Orjinal Araştırma **Van Sağ. Bil. Derg.** *2026; 19(2):68-75.*
Original Research *https://doi.org/10.52976/vansaglik.1753548*

The Relationship Between Carotid Artery Intima-Media Thickness and Mean Platelet Volume in Hemodialysis Patients

Hemodiyaliz Hastalarında Karotis Arter İntima-Media Kalınlığı ile Ortalama Trombosit Hacmi Arasındaki İlişkinin Araştırılması

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Cited: Akbaş Ü, Erdem M, Düzen Oflas N, Aydemir O, Akbaş T. (2026). The Relationship Between Carotid Artery Intima-Media Thickness and Mean Platelet Volume in Hemodialysis Patients. *Van Sağlık Bilimleri Dergisi*, 19(2), 68-75.

ABSTRACT

Objective: This study aimed to detect early atherosclerosis by measuring carotid intima-media thickness (CIMT) in patients undergoing hemodialysis and to investigate the relationship between mean platelet volume (MPV) and CIMT.

Material and Method: Data were retrospectively collected from 50 patients undergoing hemodialysis. Both carotid arteries were examined using carotid Doppler ultrasonography, and CIMT greater than 1 mm was defined as elevated. MPV was measured from EDTA blood samples. Independent T-tests, Chi-square tests, Pearson correlation and ROC analyses were used for statistical evaluation.

Results: Elevated CIMT was found in 48% of the patients. Patients with elevated CIMT were older and had significantly higher MPV, blood glucose and CRP levels ($p<0.05$). A significant, positive, low-level correlation was observed between CIMT and MPV ($r=0.158$). CIMT, MPV and CRP showed statistically significant diagnostic accuracy for coronary artery disease (AUC: CIMT=0.799, MPV=0.861, CRP=0.692). The cut-off value for MPV was 11.4 fl.

Conclusion: In patients with elevated CIMT, a known marker of atherosclerosis, MPV was also found to be elevated. Age, MPV, glucose and CRP were associated with atherosclerosis and should be considered as important indicators of cardiovascular risk in hemodialysis patients.

Keywords: *Carotid intima-media thickness, mean platelet volume, hemodialysis, atherosclerosis*

ÖZET

Amaç: Bu çalışma, hemodiyaliz uygulanan hastalarda karotis intima-media kalınlığını (KİMK) ölçerek erken ateroskleroz saptamayı ve ortalama trombosit hacmi (OTH) ile KİMK arasındaki ilişkiyi incelemeyi amaçlamıştır.

Gereç ve Yöntem: Hemodiyaliz uygulanan 50 hastanın verileri retrospektif olarak toplandı. Her iki karotis arter, karotis Doppler ultrasonografisi ile incelendi ve 1 mm'den büyük KİMK yüksek olarak tanımlandı. OTH, EDTA'lı kan örneklerinden ölçüldü. İstatistiksel değerlendirmede Bağımsız T-testi, Ki-kare testi, Pearson korelasyonu ve ROC analizi kullanıldı.

Bulgular: Hastaların %48'inde KİMK yüksek bulundu. KİMK'si yüksek olan hastalar daha yaşlıydı ve OTH, kan glukozu ve CRP düzeyleri anlamlı olarak daha yüksekti ($p<0,05$). KİMK ile OTH arasında anlamlı, pozitif, düşük düzeyde korelasyon gözlendi ($r=0,158$). KİMK, OTH ve CRP koroner arter hastalığı için istatistiksel olarak anlamlı tanısal doğruluk gösterdi (AUC: KİMK=0,799, OTH=0,861, CRP=0,692). OTH için eşik değer 11,4 fl idi.

Sonuç: Ateroskleroz belirteci olan KİMK'si yüksek hastalarda OTH de yüksek bulunmuştur. Yaş, OTH, glukoz ve CRP ateroskleroz ile ilişkilidir ve hemodiyaliz hastalarında önemli kardiyovasküler risk göstergeleri olarak değerlendirilmelidir.

