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The Relationship between Serum Lipid Levels and Hemodialysis Adequacy

Okan Dikker[1]*, Mustafa Şahin[2], Barış Eser[3], Mustafa Durmuşcan[4], Alpaslan Karabulut[5]

[1]*Department of Medical Biochemistry, Okmeydanı Training and Research Hospital, University of Health Sciences, Istanbul, Turkey*
[2]*Department of Medical Biochemistry, Erol Olçok Training and Research Hospital, Hitit University, Çorum, Turkey*
[3]*Department of Nephrology, Faculty of Medicine, Hitit University, Çorum, Turkey*
[4]*Department of Medical Biochemistry, Public Health Laboratory, Adana, Turkey*
[5]*Department of Internal Medicine, Faculty of Medicine, Hitit University, Çorum, Turkey*

***Corresponding Author:** Okan Dikker, Specialist and PhD, Department of Medical Biochemistry, Turkey.*

ABSTRACT

***Aim:** The goal of hemodialysis treatment is to perform adequate dialysis and to improve the quality of life. In order to analyze dialysis adequacy, in clinical practice, urea reduction rate (URR%) and Kt/V are calculated in each hemodialysis session. Lipid profile in Chronic renal failure (CRF) varies according to disease stage. Hypertriglyceridemia is the most common lipid disorder in CRF patients. In our study, we aimed to evaluate the relationship between serum lipid profile and URR% and Kt/V values showing dialysis adequacy in patients receiving regular chronic hemodialysis treatment.*

***Methods:** This study was performed retrospectively with the data of 65 patients who were followed-up in the Hemodialysis Unit with the diagnosis of CRF, who had undergone hemodialysis treatment. Serum lipid profile [total cholesterol, triglyceride, LDL-cholesterol, HDL-cholesterol] obtained from venous blood samples was recorded. In addition, fasting glucose levels, predialysis-postdialysis urea, predialysis-postdialysis creatinine levels and dialysis adequacy tests (URR% and Kt/V) were recorded. Correlations between URR% and Kt/V values and lipid profile were examined in a group of 65 patients.*

***Results:** In the correlation analysis, we did not find any statistically significant correlation between lipid profile tests and Kt/V or URR% values. There was no statistically significant difference regarding Kt/V or URR% values between two groups with triglyceride level ≤ 150 mg/dL and > 150 mg/dL. In addition, we did not find any statistically significant correlation between triglyceride levels and Kt/V or URR% values in any groups.*

***Conclusion:** In our study, no correlation was found between serum lipid levels and hemodialysis adequacy. We believe that similar studies performed in larger patient groups under hemodialysis treatment and having dyslipidemia (triglyceride > 150 mg/dL and total cholesterol > 200 mg/dL) are warranted.*

Keywords: *Hemodialysis, Dialysis adequacy, Lipid profile*

INTRODUCTION

Chronic renal failure (CRF) is an irreversible and progressive loss of nephrons due to renal or non-renal causes [1]. Many factors including diabetes mellitus, chronic glomerulonephritis, hypertension and polycystic kidney disease are among the causes of CRF [2]. Hemodialysis, peritoneal dialysis and renal transplantation are the main treatment options in CRF. In hemodialysis, blood obtained from the patient is homogenized via dialysate by filtering through a semipermeable membrane through the opposite direction. Then, the acid-base status, electrolytes and toxic substances are regulated by diffusion, osmosis, and ultrafiltration and returned to the patient [3].

