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Original Article

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Analysis of the Factors Affecting the Reasons of Transition From Peritoneal Dialysis to Hemodialysis

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ABSTRACT

Background: Peritoneal dialysis is a frequently used renal replacement treatment option in patients with end-stage renal failure, and it is emphasized several times that it should be started as the first treatment in the literature. However, for many different reasons, sometimes the treatment is stopped and switched to hemodialysis. In this study, we aimed to examine the reasons and factors affecting the transition to hemodialysis in our unit.

Methods: Fifty-five patients who were – transferred to hemodialysis – regularly attending the Peritoneal Dialysis Unit of Erciyes University Nephrology Department were included in our study. Biochemical analysis, peritoneal equalization test (PET), dialysis adequacy (kt/V), and creatinine clearance of these patients were recorded regularly. Regular cardiac examinations and ambulatory blood pressure measurements were also performed. The reasons for the transition from peritoneal dialysis to hemodialysis were also noted in detail.

Results: The mean age of the patients was 54.02 ± 11.41 years, and 27 (62.8%) of the patients were male. While the shortest period spent on peritoneal dialysis was 13 months, the longest was 191 months. The most common type of permeability in PET analysis of the patients was observed as high-average. The most common reason for the transition to hemodialysis was inadequate dialysis. Using univariate and multiple regression models, factors that predict the duration of stay in peritoneal dialysis were examined. We found that the urine volume, total kt/V, and the number of peritonitis could be effective in predicting this period.

Conclusion: Peritoneal dialysis is a renal replacement option that has advantages such as patient comfort, preservation of the kidney's remaining work, and social life. The reasons for the transition should be examined in detail, and the necessary interventions to prolong the time in peritoneal dialysis should be evaluated.

Keywords: Peritoneal dialysis, peritonitis, hemodialysis, urine volume

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INTRODUCTION

The prevalence of the end-stage renal disease has been increasing both in our country and all over the world. Renal replacement therapies (RRT), including dialysis and transplantation, improve survival in patients with end-stage renal disease (ESRD).[1,2]

Peritoneal dialysis (PD), which has been used in the world since the 1970s, is a frequently used renal replacement treatment option in patients with end-stage renal failure, and it usually should be started as the first treatment in the literature. This treatment modality preference has gradually decreased in recent years, and the number of patients receiving PD treatment in our country, similar to the world, decreased to 3192 (3.94%) in 2018.[3,4]

It is well known that patients on chronic dialysis frequently change modality because of both medical and social reasons.[5] Although it has various

advantages such as the ability to be applied at home and no need for a device,[6] patient survival rates in PD and hemodialysis (HD) appear similar. Besides, patients switch from PD to HD for many different reasons. Reasons such as technical failure, peritonitis, ultrafiltration failure, catheter problems, and patient's desire cause the switch to HD.[7-10]

Less than 12% of patients who started PD in the United States are still using PD after 5 years. The majority of patients that started RRT with PD discontinued this method within 5 years, and transition to HD was the most common reason. Besides, PD use among dialysis patients is only 6.9%, and many patients who chose PD eventually switched to HD.[11]

After the COVID pandemic that has emerged nowadays, the risks of both common devices and public areas have begun to attract more attention, and the importance of home treatments has become more evident. However, in many PD programs, a significant percentage of patients, ranging from 15 to 25%, were transferred from HD to PD due to problems experienced during HD treatment or patient selection.[7-12,13] In this study, we aimed to examine the reasons and factors affecting the transition to HD in our unit.

METHODS

Fifty-five patients older than 18 years of age who were regularly followed up in the Peritoneal Dialysis Unit of Erciyes University Nephrology Department and who had undergone PD treatment for at least 3 months were included in our study. After obtaining ethics committee approval from Erciyes University Medical School (no. 2020/609), consent was obtained from all participants. It was observed that 50 patients had been included in continuous ambulatory peritoneal dialysis (CAPD), and 5 patients had been receiving automated peritoneal dialysis treatment. CAPD therapy was administered as 4 to 5 changes per day with varying glucose concentrations.

