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The Relationship Between Parkinson's Disease and Mean Platelet Volume

Parkinson Hastalığı ve Ortalama Trombosit Hacmi Arasındaki İlişki

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Parkinson's disease (PD) is the most common neurodegenerative disease after Alzheimer's disease (AD). Possible mechanisms are associated with genetic, environmental factors, mitochondrial dysfunction, oxidative stress, vascular risk factors and apoptosis. Mean platelet volume (MPV) is a value that can be measured in routine blood count and indicates platelet size. It is an indicator showing increased platelet activity with positive correlation *in vivo*. It increases in case of the presence of vascular diseases and risk factors (hypertension, diabetes mellitus, hyperlipidemia, etc.)^[1-3] and it decreases in inflammatory diseases such as sepsis, active rheumatoid arthritis, systemic sclerosis.^[3,4] At the same time, MPV was also examined in patients with acute ischemic stroke and was associated with prognosis.^[5] It has been reported that increased platelet activity and atherosclerosis caused AD.^[6] Koçer et al.^[7] suggested that PD patients had higher MPV values than those of AD patients and controls. In this study, we aimed to discuss the relationship between Parkinson's disease and MPV and to explain its connection with disease severity.

PATIENTS AND METHODS

The study protocol was approved by the institutional ethics committee of the School of Medicine, Gaziantep University, Turkey. Eighty patients diagnosed according to the Brain Bank clinical diagnostic criteria of UK Parkinson's Disease Society^[8] and 80 healthy volunteers were enrolled between April 2013 and June 2014 in the Departments of Neurology at Gaziantep University Medical Faculty and Doctor Ersin Aslan State Hospital. Patients who had stroke history, severe level of hypertension ($\geq 150/90$ mmHg), cancer, abnormal liver and thyroid function tests, uncontrolled diabetes (HbA1c >8), any other dementia including vitamin B12 deficiency and receiving antiplatelet, anticoagulant or statin therapy and those who were active smokers were excluded. Parkinson's disease patients were examined by using Hoehn and Yahr scale (HYS) which is a scale for PD's severity. After the 12-hour fasting, 10 mL of blood samples was drawn from the antecubital vein in the early morning

(between 9:00 and 10:00 am.), into standardized tubes containing 0.04 mL of the 7.5% K3 salt of ethylenediaminetetraacetic acid (EDTA) from each subject and the samples were analyzed in two hours. Mean platelet volume levels were measured by using Beckman Coulter LH 780 Hematology Analyzer (Beckman Coulter, Brea, California, USA). Laboratory parameters which consisted of hemoglobin range 14-18 g/dL for men, 12-16 g/dL for women, white blood cell (WBC) range $4.5-10.3 \times 10^9/L$, platelet count range $156-373 \times 10^9/L$, MPV range 7.4-10.4 fL, total cholesterol, low density lipoprotein (LDL), triglycerides were measured.

Statistical analysis

NCSS (Number Cruncher Statistical System) 2007 and PASS (Power Analysis and Sample Size) 2008 Statistical Software (Utah, USA) were used for statistical analysis. For evaluation of study data, besides descriptive statistical methods (mean \pm standard deviation, minimum, maximum, median, frequency, rate), Student's t test was used in comparison of two groups with normal distribution parameters and Mann-Whitney U test was used in comparison of two groups with abnormal distribution parameters in comparison of quantitative data. In comparison of qualitative data, Pearson's chi-square test and Yates Correction for Continuity Test (Yates-corrected chi-square) were used. Relationship between numerical variables was determined by Spearman rank correlation coefficient. Significance was evaluated at $p < 0.01$ and $p < 0.05$ levels.

RESULTS

The mean age was 66.84 ± 11.82 years in the patients with PD and 64.37 ± 11.06 years in healthy controls. Demographic and clinical characteristics of patients and controls participating in the study are shown in Table 1. According to the results of the blood count, median platelet levels were similar between groups (Table 1). Mean MPV values of patients with PD and controls were 8.81 ± 0.99 fl and 8.84 ± 0.96 fl, ($t=0.210$; $p > 0.05$) (Figure 1). In the statistical analysis of PD patients, MPV correlated with the HYS score (0.75 ; -0.75 , $p=0.001$). The relationship between

Table 1. Evaluation of demographic characteristics and blood counts according to groups

