Evaluation of the Neutrophil-lymphocyte Ratio and Mean Platelet Volume in Hypertensive Patients with Coronary Artery Ectasia

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ABSTRACT

Introduction: Coronary artery ectasia (CAE) is associated with increased morbidity and mortality, and is known to also be associated with atherosclerosis. CAE is considered a variant of coronary artery disease, and is more common in patients with hypertension. We aimed to evaluate the neutrophil-lymphocyte ratio (NLR) and mean platelet volume (MPV) in hypertensive patients with CAE.

Patients and Methods: The study was designed retrospectively in the cardiology unit of Bolu Abant Izzet Baysal University Medical Faculty Hospital between January 2017 and October 2019. A total of 7287 coronary angiographies were retrospectively analyzed to detect the incidence of ischemic heart disease. Diagnosis of CAE was made visually by two cardiologists who were blinded to the study aims. All included patients had a diagnosis of hypertension. After appropriate exclusions, hypertensive patients were divided into CAE and normal coronary artery groups, and the laboratory parameters of the two groups were compared.

Results: The neutrophil counts [4.2 (2.4-8.6) vs. 4.2 (2.0-6.7) u/mm^3, p= 0.015], red cell distribution width [15.7 (12.8-21.6) vs. 15.3 (13.2-18.6) %, p= 0.002], platelet distribution width [17.9 (15.5-23.0) vs. 17.5 (15.9-20.8) %, p= 0.001], NLR [2.1 (0.7-12.8) vs. 1.9 (0.8-4.5), p< 0.001], platelet-lymphocyte ratio [109.8 (63.0-321.8) vs. 100.9 (34.7-223.6), p= 0.001], MPV (8.4 ± 1.4 vs. 7.9 ± 1.0 fL, p< 0.001), and plateletcrit (0.19 ± 0.05 vs. 0.18 ± 0.4 %, p= 0.007) were significantly higher, and the lymphocytes counts [2.1 (0.5-4.2) vs. 2.2 (1.1-6.7) u/mm^3, p= 0.013] were significantly lower in hypertensive patients with CAE than in those without.

Conclusion: Hemogram parameters could be useful biomarkers for determining a thrombotic state and inflammatory response in hypertensive patients with CAE.

Key Words: Coronary artery ectasia; hypertension; inflammation; mean platelet volume; neutrophil-lymphocyte ratio

Koroner Arter Ektazi Olan Hipertansif Hastalarda Nötrofil-Lenfosit Oranının ve Ortalama Trombosit Hacminin Değerlendirilmesi

ÖZET

Giriş: Artmış morbidite ve mortalite ile ilişkili olan koroner arter ektazi (KAE), ateroskleroz ile ilişkilidir ve koroner arter hastalığının bir varyantı olarak kabul edilir. KAE hipertansiyonu olan hastalarda daha yaygındır. Bu çalışmada, hipertansif KAH olan hastalarda nötrofil-lenfosit oranını (NLR) ve ortalama trombosit hacmini (MPV) değerlendirmek amaçlanmıştır.

Hastalar ve Yöntem: Çalışma Ocak 2017-Ekim 2019 tarihleri arasında Bolu Abant İzzet Baysal Üniversitesi Tıp Fakültesi Hastanesi kardiyoloji ünitesinde retrospektif olarak tasarlandı. Çalışmada 7287 koroner anjiyografi iskemik kalp hastalığını saptamak için retrospektif olarak incelendi. KAE tanısı görsel olarak iki kör kardiyolog tarafından konuldu. Çalışmaya dahil edilen tüm hastalarda hipertansiyon tanısı vardı. Uygun dışlamalar sonrasında hipertansif hastalar KAE ve normal koroner arter gruplarına ayrıldı. Bu iki grubun laboratuvar parametreleri karşılaştırıldı.

Bulgular: Nötrofil sayısı [4.2 (2.4-8.6) vs. 4.2 (2.0-6.7) u/mm^3, p= 0.015], RDW [15.7 (12.8-21.6) vs. 15.3 (13.2-18.6) %, p= 0.002], PDW [17.9 (15.5-23.0) vs. 17.5 (15.9-20.8) %, p= 0.001], NLR [2.1 (0.7-12.8) vs. 1.9 (0.8-4.5), p< 0.001], PLR [109.8 (63.0-321.8) vs. 100.9 (34.7-223.6), p= 0.001], MPV (8.4 ± 1.4 vs. 7.9 ± 1.0 fL, p< 0.001) ve PCT (0.19 ± 0.05 vs. 0.18 ± 0.4 %, p= 0.007) KAE olan hipertansif hastalarda anlamlı olarak daha yüksekti. KAE olan hipertansif hastalarda lenfosit sayısı [2.1 (0.5-4.2) vs. 2.2 (1.1-6.7) u/mm^3, p= 0.013] anlamlı derecede düşüktü.