The goal of hemodialysis treatment is to perform adequate dialysis and to improve the quality of life; because there is a very close relationship between quality of life and mortality and morbidity in patients receiving hemodialysis treatment [4-6]. Inadequate dialysis is one of the main risk factors that increase morbidity and mortality. In order to analyze dialysis adequacy, in clinical practice, kinetic model measurements that determine the rate of uremic toxins' removal from the body are used [7]. For this purpose, urea reduction rate (URR%) and Kt/V are calculated in each hemodialysis session. These are the most commonly used indicators of dialysis adequacy related to urea clearance. URR% shows the rate of urea reduction in a dialysis session. An assessment of the effectiveness of dialysis can be made by defining the degree of urea reduction during the dialysis session. The minimum target of URR% is 55. In the fractional expression of Kt/V, numerator is the 'clearance' and the denominator is the 'volume in which the clearance performed substance is dispersed'. In this expression; K shows the clearance of the dialyzer at a given blood flow rate (ml/min), t is the dialysis time (min), and V is the urea dispersion volume. In Kt/V kinetic approach, the ratio is requested to be minimum '1'. Accordingly, if the numerator and denominator are equal to each other in this formula, which is expressed as Clearance/ Production, that is to say the clearance is performed as much as produced, and the result will be '1' [8,9].

Lipid profile in CRF varies according to disease stage. In stage 1-4 CRF, low-density lipoprotein-cholesterol (LDL-cholesterol) and triglyceride levels tend to be high, whereas in stage 5 CRF, LDL-cholesterol often tends to decrease while triglyceride levels tend to increase. Hypertriglyceridemia is the most common lipid disorder in CRF patients. Approximately 30–50% of all CRF patients have hypertriglyceridemia [10]. Serum cholesterol levels are recommended as a routine parameter for monitoring the nutritional status of adult dialysis patients [11]. It has been reported that low cholesterol levels may be an indicator of malnutrition in CRF [11,12]. Decreased cholesterol levels in adult dialysis patients have been reported to be associated with increased mortality risk, such as hypoalbuminemia [11,13].

Based on this information, we aimed to evaluate the relationship between serum lipid profile and URR% and Kt/V values showing dialysis adequacy in patients receiving regular chronic hemodialysis treatment. In this way, we will seek an answer to the question whether changes in lipid profile have an effect on dialysis adequacy. If present, treatment of dyslipidemia may increase the dialysis adequacy and reduce the risk of mortality and morbidity in CRF patients.

MATERIALS AND METHODS

This study was approved by the Local Ethics Committee (Aproval no: 68 /2019) and performed in accordance with the principles of Declaration of Helsinki. The study was performed retrospectively with the data of 65 patients who were followed-up in the Hemodialysis Unit of Hitit University Erol Olçok Education and Research Hospital with the diagnosis of CRF, who had undergone hemodialysis treatment for at least one year and regularly received three sessions of hemodialysis treatment per week. Patients complying with the inclusion criteria were informed by the researchers. After obtaining informed consent form from the volunteers, detailed history of participants were taken. All patients were dialyzed 3 times a week for 4 hours using dialyzers with bicarbonate dialysis solutions with a blood flow rate of 300 mL/min and dialysate flow rate of 500 mL/min having a surface area of 1.4 m^2. Serum lipid profile [total cholesterol, triglyceride, LDL-cholesterol, HDL-cholesterol] obtained from venous blood samples before the first dialysis following 12-hour fasting was recorded. In addition, fasting glucose levels, predialysis-postdialysis urea, predialysis-postdialysis creatinine levels and dialysis adequacy tests (URR% and Kt/V) were recorded. Correlations between URR% and Kt/V values and lipid profile were examined in a group of 65 patients. Delta-urea value was calculated from the difference between pre-dialysis and post-dialysis urea levels, and pre-dialysis creatinine and post-dialysis creatinine difference was calculated and defined as Delta-creatinine.

For a second statistical analysis, 8 patients with serum total cholesterol levels above the reference range (> 200 mg/dL) were excluded from the data analysis; and remaining 57 patients were subdivided into two groups as having triglyceride levels within the reference range (≤ 150 mg/dL, n: 30) or having higher triglyceride levels than the reference range (> 150 mg/dL, n: 27). Between these two groups, URR% and Kt/V values were compared. In addition, correlations between URR% and Kt/V values and triglyceride levels were examined separately in these two groups.

