Evaluation to Treatment Adherence, Rational Drug Use in Hemodialysis Patients and Predictive Factors on Dialysis Adequacy

Hemodializ Hastalarında Tedavi Uyumu, Akılcı İlaç Kullanımının Değerlendirilmesi ve Diyaliz Yeterliliğini Öngörücü Faktörler

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Özet

Amaç: Bu çalışmada hemodiyaliz hastalarında tedaviye uyum ve akılcı ilaç kullanımının değerlendirilmesi ve diyaliz yeterliliğini öngören faktörlerin araştırılması amaçlanmıştır.

Gereç ve Yöntemler: Bu, kesitsel tanımlayıcı bir çalışmadır. Veriler yüz yüze anketler ve hasta dosyaları incelenerek elde edildi. Hastalara Hastanede Yatan Hasta Anketi ve Son Dönem Böbrek Hastalığı Uyum Anketi (ESRD-AQ) uygulandı. Diyaliz yeterliliği için Kt/V değeri kullanıldı. Elde edilen veriler incelenerek Kt/V değeri ile ilişkilendirilebilecek değişkenler araştırılmıştır.

Bulgular: Çalışmaya toplam 145 hasta dahil edildi. Katılımcıların %69'u 51 yaş üstü ve %54.5'i erkekti. Medyan Kt/v değeri 1.38 idi (Q1=1.25; Q3=1.54). İlaçlara gelince, Kt/V≥1.2 olanların Kt/V<1.2 olan gruba göre daha fazla antihipertansif ajan, folik asit, vitamin B12 ve vitamin C kullandığı ancak daha az levokarnitin kullandığı bulundu (p<0.05). Son Dönem Böbrek Yetmezliği Uyum Anketindeki Medyan Puanı 1150 idi (Q1=1050; Q3=1200). Toplam Uyum Skoru Kt/V≥1.2 olan grupta istatistiksel olarak anlamlı derecede yüksek bulundu (p<0.05).

Sonuç: Araştırmaya katılan hastaların tedaviye uyum düzeylerinin oldukça yüksek olduğu belirlendi. Toplam uyum puanları arttıkça yeterli diyaliz alma olasılığı artmaktaydı. Hastaların akılcı ilaç kullanımına ilişkin bilgi düzeyi uyumu etkiler. Bu çalışmada folik asit, C vitamini ve levokarnitin kullanımı diyaliz yeterliliği ile ilişkilendirilmiştir.

Anahtar kelimeler: Akılcı ilaç kullanımı, Diyaliz yeterliliği, ESRD-AQ, Hemodiyaliz, Uyum

Abstract

Objective: This study aimed to evaluate treatment adherence and rational drug use in hemodialysis patients and investigate predictive factors on dialysis adequacy.

Materıals and Methods: This is a cross-sectional descriptive study. The data were obtained by examining face-to-face questionnaires and patient files. The Hospitalized Patient Questionnaire and the End Stage Kidney Disease Compliance Questionnaire (ESRD-AQ) were administered to the patients. Kt/V was used for dialysis proficiency. By examining the obtained data, the variables that can be associated with the Kt/V value were investigated.

Results: A total of 145 patients were included in the study. Sixty nine percent of the participants were over 51 years of age and 54.5% were male. Median Kt/V level was 1.38 (Q1=1.25; Q3=1.54). As for the medications, those with Kt/V≥1.2 were found to be using more antihypertensive agents, folic acid, vitamin B12, and vitamin C but less levocarnitine concerning the group with Kt/V<1.2 (p<0.05). The Median Score on the End-Stage Renal Failure Adherence Questionnaire was 1150 (Q1=1050; Q3=1200). Total Adherence Score was found to be statistically significantly higher in the group with Kt/V≥1.2 (p<0.05).

Conclusıon: It was determined that the level of treatment adherence of the patients participating in the study were considerably high. The probability of receiving adequate dialysis increased as total adherence scores increased. The knowledge level of patients on rational drug use affects adherence. In this study, folic acid, vitamin C, and levocarnitine were associated with dialysis adequacy.