Anahtar Kelimeler: *Karotis intima-media kalınlığı, ortalama trombosit hacmi, hemodiyaliz, ateroskleroz*

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Received: 21.07.2025, Accepted: 12.05.2026 and Published: 30.08.2026

INTRODUCTION

Chronic kidney disease (CKD) is a global problem whose prevalence is increasing and affecting the entire world. According to the Chronic Renal Disease in Turkey (CREDIT) prevalence study performed via by the Turkish Society of Nephrology, the prevalence of CKD was found to be 15.7% in the adult population. Stage 3 CKD was found in 5.1% of adults, indicating critical kidney disease in one out of every 20 adults. The prevalence of stage 5 CKD, also known as end-stage renal disease (ESRD), was found to be 0.15%, at which point renal replacement therapy (RRT) becomes necessary. Among these patients, 63% receive hemodialysis, 7% undergo peritoneal dialysis, and 30% receive kidney transplantation (Levey et al., 1998).

CKD is another independent risk factor for coronary artery disease. Reduced glomerular filtration rate and increased proteinuria both enhance the risk of cardiovascular disease (Shlipak et al., 2005). Mortality rates in ESRD patients have been reported to be 10-30 times significantly higher compared to those in the general population. Cardiovascular diseases are significant predictors of mortality in ESRD patients and represent the most common cause of death (Faxon et al., 2004).

Atherosclerosis is the primary cause of cardiovascular diseases. It is a pathological process that progresses silently for several decades before leading to cerebral and peripheral artery disease. Therefore, early detection of atherosclerosis is of utmost importance (Olin et al., 2004). Atherosclerotic lesions develop in the intimal layer of arteries, most commonly in the aorta, femoral, popliteal, tibial, internal and external carotid, and cerebral arteries.

An increase in carotid intima-media thickness (CIMT) occurs before plaque formation and is predictive of atherosclerosis development. CIMT is widely used to evaluate atherosclerosis risk (Kastelein et al., 2004).

Mean platelet volume (MPV) is a novel marker associated with atherothrombosis (Choi et al., 2016). A significant relationship between MPV and aortic intima-media thickness has been observed in patients without clinical manifestations of atherosclerotic cardiovascular disease (Yüksel Kalkan et al., 2015). Another study suggested MPV as a predictor of severe atherosclerosis and as useful for predicting and defining cardiac risks in patients with coronary artery disease (Uysal et al., 2016). The current study aimed to detect early atherosclerosis by measuring CIMT in patients undergoing hemodialysis and investigate the relationship between MPV and CIMT.

MATERIALS AND METHODS

Study Design and Patients

This study was initiated by the Ethics Committee of Van Yuzuncu Yil University Faculty of Medicine, dated 01/09/2022. Data were retrospectively collected from the records of patients undergoing hemodialysis between January 1, 2022, and January 31, 2022, accessed through the Enlil system at Van Yuzuncu Yil University Dursun Odabas Medical Center.

All patients undergoing hemodialysis (n=50) were included in the study. Both carotid arteries of these patients were examined using an ACUSON S2000 Ultrasound System (Siemens Solutions, Mountain View, CA, USA) equipped with a 14L5 linear ultrasound probe for carotid Doppler ultrasonography. The hypoechoic region between the carotid lumen and adventitia was defined as CIMT. An increase in CIMT was found as thickness greater than 1 mm. CIMT measurements were performed via approximately 1 cm proximal to the carotid bulb at plaque-free areas, and the average of four measurements (near and far walls on the right and left sides) was recorded.

For MPV measurement, 2 ml of blood was collected into an ethylenediaminetetraacetic acid (EDTA) tube, and samples were analyzed using a Beckman Coulter LH 780 analyzer. The normal reference range for MPV in the hospital laboratory system was 9.3–12.1 fl.

The urea reduction ratio (URR) was calculated as URR (%) = 100 × [1 – (post-dialysis urea / pre-dialysis urea)]. A 60% URR corresponds to a Kt/V of 1, where K represents dialyzer clearance (ml/min), t is dialysis duration (minutes), and V is the total body fluid volume. URR and Kt/V are parameters indicating dialysis adequacy.