Peritoneal equalization test (PET) and clearance studies were conducted shortly (usually 2-4 months) after initiation of PD therapy. Watson's formula was used to estimate total body water in kt/V calculations, and the DuBois equation was used to calculate body surface area to normalize creatinine clearance.

Main Points

- Peritoneal dialysis (PD) is a frequently used renal replacement treatment option in patients with end-stage renal failure, and it usually should be started as the first treatment in the literature.
- Transition to hemodialysis (HD) has been reported in PD patients for many different reasons.
- The reasons that have been reported such as technical failure, peritonitis, ultrafiltration failure, catheter problems, and patient desire caused the switch to HD.

The remaining renal creatinine clearance was calculated as the mean creatinine and urea clearance.

Regular cardiac examinations and ambulatory blood pressure measurements were also performed. Physical examination, demographic, clinical, and laboratory data were obtained from the patients' files. The medications used by the patients and laboratory data such as blood urea nitrogen (BUN), creatinine (Cr), calcium (Ca), phosphorus (P), albumin, parathyroid hormone (PTH), hemoglobin (Hb), ferritin, and C-reactive protein (CRP) were obtained from patients' records. Patients with daily urine volume greater than 200 mL were considered to have residual urine. Data such as daily peritoneal ultrafiltration amount, weekly kt/V, peritoneal permeation rate were obtained from PET data.

The reasons for the transition of patients from PD to HD were also noted in detail. Statistical evaluation was made with IBM SPSS 20.0 package program (IBM Corp., Armonk, NY, USA). Continuous variables were given as mean ± standard deviation and categorical variables as frequency (percentage). Univariate and multiple regression analysis were used to determine the factors affecting the variability. When a parameter in univarite analysis enters multivariate analysis, according to its interaction with other factors; may gain or lose significance.

RESULTS

The mean age of the patients included in the study was 54.02 ± 11.41 years, and 27 (62.8%) of the patients were male. The shortest duration of stay on PD was 13 months, while the longest was 191 months. When biochemical parameters were evaluated, mean values were as follows: BUN: 58.60 ± 19.8 mg/dL, Cr: 8.29 ± 3.65 mg/dL, Ca: 9.13 ± 0.96 mg/dL, P: 5.31 ± 1.89 mg/dL, and albumin: 3.85 ± 0.5 g/dL. The most common type of permeability in PET analysis of the patients was observed as high-average. The most common reason for transition to HD was inadequate dialysis. Patient characteristics are summarized in Table 1. Using univariate and multiple regression models, factors that predict the duration of stay in PD were examined. We found that the urine volume, total kt/V, and number of peritonitis could be effective in predicting this period (Table 2).

DISCUSSION

It is generally accepted that the clinical course of dialysis in a patient with ESRD is not limited to a single modality. It has been reported that approximately 10-20% of PD patients annually can switch to HD due to technical failure. However, in many PD centers, a significant percentage of patients ranging from 15 to 25% have been transferred from HD to PD.[7,13]

In recent years, in studies comparing the results of PD and HD, it is now generally accepted that there is no difference between the two modalities in terms of overall survival, although RRF is better preserved in PD compared to HD in the first years of treatment.[14-18] In the study of Zang et al.,[19] patients who switched to