Keywords: Adherence, Dialysis adequacy, ESRD-AQ, Hemodialysis, Rational Drug Uses

INTRODUCTION

End-stage renal disease (ESRD) is an important public health problem with increasing frequency. These patients are tried to be protected from uremia and its effects with renal replacement therapies such as kidney transplantation, hemodialysis (HD), and peritoneal dialysis (1). The most common method in Turkey and the world is HD treatment. There are more than 80 thousand patients receiving renal replacement therapy (RRT) in Turkey, and 76% of them are on HD (2). The Effective HD treatment involves parameters under various sub-titles including compliance with dietary recommendations, fluid restriction, participation in HD sessions, and medication adherence as well as adaptation behaviors related to accompanying diseases. Each of them affects the success of treatment (3,4). Adherence to HD treatment improves the quality of life of patients but still, it is very difficult to keep harmony at the same level all the time (5). In addition to the treatment of comorbid diseases in end-stage renal disease patients; many drugs need to be used due to hypertension, hyperphosphatemia, hypocalcemia, renal osteodystrophy, anemia, and uremic pruritus. Increasing drug load causes an increase in related problems (6,7). A study by Kimura et al. determined that the number of drugs used by hemodialysis patients reached 15 (8). Rational drug use is defined as "patients receive drugs appropriate to their clinical needs, in adequate doses and for an adequate period of time, at the lowest cost to themselves and society. Irrational drug use (IDU) is defined as all kinds of errors related to the use of drugs. Its incidence increases with polypharmacy. The use of drugs in the wrong dose or duration and without a doctor's control, inappropriate disposal, and wastage are examples of irrational drug use (9). Accordingly, the number of samples is sufficient for the study.

Non-adherence to HD treatment was associated with increased hospitalizations (10,11). Although it varies by age group, in general, about half of the patients commencing dialysis are lost within 5 years (12). Treatment adherence is an important parameter that determines mortality and morbidity in HD patients (13). There are numerous studies in the literature conducted on adherence of patients with HD treatment (14-16). More research is needed to evaluate treatment nonadherence with the predictive value of measurable parameters (17).

Some educational models that support rational drug use behaviors positively affect hemodialysis treatments (18). This study aims to determine irrational drug use in patients receiving HD treatment and to examine the contribution of behavior, knowledge level, and practices corresponding to rational drug use to treatment adherence.

In addition to this 2 study was also aimed to determine the level of adherence to treatment of patients and the effects of some laboratory parameters on dialysis adequacy.

MATERIALS AND METHODS

This study is a cross-sectional type descriptive study. The design of the study was created by following The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. The study was started after the approval of the local ethics committee of Afyonkarahisar Health Sciences University Non-Interventional Clinical Research Ethics Committee, 21.08.2020 -2020/370.

Patients

All patients (n=172) undergoing dialysis in two dialysis units located in Afyonkarahisar were interviewed between May and July 2021, for this cross-sectional study. All patients who met the inclusion criteria were included in the study without using any sampling method. However, in the post hoc power analysis of the study, if the effect size is =0.50, α=0.05, and the power is determined as 90%, the sample size was calculated as 140 (19,20).

Inclusion criteria were determined as being older than 18 years of age, receiving HD treatment for at least 1 year, being cooperative and oriented, and not having a psychiatric disease that could cause complications in communication. 145 agreed to participate in the study **Figure 1**. Patients' demographic characteristics, comorbidities, medications used, and duration of dialysis were recorded.

Dialysis procedure

The patients were dialyzed with a Polyflux 170H brand high flux membrane. The blood flow rate was kept at 300-500 ml/min, and the dialysate flow rate at 500-800 ml/min, depending on the clinical condition and blood pressure of the patient. The standard dialysate concentration consisted of 137 mEq/L sodium, 2 mEq/L potassium, 2.5 mEq/L calcium, and 35 mEq/L bicarbonate. The dialysis center had Fresenius' online water system.