Statistical Analysis: The power of the test was set at a minimum of 80% and Type-1 error at 5% for each variable. The normal distribution of continuous measurements was assessed using Shapiro-Wilk ($n<50$) and Skewness-Kurtosis tests. Parametric tests were applied due to normal distribution. Descriptive statistics included mean, standard deviation, frequency (n), and percentage (%). Independent T-tests were used for group comparisons, and Chi-square tests were used for categorical variables. Pearson correlation test was used to evaluate the relationship between the parameters. ROC analysis was performed to determine the cut-off values of the examined parameters. Statistical significance was set at $\alpha=5\%$, using IBM SPSS version 26 software.

RESULTS

Of the 50 patients included in the study, 23 (46%) were male, and 27 (54%) were female. Elevated CIMT was found in 48% of the patients. The demographic characteristics and laboratory results according to CIMT are presented in Table 1.

Table 1. Demographic characteristics and laboratory results of the patients' comparison according to carotid intima media thickness

		CIMT				
		Negatif (n:26)		Pozitif (n:24)		
		Count	Row N %	Count	Row N %	*p
Gender	**Male**	9	39,10%	14	60,90%	0,093
	Female	17	63,00%	10	37,00%	
Cerebrovascular disease	**No**	25	59,50%	17	40,50%	**0,015**
	Yes	1	12,50%	7	87,50%	
Coronary artery disease	**No**	22	57,90%	16	42,10%	0,138
	Yes	4	33,30%	8	66,70%	
Smoking	**No**	22	52,40%	20	47,60%	0,902
	Yes	4	50,00%	4	50,00%	
Etiology	**Atrophic kidney**	0	0,00%	1	100,00%	**0,002**
	İdiopathic	5	100,00%	0	0,00%	
	Other	8	88,90%	1	11,10%	
	Diabetes Mellitus	3	21,40%	11	78,60%	
	Familial mediterranean fever	1	100,00%	0	0,00%	
	Glomerulonephritis	3	75,00%	1	25,00%	
	Hypertension	4	36,40%	7	63,60%	
	Autosomal dominant polycystic kidney disease	0	0,00%	3	100,00%	
	Vesicoureteral reflux	2	100,00%	0	0,00%	
Peripheral artery disease	**No**	23	51,10%	22	48,90%	0,706
	Yes	3	60,00%	2	40,00%	
Rezidu urine	**No**	17	50,00%	17	50,00%	0,68
	Yes	9	56,30%	7	43,80%	
		Mean	**Standard Deviation**	**Mean**	**Standard Deviation**	****p**
Age (years)		40,92	16,23	60,83	12,72	**<0.001**
Dialysis duration (years)		7,83	6,65	5,91	4,06	0,228
Cystolic bp (mmHg)		116	27,05	126,46	19,48	0,126
Dıastolic bp(mmhg)		72,88	8,74	74,38	11,26	0,602
MPV (fL)		10,88	1,19	11,57	0,98	**0,031**
Hemoglobin (g/dL)		10,88	1,9	11,05	1,64	0,733
Platelet (uL)		179653,85	55616,5	216250	77925,41	0,06
Glucose (mg/dL)		98,42	28,19	132,63	75,69	**0,037**
BUN (mg/dL)		50,19	15,05	58,01	11,65	**0,047**
Creatinin (mg/dL)		12,92	25,82	12,74	27,18	0,98
Sodium (mmol/L)		135,2	26,62	133,97	27,52	0,874
Potassium (mmol/L)		5,23	1,11	5,31	0,81	0,792
Calcium (mg/dL)		8,34	1,04	8,56	1,11	0,466
Phosphor (mg/dL)		5,3	1,12	5,16	0,91	0,783
Parathormone (pg/mL)		364,04	340,95	364,15	283,17	0,999
Triglycerıde (mg/dL)		151,35	56,94	144,46	93,36	0,752
Total cholesterol (mg/dL)		148,73	36,12	158,37	42,67	0,391
LDL (mg/dL)		79,95	29,89	89,79	30,35	0,254

HDL (mg/dL)	38,85	8,53	40	6,35	0,592
Albumin (g/L)	37	10,52	37,87	5,68	0,723
HTC (%)	32,84	5,23	33,83	4,35	0,47
CRP (mg/L)	5,3	6,61	12,93	17,71	**0,046**
Kt/V	1,82	0,31	1,65	0,19	**0,026**
URR (%)	77,27	5,21	74	5,87	**0,042**