	Parkinson's group (n=80)					Control group (n=80)					Test value	p		
	n	%	Mean±SD	Median	IQR	Min.-Max.	n	%	Mean±SD	Median			IQR	Min.-Max.
Age (year)			66.8±11.8			33-89			64.4±11.1			40-80	t: 4.179	0.206*
Gender														
Male	56	70.0					51	63.8						
Female	24	30.0					29	36.3						χ ² : 0.705 0.401†
Hypertension														
Present	14	17.5					71	88.8						
Absent	66	82.5					69	86.3						χ ² : 0.812 0.367‡
Diabetes														
Present	13	16.3					11	13.8						
Absent	67	83.8					69	86.3						χ ² : 0.049 0.825‡
Hematokrit (%)			41.8±4.3						41.4±4.0					t: 0.576 0.566*
Cholesterol (mg/dL)			183.6±30.7						199.1±40.1					t: 4.524 0.340*
Hemoglobin (g/dL)			13.7±1.6						13.5±1.6					t: 0.545 0.586*
PLT (x10 ³ /mm ³)				252.00	91.25					290.00	75			z: 1.267 0.205†
Triglyceride (mg/dL)				171.00	81.5					175.50	73.5			z: 0.195 0.846†

SD: Standard deviation; IQR: Interquartile range; Min.: Minimum; Max.: Maximum; * Student-t test; † Pearson Chi-square test; ‡ Yates' Continuity Correction test.

MPV and age, platelet, gender and other vascular risk factors were not significant.

DISCUSSION

In this study, it was investigated whether there was any relationship between MPV values and PD and severity of disease. Platelets, as known, are cells regulating hemostasis between bleeding and thrombosis clinically. Because of some biochemical similarities between platelets and dopaminergic neurons and easy accessibility of them, they have been used in various studies.^[9,10]

Parkinson's disease is a heterogeneous group of diseases and the main component of Lewy

body which is responsible for sporadic pathology is especially alpha-synuclein protein. This protein is found in neurons as well as in platelets in high amount.^[11] MPTP (1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine) is, as known, a substance that causes parkinsonism. MPTP causes cell damage by deforming mitochondrial enzymes in dopaminergic neurons in the brain. In a study performed with MPTP, it was found that MPTP was taken into the platelets and led to platelet dysfunction as a result of increase in calcium (Ca) and decrease in adenosine triphosphate (ATP).^[8,10] This situation leads to aggression dysfunction of platelets and may explain the fact that PD is a protective factor for ischemic stroke as shown in many epidemiological and neurochemical studies made between PD and ischemic stroke^[12] In many studies, MPV value increases in case of the presence of vascular diseases and risk factors (hypertension, diabetes mellitus, hyperlipidemia, etc.).^[1-3] In our study, we evaluated vascular risk factors such as hypertension, diabetes mellitus and LDL measurements of patients with PD were significantly lower than subjects of the healthy control group. In a study made on AD MPV value was found higher than the control group. This situation may be explained with the correlation between AD and vascular risk factors^[13] However, Wang et al.^[14] reported opposite result and this

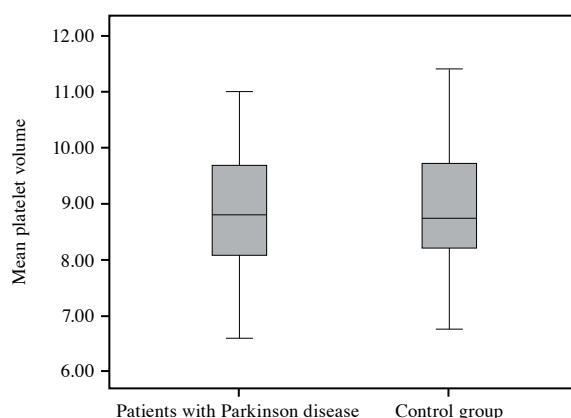


Figure 1. Distribution of mean platelet volume according to groups.

situation may be explained with the correlation between MPV and inflammatory conditions. Moreover, in Koçer et al.^[7] study increased MPV has been reported in patients with PD and progressed PD was correlated with MPV negatively. They suggested that MPV may be a risk factor for atherosclerosis in patients with PD and decreased MPV reflects inflammation in the pathological stages of PD. From the perspective of MPV value and median platelet count in our study, any statistically significant difference was not detected between PD and control groups. Therefore, we think that this situation can be explained by the fact that PD, unlike AD, doesn't show positively correlation with vascular risk factors. The other finding of our study was that the late stages of PD was correlated with MPV negatively. Decreased MPV during the progression proved the inflammation theory in PD like in literature.^[10] Our study is the second study in literature and we think that just the opposite findings are interesting.

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