688(95.7)	26.49±25.73	0.004*
	Yes	31(4.3)	15.16±15.10	
Catheter method	Open surgery	689(95.8)	25.64±25.27	0.081
	Laparoscopic	27(3.8)	34.81±30.05	
	Percutaneous	2(0.3)	36±4.24	
Different periods	2006-2009	107 (14.89)	18.02±14.649	0.009*
	2010-2013	210 (29.21)	25.03±20.710	
	2014-2017	254 (35.33)	24.50±23.331	
	2018-2022	146 (20.31)	35.83±36.436	

According to the findings of Table 5, no significant relationship was observed between past-medical history (P=0.374) and the dialysis catheter installation method (P=0.081) with the duration of PD. However, the time of PD was longer in people who did not smoke than others (P=0.004).

Regarding the relationship between the duration of PD and the different parameters the results of the Kruskal-Wallis test showed that the mean time of PD in the years 2018 to 2022 was significantly higher than other years, and the lowest mean duration of PD was in 2006 to 2009 (P=0.009).

Regarding the relationship between the duration of PD and age, body mass index (BMI), and cigarette pack-years parameter, the findings of the Spearman correlation coefficient showed that age (r=0.021, P=0.566) and BMI (r=0.016, P=0.682) the cigarette pack-years parameter (r=0.164, P=0.379) has no significant correlation with the duration of PD.

Discussion

This study aimed to determine the factors affecting the dropout of PD in patients referred to a dialysis center in northwest Iran. As mentioned before, PD and HD have advantages and disadvantages.

The most common causes of PD dropout were death, kidney transplantation, peritonitis, catheter failure, insufficient dialysis, intolerance, renal function reversal, severe disease, exit site infection, and other reasons. The duration of PD was longer in people who did not smoke than others. Along with the results of this study, another study in China also revealed that death, peritonitis, and inadequate dialysis were the leading causes of PD dropout (11). Luo et al reported that the leading cause of the very early dropout from PD was death. Age was a risk factor for very early dropout from PD, as higher systolic blood pressure, lower hemoglobin levels, lower high-density lipoprotein (HDL) levels, and lower residual urine volume were the main other factors in PD dropout (12).

According to a study, the number of hospitalizations following catheterization was a protective factor for maintaining PD. In contrast, the medium and high levels of education, diabetes, hypertension, repeated peritonitis, and repeated chest complications were independent risk factors for dropping out of PD (13). Another study found that out of all the factors that can be controlled, psychosocial factors have the highest percentage (63%) of influence on dropout. In terms of time until dropout, 50% of late dropout patients and 100% of very early dropout patients, respectively, did so due to psychosocial factors among patients who dropped out of treatment early; 67% did so for medical reasons. Psychosocial factors, other, and infection all had mean discontinuation times of 13, 26, and 33 months, respectively. Psychosocial factors were the most associated factor when investigators considered the type of initiation (14). Zhang et al study shows that the main characteristics of PD discontinuation patients for non-medical reasons are age, diabetes mellitus, patients' perception, and lack of caregiver support (15). A study reported that a risk period for early transfer from PD to HD therapy was associated with older age, diabetes, or vascular disorders, having received renal replacement therapy in the past, being referred to a nephrology service late in life, and management in a smaller center. Although the risk of technique failure during the first year due to infection or death remained constant, a more significant proportion of cases within the first nine months of treatment were due to mechanical and other causes (16). Age, cardiovascular disorders, diabetes, and residual glomerular filtration rate (rGFR) are risk factors for PD dropout because they are also linked to patient survival (17). According to a study, 40% of all technique failures could happen within the first six months. The results cannot be generalized because they are retrospective and single-center in scope (18).

Moreover, the mean duration of PD in the years 2018 to 2022 was better than previous years. Improving technical skills or upgrading service center equipment can play a role in improving this situation, as it was shown in Kang et al's study that PD outcomes could improve with the passage of time and the advancement of human and technological resources. Therefore, PD significantly improved patient survival over time (64% for 1990–1999 vs 93% for 2010–2019) (19).

A review study indicated that dropouts have a variety of causes, including systemic, patient, and modality-related factors. These consist of peritonitis episodes, problems with the catheter, failures with the ultrafiltration system, patient fatigue, and comfort in the caregiver (20). Another review

article by Piarulli et al demonstrated that regardless of the stage following PD initiation, center size, advanced age, and numerous comorbidities are risk factors associated with PD discontinuation. Instead, inadequate technique training and a delayed referral to nephrology care are related to early and late peritoneal dialysis dropout, as opposed to the need for a caregiver, patient burnout, and frequent hospitalizations (21). They also showed that the number of patients who transferred to HD during the follow-up period decreased, and it appeared that patients who switched to HD within the first months of PD were more likely to be older women and patients with multiple comorbidities. In addition to the dropout rate for psychosocial/unknown reasons, the rates of catheter and abdominal complications and dropout for catheter and abdominal complications decreased starting in the first quarter (21). However, a set of individual (physical and psychological), social, and cultural factors are influential in PD dropout, and in the meantime, technological and personnel conditions can also affect this issue. In the present study, the lack of investigation of time as an important and influential factor and the lack of a more comprehensive analysis of the factors affecting dropout can be considered as limitations of the study (21-31).

Conclusion
Death, kidney transplantation, peritonitis, catheter failure, insufficient dialysis, and intolerance are the most common causes of dropout among PD patients. Not smoking has led to a longer period of peritoneal dialysis in patients. Moreover, the mean duration of PD in the years 2018 to 2022 was better than previous years. Improving technical skills or upgrading service center equipment probably have played an important role in improving the condition of peritoneal dialysis patients during these years.

Authors' contribution:
Conceptualization: Mohammadreza Ardalan, Sepideh Zununi Vahed
Data curation: Mohammadreza Moslemi
Investigation: Mohammadreza Moslemi
Resources: Mohammadreza Moslemi
Project Administration: Sepideh Zununi Vahed , Mohammadreza Moslemi
Supervision: Mohammadreza Ardalan Validation: Mohammadreza Ardalan, Sepideh Zununi Vahed
Visualization: Mohammadreza Moslemi , Mohammadreza Ardalan, Sepideh Zununi Vahed
Writing–original draft: Mohammadreza Moslemi, Sahar Heydari
Writing–review and editing: Mohammadreza Moslemi, Sahar Heydari

Conflicts of interest
The authors declare that they have no competing interests.

Ethical issues
The research conducted in this study adhered to the principles outlined in the Declaration of Helsinki and was approved by the Ethics Committee of Tabriz University of medical sciences (Ethical code # IR.TBZMED.REC.1402.007). The authors have fully complied with ethical issues, such as plagiarism, data fabrication, and double publication.

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Implication for health policy/practice/research/medical education:
This retrospective study evaluated the factors affecting the dropout of peritoneal dialysis in 719 patients referred to a dialysis center in northwest Iran for over 20 years. Death, kidney transplantation, peritonitis, catheter failure, under-dialysis conditions, and patient intolerance are the most common causes of dropout among peritoneal dialysis patients.

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