* Significance levels according to Chi-square test,**Significance levels according to Independent T-test results Bold p-values indicate a statistically significant difference(p<0,05) Chi-square test was used for categorical variables, and Student's t-test was used for continuous non-categorical variables CIMT: carotid intima-media thickness, MPV: mean platelet volume, BUN: blood urea nitrogen, LDL: low density lipoprotein, HDL: high density lipoprotein, HTC: hematocrıte, CRP: c-reactıve protein, URR: urea reduction rate, Kt/V: a parameter used to measure the adequacy of hemodialysis and peritoneal dialysis treatment.

Patients with elevated CIMT were older and had significantly higher MPV, blood glucose, and CRP levels (p<0.05). CIMT values were directly proportional to BUN levels and inversely proportional to URR and Kt/V ratios (p<0.05). Patients with a history of cerebrovascular events (CVE) exhibited increased CIMT (p<0.05). Hypertension was the most common etiological factor identified in all patients with elevated CIMT (p<0.05).

Table 2. Demographic characteristics and laboratory results of the patients comparison according to mean platelet volume

		MPV				
		Negatif (n:39)		Pozitif (n:11)		
		Count	**Row N %**	**Count**	**Row N %**	***p**
Gender	**Male**	19	82,60%	4	17,40%	0,468
	Female	20	74,10%	7	25,90%	
Cerebrovascular disease	**No**	35	83,30%	7	16,70%	**0,037**
	Yes	4	50,00%	4	50,00%	
Coronary artery disease	**No**	35	92,10%	3	7,90%	**0,001**
	Yes	4	33,30%	8	66,70%	
Smoking	**No**	32	76,20%	10	23,80%	0,479
	Yes	7	87,50%	1	12,50%	
Etiology	**Atrophic kidney**	1	100,00%	0	0,00%	**0,825**
	İdiopathic	4	80,00%	1	20,00%	
	Other	8	88,90%	1	11,10%	
	Diabetes mellitus	9	64,30%	5	35,70%	
	Familial mediterranean fever	1	100,00%	0	0,00%	
	Glomerulonephritis	3	75,00%	1	25,00%	
	Hypertension	8	72,70%	3	27,30%	
	Autosomal dominant polycystic kidney disease	3	100,00%	0	0,00%	
	Vesicoureteral reflux	2	100,00%	0	0,00%	
Peripheral artery disease	**No**	37	82,20%	8	17,80%	**0,031**
	Yes	2	40,00%	3	60,00%	
Rezıdu urıne	**No**	24	70,60%	10	29,40%	0,65
	Yes	15	93,80%	1	6,30%	
		Mean	**Standard Deviation**	**Mean**	**Standard Deviation**	****p**
Age (years)		49,51	18,53	53,91	14,27	0,471
Dialysis duration (years)		5,85	4,97	10,64	6,3	**0,011**
Cystolic bp (mmHg)		123,08	19,35	113,73	36,6	0,259
Diastolic bp(mmHg)		73,33	9,82	74,55	10,83	0,725
CIMT (mm)		0,89	0,29	1,08	0,3	0,064

Hemoglobin (g/dL)	11,03	1,79	10,71	1,75	0,599
Platelet (uL)	203641,03	64439,89	74454,55	82827,97	0,219
Glucose (mg/dL)	91,49	38,35	126,73	104,1	0,449
BUN (mg/dL)	53,21	13,33	56,56	16,42	0,487
Creatinin (mg/dL)	14,36	29,56	7,43	1,9	0,444
Sodium (mmol/L)	133,24	30,24	39,45	2,62	0,502
Potassium (mmol/L)	5,32	1,07	5,09	0,44	0,494
Calcium (mg/dL)	8,37	1,06	8,71	1,14	0,362
Phosphor (mg/dL)	3,45	1,07	3,56	0,92	0,471
Parathormone (pg/mL)	377,63	320,65	16,09	284,78	0,568
Triglyceride (mg/dL)	144,36	60,23	61,09	119,11	0,524
Total cholesterol (mg/dL)	151,28	41,2	160,73	32,26	0,487
LDL (mg/dL)	83,32	32,57	89,45	20,26	0,558
HDL (mg/dL)	39,64	8,05	38,55	5,35	0,674
Albumin (g/L)	37,89	8,87	35,73	7	0,46
HTC (%)	33,45	4,92	32,85	4,56	0,717
CRP (mg/L)	7,33	11,16	14,73	19,57	0,111
Kt/V	1,74	0,29	1,73	0,17	0,974
URR (%)	75,79	6,13	75,36	4,2	0,828