Patients who received lipid lowering therapy, patients who received hemodialysis treatment irregularly, and patients with familial hyperlipoproteinemia were excluded from the study.

Measurement of Laboratory Tests

Lipid profile tests, glucose, urea and creatinine levels were measured by photometric method in autoanalyser (Beckman Coulter brand, AU5800 model, 2014, USA).

Calculation of URR%

URR% =100 x (1- Urea T / Urea 0) (T: after dialysis, 0: before dialysis)

Calculation of Kt/V

Kt/V= –ln (R – 0.008xt) + (4–3.5xR) x UF / W ([R = blood urea nitrogen (BUN) after dialysis / BUN before dialysis, t = duration of dialysis session (hours), UF = total ultrafiltration in dialysis, W = patient weight after dialysis (kg)] [14].

Statistical Analysis

IBM SPSS version 20.0 (SPSS Inc, Chicago Illinois) statistical program was performed. The normal distribution of the parameters was analyzed using the Shapiro Wilk test. Student-t test was utilized in comparing normally distributed parameters between two groups, and Mann Whitney U test in comparing the non-normally distributed parameters between two groups. Pearson correlation analysis was applied to analyze the correlations between normally distributed parameters. Spearman' s rho correlation analysis was applied to analyze the correlations between normally distributed parameters. The level of significance was accepted as 'P <0.05'.

RESULTS

Sixty-five patients [36 (55%) female and 29 (45%) male] were included in the study. The mean age of the patients was 66 (19-89) years. General characteristics of the patients are presented in table 1.

Table1. *General characteristics of the patients (n: 65)*

Age (years)	66 (19 - 89)
Fasting blood glucose (mg/dL)	96 (70 - 404)
Predialysis-urea (mg/dL)	130 ± 30
Predialysis-creatinine (mg/dL)	8.2 ± 3.1
Triglyceride (mg/dL)	164 (54 - 823)
Total cholesterol (mg/dL)	164 ± 53
HDL-cholesterol (mg/dL)	34 (17 - 75)
LDL-cholesterol (mg/dL)	88 ± 34
Postdialysis-urea (mg/dL)	38 ± 13
Postdialysis-creatinine (mg/dL)	3.3 ± 1.7
Delta-urea (mg/dL)	93 ± 24
Delta-creatinine (mg/dL)	5.1 ± 2.2
URR%	70.5 ± 11.9
Kt/V	1.5 (0.8-2.3)

URR (%):Urea reduction rate, Kt/V: Urea kinetic model.

In the correlation analysis, we did not find any statistically significant correlation between lipid profile tests and Kt/V or URR% values (P=0.850, P=0.795, P=0.671, P=0.129, P=0.613, P=0.908, P=0.636, P=0.630; respectively) (table 2).

Table2. *Correlation analysis between lipid profile tests and Kt/V and URR% values (n: 65)*

	Kt/V		**URR%**	
Lipid profile	**r**	**P**	**r**	**P**
Total cholesterol *	-0.024	0.850	-0.064	0.613
Triglyceride**	-0.033	0.795	-0.015	0.908
LDL-cholesterol *	0.055	0.671	-0.062	0.636
HDL-cholesterol **	0.190	0.129	-0.060	0.630

** Pearson correlation analysis, ** Spearman correlation analysis*

There was no statistically significant difference regarding Kt/V or URR% values between two groups with triglyceride level ≤ 150 mg/dL and > 150 mg/dL (P=0.112, P=0.119; respectively) (table 3).

Table3. *Comparison of Kt/V and URR% values of patients sub-divided into two groups with triglyceride level ≤ 150 mg/dL and > 150 mg/dL*

	Triglyceride ≤ 150 mg/dL (n:30)	**Triglyceride >150 mg/dL (n:27)**	**P**
Kt/V	1.61 (0.8 - 2.3)	1.45 (0.9 - 2)	0.112
URR%	73.69 (54.08 - 85.06)	69.82 (53.45 - 82.08)	0.119

In addition, we did not find any statistically significant correlation between triglyceride levels and Kt/V or URR% values in any groups (P=0.475, P=0.245, P=0.252, P=0.349; respectively) (table 4).