Table 1. Patients' Characteristics

Parameters	*n* (%)
Demographical	
Age (years)	54.02 ± 11.41
Gender (male)	27 (62.8)
BMI (kg/m^2)	29.36 ± 5.92
Durage of PD (month)	51 (13-191)
Biochemical	
BUN (mg/dL)	58.60 ± 19.88
Creatinine (mg/dL)	8.29 ± 3.65
Sodium (mmol/L)	134.77 ± 5.28
Calcium (mg/dL)	9.13 ± 0.96
Phosporus (mg/dL)	5.31 ± 1.89
Hemoglobin(g/dL)	10.4 ± 1.9
Albumin (g/dL)	3.85 ± 0.5
Residual urine volume (mL/day)	330 ± 225
kt/V (weekly)	1.89 ± 0.83
PTH (pg/mL)	88 ± 43
CRP (mg/L)	6.9 ± 4.3
PET type	
Low average	9 (20.9)
High average	26 (60.5)
High	8 (18.6)
Switch reasons	
Dialysis adequacy	16 (29)
Peritonitis	11 (20)
Hypervolemia	9 (16)
Ultrafiltation failure	7 (12)
Catheter malposition	5 (10)
Patient's wish	5 (10)
Catheter exit site infection	1 (2)
Intra-abdominal abscess	1 (2)

Values are expressed as *n* (%) or mean ± SD.
BUN: Blood Urea Nitrogen; BMI: Body Mass Index; PD:Peritoneal Dialysis; PTH: Parathyroid hormone; CRP: C reactive protein; PET: Peritoneal equilibration test.

Table 2. Univariate and Multiple Linear Regression Models for Estimating the Time Stay in Peritoneal Dialysis (PD)

	Univariate			Multivariate		
Variables	**Beta**	**SE**	***P***	**Beta**	**SE**	***P***
Age (years)	−0.287	0.515	.062	-	-	-
BMI (kg/m^2)	−0.079	1.041	.664	-	-	-
Body surface area (m^2)	−0.048	1.035	.759	-	-	-
PET type	−0.117	14.797	.455	-	-	-
Total kt/V	0.173	16.298	.266	0.422	16.620	**.010**
Number of peritonitis attack	0.310	4.208	.043	0.281	3.837	**.045**
Urine volume (mL)	−0.279	0.009	.070	−0.469	0.010	**.005**
Ultrafiltration volume (mL)	0.200	0.011	.198	-	-	-
Creatinine clearance (L/week)	0.030	1.638	.848	-	-	-

Significant values are indicated as a bold.
SE, standard error; BMI: Body mass index; PET: Peritoneal equilibration test.

PD after HD failure had PD outcomes similar to those who started and had been continuing with PD (survival and PD-related to the technique complications).

Transition to HD has been reported in PD patients for many different reasons. The most prominent of these reasons are infectious complications such as peritonitis and exit site infection. The rate of weaning from PD due to infectious complications was found to be around 30%.[20] In another study conducted in our country, the rate of discontinuation of PD treatment due to peritonitis was found to be 19%.[21]

On the contrary, Liberek et al.[22] compared the clinical outcomes of 67 patients who switched to PD from HD with 197 patients who just started PD therapy. Although the technical survival was significantly lower in patients transferred from HD, they could not find a significant difference in patient overall survival between the 2 groups.

In the study of Wang et al.,[23] patients who switched from HD to PD after at least 3 months of HD treatment may have a decrease in overall survival compared to patients starting dialysis with PD. For clinical practice, our findings provide some support for the PD initial policy and have important implications for initial dialysis selection.

While problems related to intra-abdominal pressure, such as dialysis adequacy and/or ultrafiltration failure, problems with the catheter, patient preference, and leakage, are common causes of the transition from PD to HD, peritonitis still remains the main reason for the transition of patients to HD.[24-27] It is not only the leading cause of technical failure but also contributes to mortality.[28,29] Peritonitis is responsible for 30-80% of permanent transfers to HD.[30]

Zang et al.[19] have shown that approximately 60% of technical failure was the result of peritonitis. Peritonitis remains the leading cause of technical failure in our PD population.

In a study conducted in the Netherlands, it has been observed that 64% of patients could not continue PD treatment after 2 years due to technical insufficiency.[31] Also, ultrafiltration insufficiency was shown as the most important reason for discontinuing PD treatment in patients who have used PD therapy for more than 6 years in a Japan study.[32]

In conclusion, PD is a renal replacement option that has advantages such as patient comfort, protection of the kidney's remaining work, and social life. The reasons for the transition should be examined in detail and the necessary interventions to prolong the time in PD should be evaluated.