*Significance levels according to the Chi-square test; **significance levels according to the independent t-test results. Bold p-values indicate a statistically significant difference ($p < 0.05$). The Chi-square test was used for categorical variables, and Student's t-test was used for continuous variables. MPV: mean platelet volume; CIMT: carotid intima–media thickness; BUN: blood urea nitrogen; LDL: low-density lipoprotein; HDL: high-density lipoprotein; HCT: hematocrit; CRP: C-reactive protein; URR: urea reduction rate. Kt/V: a parameter used to measure the adequacy of hemodialysis and peritoneal dialysis treatment.

High MPV was detected in 22% of the patients. Demographic characteristics and laboratory results according to MPV are shown in Table 2. Although patients with elevated MPV had higher CIMT values, the difference was not statistically significant. However, the group with elevated MPV had significantly longer dialysis durations ($p<0.05$). MPV was significantly higher in patients diagnosed with cerebrovascular disease, coronary artery disease (CAD), and peripheral artery disease (PAD) ($p<0.05$).

Table 3. Correlation analysis of some parameters of the patients

		CIMT	Platelet (uL)	MPV (fL)	CRP (mg/L)	Glucose (mg/dL)	Dialysis duration (years)	LDL (mg/dL)	Triglyceride (mg/dL)	Kt/V	URR(%)
CIMT	r	1									
Platelet (uL)	r	,158									
MPV (fL)	r	,478**	-,150								
CRP (mg/L)	r	,301*	,221	,293*							
Glucose(mg/dL)	r	,221	,164	,150	-,042						
Dialysis duration (years)	r	-,091	-,195	,248	-,226	-,215					
LDL (mg/dL)	r	,287*	,371**	,219	,014	,080	,052				
Triglyceride (mg/dL)	r	,002	-,097	,025	-,197	,589**	-,013	,125			
Kt/V	r	-,131	-,091	,044	-,114	-,195	,101	-,139	-,127		
URR (%)	r	-,118	-,108	**,017**	-,355*	-,264	,184	-,119	-,086	,697**	1

**. Correlation is significant at the 0.01 level *. Correlation is significant at the 0.05 level CIMT: carotid intima-media thickness, MPV: mean platelet volüme, CRP: c-reactıve proteı , LDL: low density lipoprotein, URR: Urea reduction rate, Kt/V: a parameter used to measure the adequacy of hemodialysis and peritoneal dialysis treatment.

Correlation analyses of certain parameters are presented in Table 3. Significant, positive, low-level correlations were observed between CIMT and MPV (r=0.158), CRP (r=0.301), and LDL cholesterol (r=0.287). Additionally, a significant positive correlation was noted between MPV and CRP (r=0.293).

Table 4. Area under the curve (AUC) of measurements, cut-off value and diagnostic tests

Test Result Variable(s)	Area(AUC)	Std. Error	p.	Cut-off	Sensitivity	Specificity
CIMT (mm)	0,799	0,075	**0,002**	0,95	0,667	0,589
MPV (fL)	0,861	0,056	**0**	11,45	0,667	0,747
Platelet (uL)	0,534	0,109	0,725	188500	0,5	0,5
CRP (mg/L)	0,692	0,09	**0,047**	3,5	0,667	0,632
Glucose (mg/dL)	0,373	0,098	0,188	88,5	0,5	0,5