Questionnaires

Questionnaire data were obtained through face-to-face interviews with the patients, while laboratory data were collected from the patients' files. The questionnaire was administered by a physician who was not involved in the treatment and follow-up of the patient. Two questionnaires were applied to patients. The Hospital Inpatient Questionnaire Form (Patients In Hospital In Turkey, For Rational Use Of Drugs Evaluation
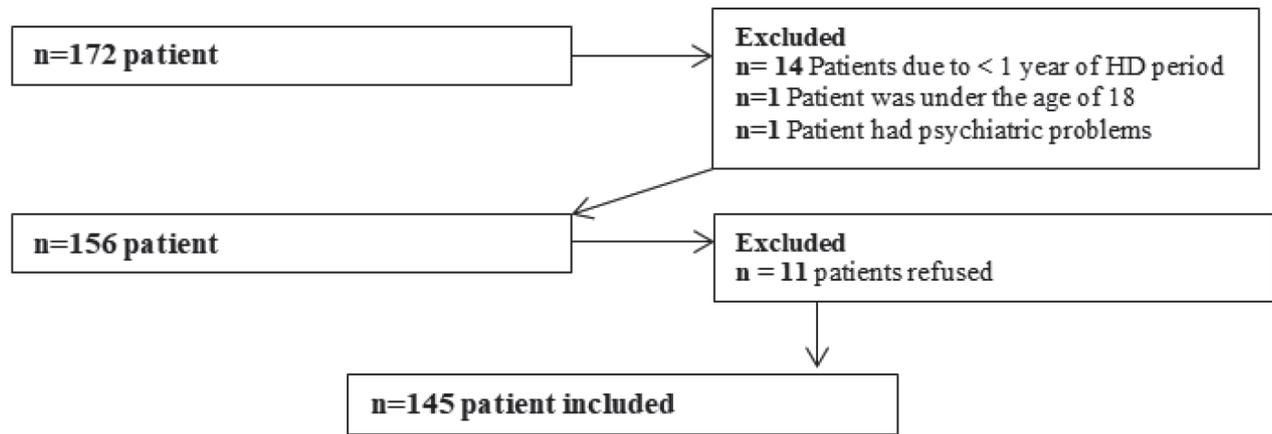
Figure 1. Included and excluded participants

Of Knowledge And Behavior) and the End-Stage Renal Disease Adherence Questionnaire (ESRD-AQ) respectively.

The Hospital Inpatient Questionnaire Form, developed by the Rational Drug Use Department of the Turkish Medicines and Medical Devices Agency, consists of 31 items (21,22). Demographic data were extracted from this questionnaire and 20 questions containing information about drug use were selected. Thus, a knowledge index was created. Correct knowledge and appropriate behavior were scored as 1 point.

ESRD-AQ, Kim, Evangelista, Phillips, et al. (2010), and consists of 5 chapters and 46 items. These items are related to the treatments received by the patients (5 items), participation in HD (14 items), medications (9 items), fluid restriction (10 items), and compliance with dietary recommendations (8 items). Questions measuring behavior towards treatment compliance are presented on a Likert- type scale. Validity and reliability analysis of ESRD-AQ in Turkish was performed by Elif Ok et al in 2019 (23).

Laboratory and dialysis adequacy

Hemoglobin, ferritin, albumin, BUN (blood urea nitrogen), phosphorus, calcium and PTH (parathormone) values of the patients were obtained from the patients' files. The recommended value of 1.2 for Kt/V value in international guidelines was determined as the cutoff value for dialysis adequacy (24).

Daugirdas formula was used to calculate dialysis adequacy;

Kt/V Daugirdas= -ln ((post-BUN/pre-BUN) - (0.008*Hrs)) + ((4- (3.5*post-BUN/pre-BUN)) * (UF amount/Weight).

Statistical analysis

Statistical Package for the Social Sciences, SPSS 26.0 (IBM Corp. 2019 IBM SPSS Statistics for Windows, version 26.0. Armonk, NY: IBM Corp) was used for data analyses. Categorical variables were presented as percentages and frequencies. Conformity of continuous variables to normal distribution was checked by Shapiro Wilk and Kolmogorov Smirnov tests. The patients were divided into two groups with respect to their Kt/V values. The participants with Kt/V≥1.2 constituted an adequate dialysis group and those with Kt/V<1.2 inadequate dialysis group. The Chi-square test was used in comparing categorical variables between the groups. As for comparing continuous variables between the groups, the Mann-Whitney U test was used for non-normal distributions while the independent sample t-test was for normal distributions. Logistic regression analysis was used for investigating the factors affecting dialysis adequacy. Parameters with significant differences between the groups and with $p<0.2$ were included in the logistic regression analysis. Parameters, considered to be determinants of dialysis adequacy in the univariate regression analysis, were included in the multivariate logistic regression analysis. All the p values presented were bidirectional and $p<0.05$ was accepted as statistically significant.