Ethics Committee Approval: Ethics committee approval was received from the Ethics Committee of Erciyes University School of Medicine (2020/609).

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

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REFERENCES

1. Xue JL, Everson SE, Constantini EG, et al. Peritoneal and hemodialysis: II. Mortality risk associated with initial patient characteristics. *Kidney Int*. 2002;61(2):741-746. [CrossRef]
2. Avram MM, Sreedhara R, Fein P, et al. Survival on hemodialysis and peritoneal dialysis over 12 years with emphasis on nutritional parameters. *Am J Kidney Dis*. 2001;37(1)(suppl 2):S77-S80. [CrossRef]
3. Oreopoulos DG, Robson M, Faller B, et al. Continuous ambulatory peritoneal dialysis: a new era in the treatment of chronic renal failure. *Clin Nephrol*. 1979;11(3):125-128.
4. Süleymanlar G, Ateş K, Seyahi N. Yılı ulusal Nefroloji, Diyaliz ve Transplantasyon kayıt sistemi raporu. *Türkiye*. *Ekim*; 2018; 2019:1-128.
5. Pulliam J, Li NC, Maddux F, et al. First-year outcomes of incident peritoneal dialysis patients in the United States. *Am J Kidney Dis*. 2014;64(5):761-769. [CrossRef]
6. Shahab I, Khanna R, Nolph KD. Peritoneal dialysis or hemodialysis? A dilemma for the nephrologist. *Adv Perit Dial*. 2006;22:180-185.
7. Guo A, Mujais S. Patient and technique survival on peritoneal dialysis in the united states: evaluation in large incident cohorts. *Kidney Int Suppl*. 2003;88(88):S3-S12. [CrossRef]
8. Lupo A, Tarchini R, Carcarini G, et al. Long-term outcome in continuous ambulatory peritoneal dialysis: a 10-year-survey by the Italian Cooperative peritoneal dialysis Study Group. *Am J Kidney Dis*. 1994;24(5):826-837. [CrossRef]
9. Davies SJ, Phillips L, Griffiths AM, et al. What really happens to people on long-term peritoneal dialysis? *Kidney Int*. 1998;54(6):2207-2217. [CrossRef]
10. Maiorca R, Cancarini GC, Brunori G, et al. Comparison of long-term survival between hemodialysis and peritoneal dialysis. *Adv Perit Dial*. 1996;12:79-88.
11. McGill RL, Weiner DE, Ruthazer R, et al. Transfers to hemodialysis Among US patients initiating renal replacement therapy With peritoneal dialysis. *Am J Kidney Dis*. 2019;74(5):620-628. [CrossRef]
12. Heaf JG, Løkkegaard H, Madsen M. Initial survival advantage of peritoneal dialysis relative to haemodialysis. *Nephrol Dial Transplant*. 2002;17(1):112-117. [CrossRef]
13. Van Biesen WV, Vanholder RC, Veys N, Dhondt A, Lameire NH. An evaluation of an integrative care approach for end-stage renal disease patients. *J Am Soc Nephrol*. 2000;11(1):116-125. [CrossRef]
14. Yeates K, Zhu N, Vonesh E, et al. Hemodialysis and peritoneal dialysis are associated with similar outcomes for end-stage renal disease treatment in Canada. *Nephrol Dial Transplant*. 2012;27(9):3568-3575. [CrossRef]
15. Jansen MAM, Hart AAM, Korevaar JC, et al. Predictors of the rate of decline of residual renal function in incident dialysis patients. *Kidney Int*. 2002;62(3):1046-1053. [CrossRef]
16. Chang YK, Hsu CC, Hwang SJ, et al. A comparative assessment of survival between propensity score-matched patients with peritoneal dialysis and hemodialysis in Taiwan. *Med (Baltim)*. 2012;91(3):144-151. [CrossRef]
17. Vonesh EF, Snyder JJ, Foley RN, Collins AJ. Mortality studies comparing peritoneal dialysis and hemodialysis: what do they tell us? *Kidney Int Suppl*. 2006;103(103):S3-S11. [CrossRef]
18. Ueda A, Nagai K, Hirayama A, Saito C, Yamagata K. Peritoneal dialysis preserves residual renal function and reduces oxidative stress during the initial period of dialysis therapy. *Adv Perit Dial*. 2017;33(2017):18-21.
19. Zhang L, Cao T, Li Z, et al. Clinical outcomes of peritoneal dialysis patients transferred from hemodialysis: a matched case-control study. *Perit Dial Int*. 2013;33(3):259-266. [CrossRef]
20. Ambruso SL, Teitelbaum I. Prevention of peritoneal dialysis Drop-Out. *Adv Perit Dial*. 2018;34(2018):19-23.
21. Bilgic A, Sezer S, Ozdemir FN, et al. Clinical outcome after transfer from peritoneal dialysis to hemodialysis. *Adv Perit Dial*. 2006;22:94-98.
22. Liberek T, Renke M, Skonieczny B, et al. Therapy outcome in peritoneal dialysis patients transferred from haemodialysis. *Nephrol Dial Transplant*. 2009;24(9):2889-2894. [CrossRef]
23. Wang J, Zeng J, Liu B, et al. Outcomes after transfer from hemodialysis to peritoneal dialysis vs peritoneal dialysis as initial therapy: A systematic review and meta-analysis. *Semin Dial*. 2020;33(4):299-308. [CrossRef]
24. Davenport A. Peritonitis remains the major clinical complication of peritoneal dialysis: the London, UK, peritonitis audit 2002-2003. *Perit Dial Int*. 2009;29(3):297-302. [CrossRef]
25. Woodrow G, Turney JH, Brownjohn AM. Technique failure in peritoneal dialysis and its impact on patient survival. *Perit Dial Int*. 1997;17(4):360-364. [CrossRef]