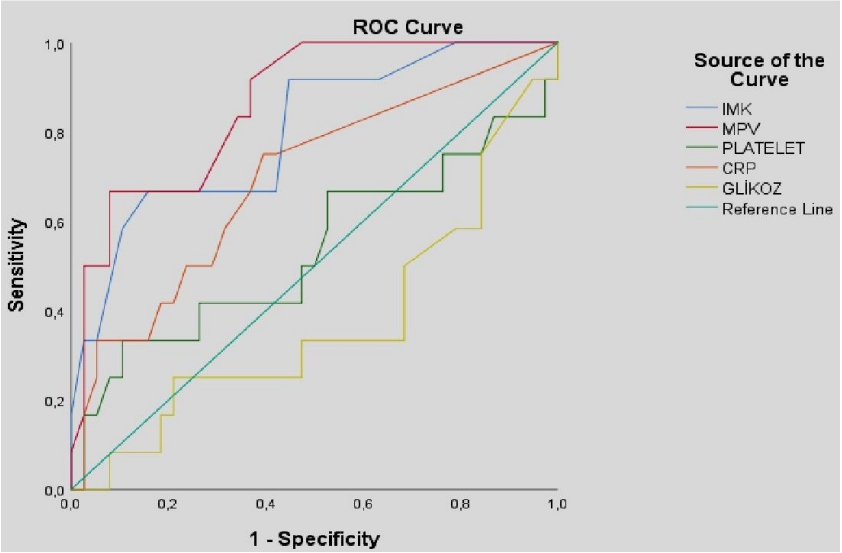

Figure 1. ROC curve and cut-off values of the examined parameters

In the study, 12 patients were diagnosed with CAD. The area under the curve (AUC), cut-off values, sensitivity, and specificity for certain laboratory tests in these patients are presented in table 4 and the ROC curve and cut-off values of the examined parameters are shown in Figure 1. CIMT, MPV, and CRP showed statistically significant diagnostic accuracy for coronary artery disease (AUC values: CIMT=0.799, MPV=0.861, CRP=0.692). Values above and below these thresholds yielded significant results for differentiating CAD.

DISCUSSION

Our study demonstrates that elevated CIMT in hemodialysis patients is positively correlated with MPV.

One study found that both MPV and CIMT were significantly elevated in dialysis patients. ROC curve analysis for predicting abnormal CIMT showed AUC values for MPV of 0.65 (P = 0.07) and 0.53 (P = 0.74). MPV has also been reported to correlate with certain cardiac abnormalities in children with ESRD (Gheissari et al., 2019).

In a study by Mayer et al. (2014), the clinical significance of MPV and its predictive value for atherosclerosis progression were investigated in patients with asymptomatic carotid artery disease. MPV was found to be independently and significantly associated with adverse cardiovascular outcomes in patients with asymptomatic carotid atherosclerosis.

In hemodialysis patients, diabetes mellitus (DM) was the most common etiological factor (28%), followed by hypertension (22%), glomerulonephritis (8%), and polycystic kidney disease (6%).

Furthermore, a meta-analysis performed via by Chu et al. (2010) examined 16 cross-sectional studies including 2809 patients, assessing the relationship between MPV and acute myocardial infarction. Their pooled results showed that MPV levels were significantly higher in patients who had experienced acute myocardial infarction compared to those who had not.

In another study performed via by Henning et al. (2002), involving 518 patients receiving chronic hemodialysis, the association between MPV and congestive heart failure was investigated. The mean MPV in hemodialysis patients was 8.22 ± 0.06 fl. Compared to patients with MPV <7.168 fl, those with MPV >9.172 fl had a significantly higher prevalence of congestive heart failure (odds ratio, 1.29; 95% confidence interval, 1.02–1.64). The study concluded that MPV may be associated with congestive heart failure in hemodialysis patients.

In a study by Bal et al. (2015), 149 consecutive asymptomatic CAD patients with ESRD (66% male)

were analyzed. The results suggested that MPV could be an independent predictor of CAD prevalence in patients with ESRD.

In our patient population, the mean CIMT value was 0.93 mm. Among patients with elevated MPV, the mean CIMT was 1.08 mm, compared to 0.89 mm in those with normal MPV. A statistically significant, positive, low-level correlation was observed between CIMT and MPV (r: 0.158). In our study, the cut-off value of CIMT for predicting CAD was determined to be 0.95 mm.