RESULTS

The gender of the patients included in the study were found to be as 54.5% (n= 79) male and 45.5% (n=66) female. As for the age groups, 34.5% (n=50) of the patients were over 65 years, 34.5% (n=50) were between 51-64, 20% (n=29) were between 41-50, %6.9 (n=10) were between 31-40 and 4.1% (n=6) were between 18-30 years of age.

The median duration of dialysis was 6 years (min-max; 1-22 years). Hypertension (HT), Diabetes Mellitus (DM), Coronary Artery Disease (CAD), and additional other disease percentages were 44.1%, 22.8%, 29%, 35%, respectively. The systolic blood pressure value is higher in the group receiving hypertension treatment ($p<0.05$). The average number of drugs used at home is 7.2±2.4, the median value is 7, and the maximum of 13 (Q1=6/Q3=9). The relationship between the number of drugs used at home and the Total Adherence Score and Knowledge Score and Kt/V could not be determined ($p>0.05$). It was determined that patients with DM, HT, CAD and co-morbidities were prescribed significantly more drugs ($p<0.05$). Kt/V was equal and above 1.2 in 79.3% (n=115) of the patients, and below 1.2 in 20.7% (n=30). Kt/V mean 1.4±0.3, min-max (0.2-2.0), median is 1.38. Kt/V groups were found to be alike in terms of demographic characteristics and comorbidities ($p>0.05$). Patients' demographic characteristics and comorbidity data are shown in **Table 1**.

The most prescribed drugs for patients participating in the study were sodium hydrogen carbonate, Calcium-based therapy and erythropoietin. In comparing the groups with respect to the medications used, it was found that the patient group with Kt/V≥1.2 used antihypertensive agents, folic acid, vitamin B12 and vitamin C more, but levocarnitine less, than the group with Kt/V<1.2 ($p<0.05$). **Table 2** shows the comparisons of the groups in terms of the medications and the number of patients and their percentages given.

Comparing the groups for the laboratory characteristics, blood pressure and dialysis time revealed that albumin levels were statistically significantly higher in the group with Kt/V≥1.2 with respect to the group with Kt/V<1.2 ($p<0.05$). But the groups were similar to each other in terms of the other parameters ($p>0.05$). Group comparisons in terms of laboratory parameters, blood pressures and dialysis periods are presented in **Table 3**.

Table 1. Comparison of demographic characteristics and comorbidities of patients by Kt/V.			
Demographic Characteristics	**Kt/V≥1.2**	**Kt/V<1.2**	**p**
Gender			
Male, %-n-median age	52.2-60	63.3-19	0.309
Female, %-n	47.8-55	36.7-11	
Age			
18-30, %-n	4.3-5	3.3-1	
31-40, %-n	6.1-7	10-3	0.206
41-50, %-n	19.1-22	23.3-7	
51-64, %-n	31.3-36	46.7-14	
≥65, %-n	39.1-45	16.7-5	
Educational Status			
İlliterate, %-n	27.8-32	13.3-4	
Primary Education, %-n	61.7-71	76.7-23	
High School, %-n	6.1-7	10-3	0.324
University, %-n	3.5-4	0	
PhD, %-n	0.9-1	0	
Diabetes mellitus, %-n	26.1-30	10-3	0.086
Hypertension, %-n	47-54	33.3-10	0.218
Coronary artery disease, %-n	29.6-34	26.7-8	0.825
Weight, mean±standard deviation	66.91±15.8	70.37±14.7	0.143
Vascular access			
Catheter, %-n	30.4-35	40-12	0.109
Fistula, %-n	75.7-87	24.3-28	

p= for all groups

Table 2. Frequency of prescription and Comparison of the groups by the medications used