Sonuç: Hemogram parametreleri, KAE olan hipertansif hastalarda trombotik bir durumun ve inflamatuvar yanıtın belirlenmesinde bir biyobelirteç olarak daha yararlı olabilir.

Anahtar Kelimeler: Hipertansiyon; inflamasyon; koroner arter ektazi; nötrofil-lenfosit oranı; ortalama trombosit hacmi

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INTRODUCTION

Coronary artery ectasia (CAE) is defined as at least a 1.5-fold increase in abnormal dilatation of the coronary artery detected between 0.3% and 4.9%, and can be either congenital (20%-30%) or acquired[1]. Although the pathogenesis of CAE is not clearly understood, the most common cause of CAE is atherosclerosis (50% of acquired cases)[2]. CAE is often thought of as a random angiographic finding; however, CAE, which is associated with increased morbidity and mortality, has been associated with atherosclerosis and is considered a variant of coronary artery disease (CAD)[3,4]. CAE coexists in approximately 80% of obstructive CAD cases[4]. Furthermore, CAE patients have been found to have a similarly increased risk of mortality to patients with CAD[5].

Although clinical symptomatology is different among CAE patients, the most common presentation is angina[6]. Clinical presentation can be in the form of acute coronary syndrome, cardiac arrhythmias, spontaneous dissection of the ectatic coronary artery, and even sudden cardiac death[7]. In addition, a slow flow phenomenon has been demonstrated in CAE patients as a result of the changing coronary flow dynamics[8,9]. CAE increases the risk of myocardial infarction, especially in dilated segments as a result of vasospasm, coronary slow flow, and thrombosis[10].

Hypertension is a chronic disease that is an important risk factor for cardiovascular diseases (CVD). Although hypertension causes high morbidity and mortality worldwide, the cause is not fully understood[11,12]. Hypertension is more common in patients with CAE[13], and among the risk factors for CAD, hypertension is the most associated with CAE[14].

Systemic inflammation can be detected using several laboratory parameters, and complete blood count (CBC) parameters are one of the most promising as they are both simple and inexpensive. Inflammatory markers, such as c-reactive protein, interleukin-6, and white blood cells have been associated with CAE development, but this relationship has not been investigated in isolated hypertensive CAE patients. Therefore, this study was designed to evaluate the neutrophil-lymphocyte ratio (NLR) and mean platelet volume (MPV) in hypertensive patients with CAE.

PATIENTS and METHODS

Ethics committee approval was received for this study from the Bolu Abant Izzet Baysal University Ethics Committee (Decision Number: 2019/305; Decision Date: December 5, 2019).

Patient Selection

The study was designed retrospectively in the cardiology unit of Bolu Abant Izzet Baysal University Medical Faculty Hospital between January 2017 and October 2019. Coronary angiographies were performed using the "Siemens Axiom Artis diagnostic device (Siemens Healthcare GmbH, Forchheim, Germany)". A total of 7287 coronary angiographies were retrospectively analyzed to detect ischemic heart disease. Diagnosis of CAE was made visually by two cardiologists who were blinded to the study aims, from the hospital database, and from patient records. All patients included in the study had a diagnosis of hypertension. The demographic data and laboratory parameters of the patients, such as their medical history and family history, were obtained from the hospital database and the patients' records.

Exclusion Criteria

- Serious organ diseases, including thyroid diseases, liver-kidney failure, stroke, acute and chronic lung disease, and obstructive sleep apnea
- Arrhythmias, including atrial fibrillation, supraventricular tachycardia, and ventricular tachycardia
- Heart failure (ejection fraction < 50%)
- Significant heart valve disease
- Acute coronary syndrome (ACS)
- Percutaneous coronary intervention
- Previous coronary artery bypass grafting
- Diabetes mellitus
- Smoking
- Autoimmune diseases, including cancer, behçet disease, and systemic lupus erythematosus
- Antiplatelet/anticoagulant agents and steroid users (immunosuppressive therapy)
- Patients under 18 years of age
- Active infection, such as pericarditis and myocarditis

Statistical Analysis

The statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software (SPSS version 20.0 for Windows, IBM Co., Chicago, IL, USA). The Kolmogorov-Smirnov test was used to determine the normality of the distribution. Normal variables were compared with a t-test and expressed as the mean ± standard deviation. A Mann-Whitney U test was employed for variables with an abnormal distribution, and the results were expressed as the median (IQR: interquartile interval). A chi-square test was used to compare nonparametric variables. A p value < 0.05 was considered statistically significant.