26. Maiorca R, Vonesh EF, Cavalli P, et al. A multicenter, selection-adjusted comparison of patient and technique survivals on CAPD and hemodialysis. *Perit Dial Int*. 1991;11(2):118-127. [CrossRef]
27. Kim GC, Vonesh EF, Korbet SM. The effect of technique failure on outcome in black patients on continuous ambulatory peritoneal dialysis. *Perit Dial Int*. 2002;22(1):53-59. [CrossRef]
28. Chung SH, Heimbürger O, Lindholm B, Lee HB. Peritoneal dialysis patient survival: a comparison between a Swedish and a Korean centre. *Nephrol Dial Transplant*. 2005;20(6):1207-1213. [CrossRef]
29. Pérez Fontan M, Rodríguez–Carmona A, García–Naveiro R, et al. Peritonitis-related mortality in patients undergoing chronic peritoneal dialysis. *Perit Dial Int*. 2005;25(3):274-284. [CrossRef]
30. Miskulin DC, Meyer KB, Martin AA, et al. on behalf of Choices for Healthy Outcomes in Caring for End-Stage Renal Disease (CHOICE). Comorbidity and its change predict survival in incident dialysis patients. *Am J Kidney Dis*. 2003;41(1):149-161. [CrossRef]
31. Jager KJ, Merkus MP, Dekker FW, et al. Mortality and technique failure in patients starting chronic peritoneal dialysis. Results of the Netherlands Cooperative Study on the adequacy of dialysis. *Kidney Int*. 1999;55(4):1476-1485. [CrossRef]
32. Kawaguchi Y, Hasegawa T, Nakayama M, Kubo H, Shigematu T. Issues affecting the longevity of the continuous peritoneal dialysis therapy. *Kidney Int Suppl*. 1997;62:S105-S107.