Medications	Frequency of prescription	Kt/V≥1.2	Kt/V<1.2	p
Erythropoietin, %-n	67.6- 98	67-77	70-21	0.829
Antihypertensive, %-n	40.7- 59	48.7-56	10-3	**<0.001**
İntravenous ıron, %-n	62.8-91	62.6-72	63.3-19	1
Levocarnitine, %-n	66.9-97	62.6-72	83.3-25	**0.048**
Vitamin D, %-n	46.9-68	47-54	46.7-14	1
Calcium-based phosphorus binder, %-n	68.3-99	67.8-78	70-21	1
Sevalemer, %-n	43.4-63	45.2-52	36.7-11	0.418
Sodium hydrogen carbonate, %-n	91 -132	92.2-106	86.7-26	0.470
Folic acid, %-n	37.9-55	45.2-52	10-3	**<0.001**
Vitamin B12, %-n	44.1-64	50.4-58	20-6	**0.003**
Vitamin C %-n	47.6-69	54.8-63	20-6	**0.001**

Table 3. Comparison of the patients in terms of laboratory parameters, blood pressure values and dialysis periods

Parameters	Kt/V≥1.2 n= 130	Kt/V<1.2 n=15	p
Hemoglobin (g/dl), median-IQR	11.2-1.6	9.9-3.2	0.187
Ferritin (mg/dl), median-IQR	1057-883	658-410	0.667
Albumin (g/dl), median-IQR	4.1-0.5	4-1.3	**0.002**
Blood Urea Nitrogen (mg/dl), median-IQR	59-19.5	59-20.5	0.458
Phosphorus mEq/l, median-IQR	5.95-2.5	6-3	0.963
Calcium (mg/dl), median-IQR	9-1.3	8-1.8	0.240
Parathyroid Hormone (pg/ml), median-IQR	236-424	268-1096	0.681
Systolic Blood Pressure (mmHg), median-IQR	120-20	120-15	0.929
Diastolic Blood Pressure (mmHg), median-IQR	80-10	84-12	0.293
Dialysis time (years), median-IQR	4.41-6	2.39-7.7	0.361

IQR: Interquartile range

In the questionnaire, 20 questions concerning information on drug taking were chosen and correct knowledge and appropriate behavior were scored by 1 point. In the study, the mean number of correct answers was 15.46±2.1 (min-max 10-19) according to the knowledge score analysis. The median Total Knowledge Score was 16 (IQR= 3) in the group with Kt/V≥1.2, while 15.5 (IQR=3) in the group with Kt/V<1.2, indicating a similarity between the groups in this respect. The median Total Adherence Score was calculated as 1150 (IQR=150) and 1075 (IQR=262.5) in the Kt/V>1.2 and Kt/V<1.2 groups, respectively. Total Adherence Score was found to be statistically significantly higher in the group with Kt/V≥1.2 (p<0.05). **Figure 2** and **Figure 3** show the comparison of patients' total knowledge and adherence scores, respectively.