RESULTS

Baseline patient demographics, including age, sex, and clinical risk factors, were compared between the groups (Table 1).

Table 1. General characteristics of the study groups

Baseline characteristics	Hypertensive patients with CAE (n= 208)	Hypertensive patients with NCA (n= 208)	p
Median (min-max)			
Age (years)	55 (36-68)	55 (30-68)	0.235
Male/female	116/92	120/80	0.233
LVEF (%)	60 (55-65)	60 (55-65)	0.341
Heart rate (bpm)	72 (50-100)	74 (54-99)	0.149
SBP (mmHg)	130 (100-164)	127.5 (100-169)	0.976
DBP (mmHg)	79 (60-100)	75.5 (57-95)	0.141
BMI	28.3 (19.9-33.3)	27.4 (20.0-34.9)	0.111

CAE: Coronary artery ectasia, NCA: Normal coronary artery, LVEF: Left ventricular ejection fraction, BPM: Beats per minute, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, BMI: Body mass index.

The neutrophil counts [4.2 (2.4-8.6) vs. 4.2 (2.0-6.7) u/mm^3, p= 0.015], red cell distribution width (RDW) [15.7 (12.8-21.6) vs. 15.3 (13.2-18.6) %, p= 0.002], platelet distribution width (PDW) [17.9 (15.5-23.0) vs. 17.5 (15.9-20.8) %, p= 0.001], NLR [2.1 (0.7-12.8) vs. 1.9 (0.8-4.5), p< 0.001], platelet-lymphocyte ratio (PLR) [109.8 (63.0-321.8) vs. 100.9 (34.7-223.6), p= 0.001], MPV (8.4 ± 1.4 vs. 7.9 ± 1.0 fL, p< 0.001), and plateletcrit (PCT) (0.19 ± 0.05 vs. 0.18 ± 0.4 %, p= 0.007) were significantly higher, while the lymphocytes counts [2.1 (0.5-4.2) vs. 2.2 (1.1-6.7) u/mm^3, p= 0.013] were significantly lower in hypertensive patients with CAE than in those without (Table 2).

DISCUSSION

In this study, we found that the neutrophils, lymphocytes, RDW, PDW, NLR, PLR, MPV, and PCT were significantly higher in hypertensive patients with CAE compared to the control group. This represents a novel finding in this specific patient group.

Hypertension remains the important preventable cause of CVD and all-cause death in the world[15]. It has been suggested that hypertension in CAE patients can cause CAE by disrupting the media layer of the vessel[16]. Furthermore, previous epidemiological studies have shown that CVD and inflammatory markers are related[17]. CAE represents a positive remodeling response caused by inflammation in the arterial wall, and the primary pathological findings of CAE are endothelial dysfunction and chronic inflammation[1,9]. Hypertension is a chronic disorder that mainly causes endothelial dysfunction, which can lead to elevated inflammatory markers. Significantly higher inflammatory markers may be expected in CAE, which can also be accompanied by hypertension; this may adversely affect the prognosis of patients with comorbidity. We found no studies investigating the prognosis of patients with hypertensive CAE in the literature, and further studies are needed on this important subject.

CBC tests are used commonly in clinical practice. Neutrophilia and lymphopenia have been reported to be associated with atherosclerosis in the general population[18], and it has been reported that the NLR and the PLR may be biomarkers for cardiovascular diseases[19]. The NLR plays an important role in several common chronic diseases, and an elevated NLR is associated with disease in patients with hypertension[20]. Işık et al.[21] found a high NLR in CAE patients in their 2013 study; this is in agreement with the findings of the current study where we demonstrated high NLR and PLR values in hypertensive CAE patients.

The size of the red blood cells is indicated by the RDW. An increased RDW indicates the release of reticulocytes into the circulation before it matures, and is associated with inflammatory processes[22]. Gürel et al.[23] demonstrated that the RDW may be beneficial in the prognosis of CVD. As seen in our study, the higher RDW level in hypertensive CAE patients may be related to the development of CVD.