Table4. *Correlation analysis between triglyceride levels and Kt/V and URR% values in subgroups of patients with triglyceride level ≤ 150 mg/dL and > 150 mg/dL*

	Kt/V		URR%	
Triglyceride levels	**r**	**P**	**r**	**P**
≤ 150 mg/dL (n:30)	-0.135	0.475	-0.216	0.252
>150 mg/dL (n:27)	0.231	0.245	0.187	0.349

DISCUSSION

The most common cause of mortality in CRF is cardiovascular diseases and sepsis. Atherogenic dyslipidemia such as high small-dense LDL particles, low HDL and high triglyceride levels, are strong risk factors for atherosclerosis which is at the center of cardiovascular diseases [15]. In CRF, changes in lipid profile depending on the stage of the disease, especially hypertriglyceridemia, are seen [10]. In our study to determine whether changes in serum lipid levels affect hemodialysis treatment in patients with CRF, we found that there was no relationship between URR% and Kt/V values, which are indicators of dialysis adequacy, and lipid profile tests. Since we did not find any similar studies in the literature, we could not compare our results directly.

The dyslipidemia guideline shows a target of ≤ 150 mg/dL for triglyceride levels in the high-risk patient group. In this guideline, life style changes are recommended to achieve this goal in patients with serum triglyceride levels < 200 mg/dL, while in those with triglyceride levels greater than 200 mg/dL drug therapy may be considered, statin therapy should be the first choice, and those with triglyceride levels above 200 mg/dL despite statin treatment, fenofibrate has been reported to be given in addition to statins [16]. In our study, we eliminated the patients with high cholesterol levels and found no correlation between triglyceride levels and URR% or Kt/V values in the correlation analysis performed in two groups with triglyceride level ≤ 150 mg/dL or > 150 mg/dL, separately.

In our study, we detected hypertriglyceridemia in approximately half of the patients with CRF. This information is consistent with the literature [10]. Two mechanisms that increase triglyceride levels in patients who do not require dialysis yet, are; delayed catabolism and increased hepatic VLDL-cholesterol synthesis. Secondary hyperparathyroidism in CKD causes a slowing of triglyceride-rich lipoprotein catabolism [15]. Plasma total cholesterol level is also considered as an indicator of nutritional status in hemodialysis patients. As an indicator of malnutrition, the risk of mortality increases, particularly at cholesterol levels below 150 mg/dL [17]. Total cholesterol levels were acceptable in our patients. CRF-induced dyslipidemia may accelerate the deterioration of renal function. Therefore, the presence of dyslipidemia should be investigated in patients with CRF and effective struggle should be performed [18].

In each hemodialysis treatment, measurements of urea clearance are among the most commonly used markers of dialysis adequacy. For this purpose, URR and Kt/V values are calculated [7]. In a further analysis, we found that URR% and Kt/V values were not statistically significantly different between the two groups of patients with CRF who had normal or high triglyceride levels. We did not come across a study where we could directly compare our results.

There are some limitations of our study. First of all, the number of patients could have been higher. In this way, similar statistical analyzes could be performed in patient subgroups formed according to the CRF etiologies. In addition, patients with higher total cholesterol levels could be included in the study and the study could be repeated in a group of all dyslipidemic patients. However, we believe that our study will contribute to the literature since our study is a preliminary study and no similar research has been found in the literature.

CONCLUSION

In our study, no correlation was found between serum lipid levels and hemodialysis adequacy. We believe that similar studies performed in larger patient groups under hemodialysis treatment and having dyslipidemia (triglyceride > 150 mg/dL and total cholesterol > 200 mg/dL) are warranted.

