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Original Article

Elevated platelet distribution width in peripheral artery disease

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Abstract

Aim: This study was planned with the hypothesis that atherosclerosis is in the etiology of peripheral artery disease (PAD), whether symptomatic or not, and therefore thrombocyte-related parameters could show variability.

Material and Methods: A retrospective examination was made of the laboratory records of 48 patients who presented at the Cardiovascular Surgery Polyclinic with mild or severe symptoms and were diagnosed with PAD and a control group of 33 healthy individuals.

Results: No difference was determined between the patient and control groups in respect of age, gender, Platelet Count (Plt), C-reactive protein (CRP), neutrophil-lymphocyte ratio (NLR), Mean Platelet Volume (MPV), Hemoglobin (Hgb) and White Blood Cells (WBC) values. The Platelet distribution width (PDW) value of the patient group was found to be statistically significantly higher than that of the control group ($p<0.05$). PDW was determined with high sensitivity (58.3%) and specificity 861%) for PAD.

Conclusion: In an individual developing PAD, the onset of the atherosclerotic process in the vascular structure is a warning. According to the data obtained in this study, elevated PDW can be used as a marker that the atherosclerotic process has started in the vascular structure.

Keywords: Peripheral artery disease; platelet distribution width; atherosclerosis

INTRODUCTION

Peripheral artery disease (PAD) is a progressive atherosclerotic vascular disease including the extracranial carotid artery, and the main vessels of the vertebrae, mesentery, kidneys and upper and lower extremities, with the exception of the aorta. However, as a term in routine clinical use, PAD can be defined as chronic or progressively deteriorating arterial blood circulation in the lower extremities associated with systemic atherosclerosis. Atherosclerotic risk factors in the etiology (diabetes, smoking, obesity, hypertension, hyperlipidemia, family history of PAD and heart disease, high homocysteine level) can develop associated with inflammation of the arterial vessels or exposure to damage or radiation (1).

Diagnosis is made from clinical findings and radiological imaging. Just as PAD may be asymptomatic, there may also be symptoms of hair loss, lethargy, weakness, ulcers, skin color changes and muscle claudication. Diagnosis can be made using the ankle-brachial index, Doppler Ultrasound (USG), computerized tomography angiography, Magnetic Resonance Image angiography and angiography (2). In various studies, Doppler USG has been determined to have 85-90% sensitivity and specificity of >95% (3-4).

Platelet distribution width (PDW) directly measures variability in thrombocyte size. An increase in PDW level shows that there is Platelet Count (Plt) of different sizes in the blood circulation and are more active as young, metabolic and inflammatory thrombocytes in circulation. A low PDW level indicates that the thrombocytes in circulation are close to each other in size, that they are metabolic, less active and they are older thrombocytes (5). PDW provides information about the inflammatory processes of some diseases (6, 7).

This study was planned with the hypothesis that the properties of distribution width, volume and count of thrombocytes, which play an important role in

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coagulation secondary to the atherosclerotic process, could show variability in patients diagnosed with PAD.

MATERIAL and METHODS

This retrospective study included 81 subjects comprising 48 patients who presented as outpatients at the Cardiovascular Surgery Polyclinic and a control group of 33 age and gender-matched subjects. The patient group was diagnosed with PAD determined from Doppler US (General Electric Logic 9) examination with a 3 Mhz convex device and 7.5 Mhz linear probes. With the patient supine, the Doppler US technique was applied from the lower abdominal region to the ankles. Peak systolic velocity (PSV), peak systolic velocity ratio (PSVR), flow form and spectral changes were evaluated in the Doppler USG evaluation. The PSVR value in any stenotic segment was determined by the ratio of velocity in the stenotic region to the velocity of the vessel segment of normal appearance in the restenotic region. PSHO ≥ 2 was considered to be significant hemodynamic stenosis (>50% stenosis) and <2 was considered to be significant hemodynamic stenosis. The control group subjects were selected from healthy individuals. In both groups, the subjects participated voluntarily, had no chronic disease, and biochemistry laboratory results for electrolytes, fasting blood glucose, urea,and creatinine were within the reference intervals. Platelet Count (Plt), C-reactive protein (CRP), neutrophil-lymphocyte ratio (NLR), Mean Platelet Volume (MPV), Hemoglobin (Hgb) and White Blood Cells (WBC) and distribution volume of platelets (PDW) were examined.

Statistical Analysis

The data obtained in the study were statistically analyzed using the Statistical Package for Social Sciences (SPSS) version 22.0 software. Conformity of the data to normal distribution was examined visually (histogram and probability graphs) and with the analytical method of the Kolmogorov-Smirnov test. In descriptive analyses, variables with normal distribution were stated as mean ± standard deviation (SD), and variables not showing normal distribution were stated as median, minimum and maximum values. Continuous variables were reported as mean±SD, and categorical variables as number (n) and percentage (%). In the comparison between group of continuous variables, the Student's t-test or the Mann Whitney U-test was applied according to whether distribution was normal or not. In the comparison of categorical variables between groups, the Chi-square test was applied. The cutoff values of independent predictors and predictivity were analyzed with the receiver operating characteristic (ROC) curve. The ROC curve analysis and the area under the curve (AUC) were evaluated with the Hanley and McNeil method. A value approaching 1.0 in the AUC was interpreted as an increase in predictive excellence. In all the statistical evaluations, a total Type-1 error level of 5% was set as significance.