The mean MPV in our hemodialysis patients was 11.2 fl. In our study, the cut-off value for MPV was determined to be 11.4 fl. Coronary artery disease was found to be more prevalent among hemodialysis patients with MPV >11.4 fl. MPV showed a sensitivity of 66.7% and specificity of 74.7% in predicting CAD. Our findings suggest that elevated MPV may be associated with coronary artery disease in hemodialysis patients.

Atherosclerosis plays a role in the pathogenesis of most chronic diseases and some inflammatory factors. These responses include abnormal reactions to vascular wall injuries, leading to degeneration, exudation, and hyperplasia rather than classical inflammation. The detection of CRP as an inflammatory biomarker may be a valuable tool in diagnosing atherosclerosis and cardiovascular disease (Poznyak et al., 2020).

In a study by Parildar et al. (2013), which aimed to evaluate CIMT and CRP levels as potential predictors of subclinical atherosclerosis and inflammation in prediabetic patients, a significant positive correlation was observed between CIMT and fasting blood glucose, HbA1c, and CRP levels.

In our study, elevated CRP levels were found to be significantly associated with increased CIMT. Correlation analysis revealed a statistically significant, positive, low-level correlation between CRP and both CIMT (r: 0.301) and MPV (r: 0.293). These findings suggest that elevated CRP levels may serve as a useful marker for diagnosing atherosclerosis and cardiovascular disease.

Infections that could potentially lead to elevated CRP levels in hemodialysis patients, such as catheter-related infections, urinary tract infections, or upper respiratory tract infections, were excluded from the study.

Diabetes mellitus (DM) is a chronic disease characterized by microvascular and macrovascular complications, insulin resistance, and insulin insufficiency. Alterations in lipid metabolism represent a risk factor and a characteristic feature of atherosclerosis. The potential links between these two chronic disorders—DM and atherosclerosis—have been explored in numerous studies. Both types of DM have been shown to induce or accelerate the progression of atherosclerosis (Zhu et al., 2018). Elevated glucose levels, dyslipidemia, and other metabolic alterations associated with the disease play a central role in almost every step of the atherogenic process and the pathogenesis of atherosclerosis (Zhu et al., 2018).

In a study by Ben Tekaya et al. (2022), CIMT showed a positive correlation with patient-related parameters such as age and systolic blood pressure. Additionally, CIMT was positively correlated with creatinine, glucose, and total cholesterol levels, while multivariate regression analysis identified age, LDL cholesterol, and creatinine as independent predictive factors for increased CIMT.

In our study population, 28% of the patients were diagnosed with DM. Among patients with elevated CIMT, 45.8% had DM. Notably, 11 out of 14 patients with DM (78.6%) exhibited significantly increased CIMT. The mean glucose level was also higher in patients with elevated CIMT.

CIMT was found to be higher with increasing age. Correlation analysis between CIMT and LDL cholesterol revealed a statistically significant, positive, low-level relationship.

Among the hemodialysis patients included in our study, 28% had DM, 22% had hypertension, 8% had glomerulonephritis, and 6% had polycystic kidney disease. Despite the limited sample size, the etiological distribution of chronic kidney disease in our study appeared consistent with national included Turkey.

CONCLUSION

In patients with elevated carotid artery intima-media thickness (CIMT), a known marker of atherosclerosis, mean platelet volume (MPV) was also found to be elevated. In our study, variables such as age, MPV, glucose levels, and CRP were associated with atherosclerosis and should be considered as important indicators of cardiovascular risk.

The cut-off value for MPV was determined to be 11.4 fl, and values above or below this threshold were found to significantly differentiate the presence of coronary artery disease. Large-scale, randomized controlled studies should be performed via in our hospital to define a clinically meaningful upper limit for MPV.

However, our study is retrospective in nature and includes a relatively small number of patients. Therefore, further research with larger patient populations and randomized controlled designs is

necessary to confirm these findings and provide broader clinical applicability.

Conflict of Interest: The authors have no conflicts of interest relevant to this article.

Ethical approval: This study was initiated following approval (No. 2022/08-07) by the Ethics Committee of Van Yuzuncu Yil University Faculty of Medicine, dated 01/09/2022.

Funding: No funding

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