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REFERENCES

[1] Ryu S, Chang Y, Kim DI, Kim WS, Suh BS. Gamma-glutamyl transferase as a predictor of chronic kidney disease in nonhypertensive and nondiabetic Korean men. Clin Chem. 2007;53(1):71-7.

[2] Teppala S, Shankar A, Li J, Wong TY, Ducatman A. Association between serum gamma-glutamyl transferase and chronic kidney disease among US adults. Kidney Blood Press Res. 2010;33(1):1-6.

[3] Vadakedath S, Kandi V. Dialysis: A review of the mechanisms underlying complications in the management of chronic renal failure. Cureus. 2017;9(8):e1603.

[4] Khalil AA, Frazier SK, Lennie TA, Sawaya BP. Depressive symptoms and dietary adherence in patients with end-stage renal disease. J Ren Care. 2011;37:30-9.

[5] Barzegar H, Jafari H, Charati JY, Esmaeili R. Relationship between duration of dialysis and quality of life in hemodialysis patients. Iran J Psychiatry Behav Sci. 2017;11(4):e6409.

[6] Afrasiabifar A, Karimi Z, Hassani P. Roy's Adaptation model-based patient education for promoting the adaptation of hemodialysis patients. Iran Red Crescent Med J. 2013;15:566-72.

[7] Düşünsel R, Poyrazoglu HM. Çocuklarda hemodiyaliz. Turk Neph Dial Transpl. 2003;12(3):116-21.

[8] Stankuviene A, Bumblyte IA, Kuzminskis V, Ziginskiene E, Balciuviene V. Impact of hemodialysis dose and frequency on survival of patients on chronic hemodialysis in Lithuania during 1998-2005. Medicina. 2007;43:96-102.

[9] Stolic RV, Trajkovic GZ, Jekic D, Sovtic SR, Jovanovic AN, Stolic DZ, et al. Predictive parameters of survival in hemodialysis patients with restless leg syndrome. Saudi J Kidney Dis Transpl. 2014;25:74-80.

[10] Gryn SE, Hegele RA. Novel therapeutics in hypertriglyceridemia. Curr Opin Lipidol. 2015;26:484–91.

[11] Fouque D, Vennegoor M, Ter Wee P, Wanner C, Basci A, Canaud B, et al. EBPG Guideline on nutrition. Nephrol Dial Transplant. 2007;22(2):45-87.

[12] Sezer S, Arat Z, Özdemir N. Kronik böbrek yetmezliginde malnutrisyon. Turk Neph Dial Transpl. 2000;3:125-9.

[13] Liu Y, Coresh J, Eustace JA, Longenecker JC, Jaar B, Fink NE, et al. Association between cholesterol level and mortality in dialysis patients: role of inflammation and malnutrition. JAMA. 2004;28(4):451-9.

[14] Vanholder R, DeSmet R, Lesaffer G. Dissociation between dialysis adequacy and Kt/V. Semin Dial. 2002;15(1):3-7.

[15] Tsimihodimus V, Mitrogianni Z, Elisaf M. Dyslipidemia associated with chronic kidney disease. Open Cardiovasc Med J. 2011:5:41–8.

[16] Catapano AL, Graham I, De Backer G, Wiklund O, Chapman MJ, Drexel H, et al. ESC/EAS guidelines for the management of dyslipidaemias. Atherosclerosis. 2016;253: 281 –344.

[17] Rauchhaus M, Clark AL, Doehner W, Davos C, Bolger A, Sharma R, et al. The relationship between cholesterol and survival in patients with chronic heart failure. J Am Coll Cardiol. 2003;42:1933–40.

[18] Kronenberg F, Lingenhel A, Neyer U, Lhotta K, König P, Auinger M, et al. Prevalance of dyslipidemic risk factors in hemodialysis and CAPD patients. Kidney Int. 2003;84:113–6.

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