RESULTS

The mean age was similar in both study groups as 48.2± 13.1 years in the patient group and 44.3±15.5 years in the control group (p>0.05). The basal demographic, clinical and laboratory data of both groups are shown in Table 1.Significant differences were determined between the groups in respect of PDW values. The PDW values were measured higher in the patient than controls group (p< 0.05) (Table1, Figure 1). In the ROC curve analysis applied for predictivity peripheral artery disease, the AUC value of PDW was calculated as 0.640(p= 0.034),(95% CI, 0.52-0.75) respectively and the cutoff value was determined as ≥14.5. Sensitivity and specificity were calculated as 58.3% and 61%, respectively (Figure 2).

Table 1. Demographic and biochemical characteristics of the study groups

Parameter	Controls (n = 33)	Patients (n = 48)	P value
Sex, male	14(42.4%)	14(29.2%)	0.218
Age, years	44.3± 15.5	48.2± 13.1	0.199
HGB, gr/dl	13± 1.18	13.5± 1.4	0.076
WBC, 1000/µL	7± 2.26	7.6±1.82	0.210
PLT, 1000/µL	241± 65.4	272± 69.8	0.053
MPV, fL	7.95± 0.29	8.70± 1.92	0.073
PDW, fL	13.29±2.91	14.79±3.33	0.034*
MPV/PLT	0.034±0.012	0.034±0.013	0.954
PDW/PLT	0.058±0.01	0.058±0.02	0.962
Neutrophil	4.64±2.17	5.01±1.56	0.102
Lymphocyte	1.95±0.77	2.28±1.00	0.063
NLR	3.26±3.69	5.05±11.44	0.387
CRP	0.59±0.36	0.43±0.37	0.099

HGB: Hemoglobin, PLT:Platellet Count , WBC: White Blood Cells, MPV: Mean Platelet Volume, PDW: Platelet Distribution Width MPV/PLT: Platelet Count Ratioto Mean Platelet Volume PDW/PLT: Platelet Count Ratio to Platelet Distribution Width, NLR: Neutrophil-lymphocyte Ratio, CRP: C-reactive protein

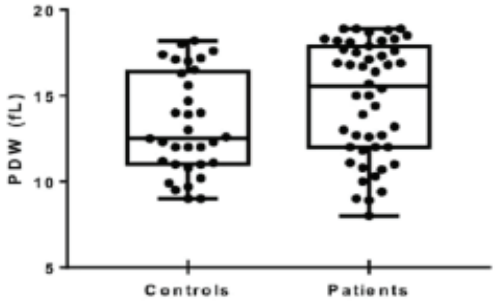

Figure 1. Comparison of Platelet Distribution Width (PDW) between the study groups

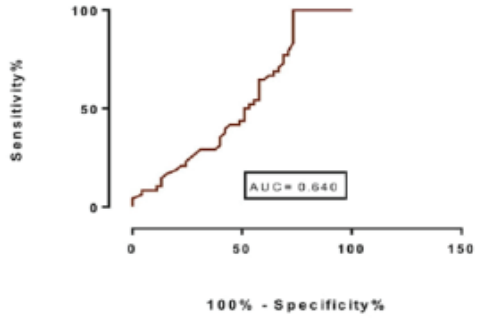

Figure 2. ROC curve with Area Under the Curve (AUC) for Platelet Distribution Width (PDW) predicting peripheral artery disease

DISCUSSION

Chronic atherosclerosis of peripheral arteries is a disorder that develops slowly, causing narrowing of the arteries. Although the severity of symptoms may vary depending on the degree of narrowing in each vascular region, some patients may not show any symptoms throughout life.

A definitive diagnosis is made with catheter angiography. However, as this is invasive and because of exposure to radiation and contrast materials, the readily available, non-invasive Doppler USG imaging method used in the visualization of lower extremity arteries is often preferred (8).

The range of variability in thrombocyte size is reflected in PDW. Thrombocytes have been shown to play an important role in inflammatory reactions and immune responses. PDW, which represents heterogeneity in PLT morphology, is clinically related to PLT activation (9).

Many previous studies have shown the relationship between PDW and vascular diseases. In one study, it was shown that PDW played a role in the positive effect on the functional result of acute ischemic stroke following intravenous thrombolysis (10). In another study that compared a cerebral sinus vein thrombosis group with a control group, the PDW value was determined to be significantly higher in the patient group (11). PDW was evaluated in infants with intrauterine retarded growth and a high PDW value was determined to be correlated with placental vascular dysfunction, also showing a relationship of PDW with vascular structure (12).

In another study, the PDW value was evaluated in individuals with severe traumatic brain injury, and the PDW value was determined to be highly correlated with the severity of the brain damage (13). SLE is a disease of autoimmune origin, which is seen with all vascular involvement. In a study which separated SLE as active and inactive, the p value of the PDW value of the active SLE group was found to be significantly high (14). The 1-year mortality rates of 119 patients aged 68-105 years were examined in a 2013 study, and it was concluded that 1-year mortality was directly related to PDW in the elderly population, and that atherosclerotic vascular diseases were predominant in this age group (15). In the current study, PAD was determined with Doppler USG, and as the PDW value in the patient group without severe disease symptoms was found to be significantly higher than that of the control group, this was consistent with the findings of other reports that have associated PDW with vascular diseases. This finding is important in demonstrating that elevated PDW could be accepted as a predictive value in all diseases involving the vascular system.

CONCLUSION

In conclusion, this study can be considered of value as, to the best of our knowledge; there has been no previous study in literature that has examined the relationship between PAD and PDW. From the results of the study of the determination of high PDW on a hemogram, which is a simple and inexpensive test, it can be concluded that this could be important as a simple assistive test in the diagnosis of the atherosclerotic process in the PAD patient group.

Competing interests: The authors found that the conflict of interest did not fully coincide.
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