Potential factors affecting dialysis adequacy, including the presence of DM, use of antihypertensive agents, levocarnitine, folic acid, vitamin B12 and vitamin C, hemoglobin levels and serum albumin levels were incorporated in the logistic regression analysis. Univariate logistic regression analysis showed that antihypertensive use, folic acid use, vitamin B12 and vitamin C use, and serum albumin level affected dialysis adequacy positively, while levocarnitine use affected negatively (p<0.05). Multivariate logistic regression analysis, however, revealed that folic acid use, serum albumin level and total compliance score were independent predictors of dialysis adequacy (p<0.05). The results of univariate and multivariate logistic regression analyses are shown in **Table 4**.
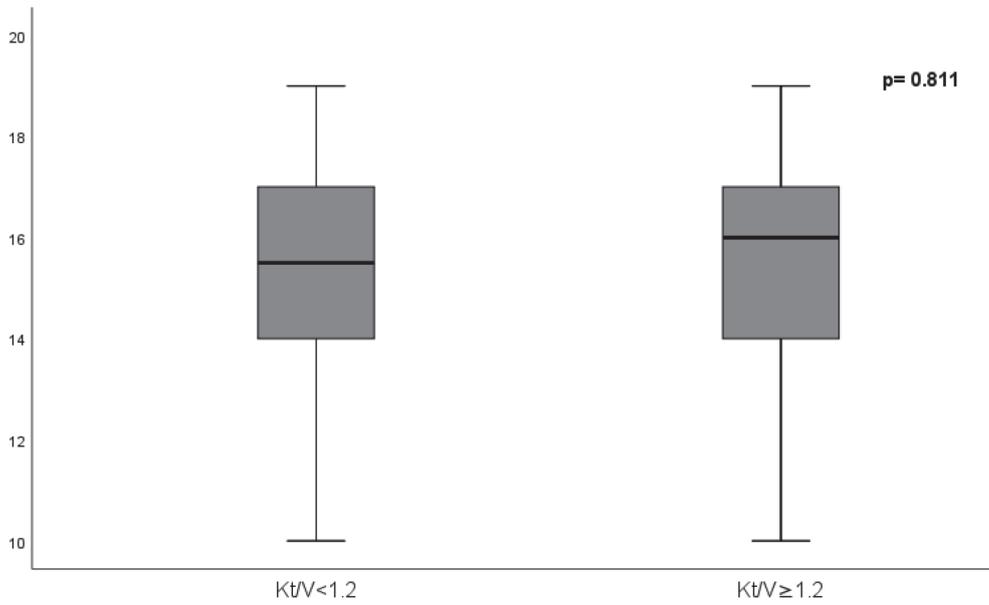
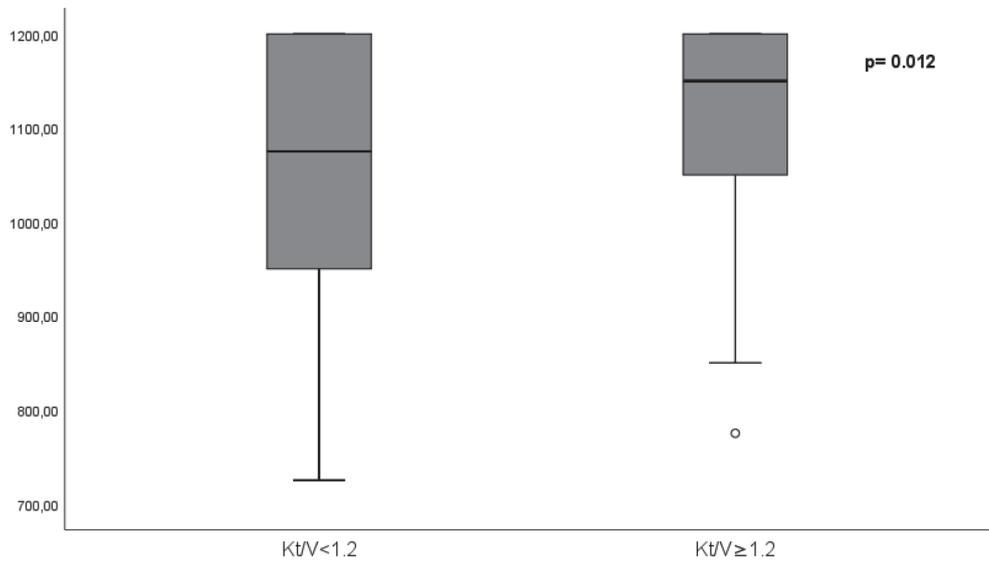**Figure 2.** Comparison of total knowledge scores by Kt/V