Activated platelets, which have close associations with inflammation, may play a role in the aggravation of atherothrombosis. MPV, PDW, and PCT derived from CBC are indices specific to platelet morphology and proliferation kinetics[24]. Studies have shown the relationship between parameters indicative of platelet activity and coronary heart disease[25]. Indeed, it has been demonstrated that crooked blood flow in the segment of CAE may lead to thrombus formation, and subsequent myocardial infarction[10]. PDW reflects the size of the platelets, while MPV reflects the variability of platelets[26], and MPV height is associated with platelet aggregation. MPV was found

Table 2. Laboratory data of study groups

	Hypertensive patients with CAE (n= 86)	Hypertensive patients with NCA (n= 86)	p
Median (min-max)			
HDL-cholesterol (mg/dL)	43.8 (23.6-80.2)	42.8 (22.8-77.8)	0.623
Triglyceride (mg/dL)	130 (42-913)	143 (41-702)	0.472
ALT (u/L)	17 (6-68)	20 (7-57)	0.021
AST (u/L)	20 (8-49)	21 (6-50)	0.206
TSH (μIU/mL)	1.2 (0.3-4.5)	1.0 (0.4-4.4)	0.756
CRP (mg/L)	0.7 (0.01-20)	0.7 (0.01-7.7)	0.144
GFR (%)	88.6 (53.0-123.1)	90.9 (53.0-110)	0.069
Na (mmol/L)	139 (131-148)	139 (131-147)	0.368
K (mmol/L)	4.3 (3.5-5.3)	4.4 (3.2-5.2)	0.729
Neutrophil (u/mm^3)	4.2 (2.4-8.6)	4.2 (2.0-6.7)	0.015
Lymphocyte (u/mm^3)	2.1 (0.5-4.2)	2.2 (1.1-6.7)	0.013
Monocyte (u/mm^3)	0.5 (0.2-1.4)	0.5 (0.1-1.4)	0.342
Basophils (u/mm^3)	0.06 (0.001-0.4)	0.7 (0.001-0.2)	0.799
Eosinophil (u/mm^3)	0.16 (0.002-0.957)	0.15 (0.002-1.380)	0.808
MCV (fL)	87.8 (63.7-100)	87.1 (56.8-96.9)	0.767
RDW (%)	15.7 (12.8-21.6)	15.3 (13.2-18.6)	0.002
PDW (%)	17.9 (15.5-23.0)	17.5 (15.9-20.8)	0.001
NLR	2.1 (0.7-12.8)	1.9 (0.8-4.5)	< 0.001
PLR	109.8 (63.0-321.8)	100.9 (34.7-223.6)	0.001
Mean ± SD			
Total cholesterol (mg/dL)	187.7 ± 45.9	187.9 ± 40.8	0.968
LDL-cholesterol (mg/dL)	108.7 ± 36.9	111.4 ± 36.4	0.457
WBC (u/mm^3)	7.4 ± 1.7	7.3 ± 1.6	0.534
Hemoglobin (g/dL)	13.7 ± 1.6	13.9 ± 1.5	0.105
Platelet counts (Plt) (k/mm^3)	239.4 ± 64.1	232.1 ± 44.5	0.178
MPV (fL)	8.4 ± 1.4	7.9 ± 1.0	< 0.001
PCT (%)	0.19 ± 0.05	0.18 ± 0.4	0.007

CAE: Coronary artery ectasia, NCA: Normal coronary artery, HDL: High-density lipoprotein, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, TSH: Thyroid-stimulating hormone, CRP: C-reactive protein, GFR: Glomerular filtration rate, Na: Sodium, K: Potassium, MCV: Mean corpuscular volume, RDW: Red cell distribution width, PDW: Platelet distribution width, NLR: Neutrophil-lymphocyte ratio, PLR: Platelet-lymphocyte ratio, SD: Standard deviation, LDL: Low-density lipoprotein, WBC: White blood count, MPV: Mean platelet volume, PCT: Plateletcrit.

to be high in patients with hypertension, diabetes, ischemic stroke, obesity, and acute myocardial infarction[24,27]. Moreover, the PDW has been shown to be related to inflammation and atherosclerosis[28]. PCT, which shows the number of platelets in one unit of blood[29], has been shown to correlate with increased cardiovascular diseases[30]. In our study, we found high MPV, PDW, and PCT levels in hypertensive CAE patients compared to patients with hypertensive normal coronary arteries.

CONCLUSION

CAE, which represents abnormal coronary dilation, impairs coronary blood flow, and can lead to myocardial ischemia. Hypertension, one of the most important causes of CAE, is an important risk factor for cardiovascular diseases and has high morbidity and mortality. Hemogram parameters could represent helpful biomarkers for determining a

thrombotic state and inflammatory response in hypertensive patients with CAE. In the future, more comprehensive and multi-center studies will be required to fully validate the findings of the current study.

Ethics Committee Approval: Ethics committee approval was received for this study from the Bolu Abant Izzet Baysal University Ethics Committee (Decision Number: 2019/305; Decision Date: December 5, 2019).

Informed Consent: This is retrospective study, we could not obtain written informed consent from the participants.

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