Figure 3. Comparison of total adherence scores by Kt/V

Table 4. Univariate and multivariate regression analysis identifying the determinants of dialysis adequacy				
	Univariate		**Multivariate**	
Parameter	**Effect size (%95CI)**	**p**	**Effect size (%95CI)**	**p**
Precence of DM	3.17(0.898-11.234)	0.073		
Vascular Access, Fistula	2.071 (0.889-4.825)	0.091		
Use of Antihypertensives	8.54(2.453-29.744)	**0.001**	3.339(0.786-14.172)	0.102
Use of levocarnitine	0.335(0.119-0.940)	**0.038**	0.691(0.194-2.460)	0.568
Use of folic acid	7.429(2.132-25.878)	**0.002**	4.194(1.014-17.348)	**0.048**
Use of Vitamin B12	4.070(1.548-10.698)	**0.004**	1.507(0.416-5.459)	0.533
Use of Vitamin C	4.846(1.843-12.746)	**0.001**	1.889(0.496-7.192)	0.351
Level of Hemoglobin	1.299(0.979-1.723)	0.070		
Level of Serum Albumin	4.584(1.746-12.037)	**0.002**	4.979(1.388-17.855)	**0.014**
Total compliance score	1.005(1.002-1.009)	**0.003**	1.005(1.001-1.009)	**0.013**

DISCUSSION

Hemodialysis forces the individual to change in physical, social, psychological, and economic aspects. Treatment regimens have changed in the last 20 years, but the patients' quality of life has not improved enough. We know that quality of life can be increased with treatment adherence. At this point we care about identifying the variables that increase compliance (25,26). In the literature, it has been determined that the quality of life is higher in patients undergoing hemodialysis in groups with high health literacy (27). At the same time, it is known that motivation and knowledge levels and interventional training increase adaptation behaviors. With adherence, the chance of successful treatment rises, and comorbid conditions, symptoms such as pain, infection, insomnia, and fatigue decrease (28). We determined a significant relationship between the knowledge level of rational drug use and dialysis adequacy. For this reason, it is important to support patients' correct use of drugs and knowledge level.

The risk of cardiovascular disease in ESRD patients is 10 times higher than in the general population (29). Developing co-morbidities affect drug load. In addition, medication may be required for physical and psychological symptoms such as pain, insomnia, loss of appetite, weakness, and depression (30). In this study, patients under hemodialysis receive an average of 7 drugs. Reducing the complexity of treatment and moving away from polypharmacy are the reasons that increase compliance. Studies say that a patient on hemodialysis drinks an average of 10±4 drugs (30).

An augmentation number of patients, treatment of developing comorbid conditions, unavoidable polypharmacy, and its possible drug side effects and drug interaction results increase the cost of treatment (31). 5.4% of the gross national product in Turkey is spent on renal replacement therapies (32). Compliance is essential to improve patients' quality of life, manage complications, and reduce the burden on health economics. Treatment adherence is essential for success in HD treatment, as it is in all diseases requiring long-term follow-up and therapy. It is clear that treatment adherence can reduce morbidity and mortality (33).

Treatment adherence scores were measured by ESRD-(AQ) in hemodialysis patients. Many countries around the world use this survey (19). Treatment adherence scores of all our patients were quite high due to regular patient training on treatment adherence in dialysis units. Communicating with healthcare professionals such as nurses and physicians 3 days a week, while undergoing dialysis, may contribute to a better understanding of the significance of treatment compliance. Many dialysis patients consider healthcare staff in the dialysis unit as their families, facilitating strict adherence to their recommendations. In a questionnaire study by Ohya et al., the adherence rate of dialysis patients to medical treatment was found to be quite high, at a rate of 93.2% (34). Another reason for the high rate of adherence may be the Covid-19 pandemic. Some studies reveal that treatment adherence increases in patients with end-stage renal disease in the Covid 19 pandemic (35).

Rational drug use knowledge level is also high. According to the studies of Öztürk et al., patients receiving hemodialysis treatment also have a high level of knowledge, and this affects some laboratory values positively (13). Knowledge score and dialysis adequacy were found to be highly correlated.

Our study showed that, as total adherence scores of the patients increased, their probability of receiving adequate dialysis also increased. In a study, a strong correlation was found between treatment adherence and dialysis adequacy (36). Kidney Disease Outcomes Quality Initiative (KDOQI), publishing globally accepted guidelines on Chronic Kidney Disease (CKD), also emphasizes the significance of patients' treatment adherence for dialysis adequacy (37).

In this study, the Kt/V value was used for dialysis adequacy. Not only that the Kt/V value calculates the efficacy of dialysis, but it is also considered an independent predictor of cardiovascular and non-cardiovascular mortality (38,39). Considering the significant relationship between increasing Kt/V values and the quality of life, Kt/V can also be recognized as an important indicator for determining the adherence-related parameters (40).

Folic acid supplementation was found to be an independent predictor of dialysis adequacy. It is recommended to measure folic acid levels and monitor at regular intervals in case of anemia in CKD patients (41). Also, the transport of folates is slower in patients with uremia. For this reason, tissue folate uptake may be slowed in CKD patients despite normal plasma folate levels (42). Folate deficiency or defective folate transport may elicit hyperhomocysteinemia, which may be associated with accelerated atherosclerosis and thrombotic events (43). In a study by Cetinkaya et al. in Türkiye, a negative correlation was determined between Kt/V and serum folic acid and total serum homocysteine levels (44). It is not surprising, in this sense, that patients receiving folic acid supplementation had higher dialysis adequacy in our study.

On the other hand, receiving hemodialysis treatment is not an indication of folic acid use. Although its use is available due to its effect on erythropoietin treatment, its use is not obligatory except for the lack of it in

the guidelines (45). We think that to avoid pill burden, dialysis adequacy and the use of folic acid is needs to be investigated further.

Serum albumin level is known to be associated with morbidity and mortality in many clinical conditions (46-48). In our study, albumin level was determined as an independent predictor for dialysis adequacy. The underlying cause might be that the oncotic pressure increases and the blood pressure required for dialysis is better maintained as the albumin level increases. In a study, complications during dialysis were found to be more common in patients having low albumin levels (49). Early terminated dialysis sessions due to complications and blood flow problems during the dialysis might explain the effects of albumin levels on dialysis adequacy.

Levocarnitine is an amino acid derivative and vitamin-like compound responsible for fatty acid oxidation. A higher rate of carnitine dialysis during hemodialysis and decreased carnitine production due to renal damage are common causes of secondary carnitine deficiency. There is not sufficient evidence showing the positive effects of levocarnitine replacement in lipid and cardiovascular diseases and its supplementary properties supporting the treatment of anemia (50). In our study, the group receiving Levocarnitine displayed poor dialysis adequacy, although it did not have an independent predictive value. The fact that it is used in severely anemic patients with lower albumin levels might explain this situation.

Uremia, oxidative stress due to extracorporeal circulation, and increased inflammation predispose to cardiovascular diseases in hemodialysis patients. The protective role of vitamin C on the lipid profile and its effect in preventing atherosclerosis plaque development is promising (51). In a study conducted with 130 patients on the relationship between vitamin C levels and cardiovascular mortality, lower levels of vitamin C levels were found to be associated with cardiovascular mortality after 30 months of follow-up (52). In our study too, the dialysis adequacy rate was quite high in the group taking vitamin C.

Hypertension control is not at the desired level in hemodialysis patients (53). In our study, the systolic blood pressure level was found to be higher in the antihypertensive group.

The confusing finding of our study is that the incidence of hypertension and the frequency of antihypertensive use were found to be higher in the group of Kt/V≥1.2, although not statistically significant. We think that this may be related to the higher incidence of diabetes mellitus in the group of Kt/V≥1.2, although it did not reach statistical significance. We think that diabetes and autonomic dysfunction due to diabetes may increase the episodes of intradialytic hypotension. Therefore ultrafiltration may be more limited in patients with dialysis adequacy.

The limitations of our study are that it is a single-center study and it was conducted with a small number of patients. Another limitation of our study is that malnutrition status was not evaluated. The fact that complications during dialysis sessions were not included in our study can be considered a limitation. However, our study was designed as a survey study and it is a study showing that treatment adherence in dialysis patients is directly related to dialysis adequacy.

CONCLUSION

Dialysis adequacy can be improved by increasing patients' treatment adherence. In this sense, it is important to determine the factors affecting patients' compliance and eliminate them. The knowledge level of patients on rational drug use should be supported. Determining the relationship between dialysis adequacy and the medications used and their independent predictive effects is important in prolonged treatment processes, in terms of increasing adherence and decreasing mortality and morbidity. In this study, the use of folic acid, vitamin C, and levocarnitine were associated with dialysis adequacy. The relationship between the potential protective effects of medications and dialysis adequacy should be examined in furthermore studies.

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