Klinik Araştırma

Mean Platelet Volume in Patient with Acute Ischemic Stroke

Akut İskemik İnme Olgularında Ortalama Eritrosit Hacmi

Eren Gözke [1], Pelin Doğan Ak [1], Selgin Biber [1]

1. FSM Teaching and Research Hospital, Department of Neurology, İstanbul, Turkiye

SUMMARY

Objective: *Large platelets have more prothrombotic factors and aggregate more rapidly. In this study, our aim was to investigate the changes of mean platelet volume (MPV) in patients with acute ischemic stroke (AIS).*

Material and Method: *Fifty-seven patients (25 female, and 32 male; mean age: 72.1 ± 12.9 years) hospitalized with diagnoses of acute ischemic stroke were enrolled in the study. Mean platelet volume (MPV) was assessed in blood samples obtained within 6 hours after the onset of ischemic stroke. Data obtained were compared with those of the controls (14 female, 14 male, mean age: 59.3 ± 15.1 years). Also AIS patients were divided into two groups according to usage of antiplatelet drugs and presence of previous stroke and MPV values compared between groups.*

Results: *A significant difference was not detected between the patients, and the control group as for gender, and mean ages. When data of the cases and those of the control group were compared, any significant difference between both groups as for MPV and platelet counts could not be detected. Usage of antiplatelet drugs and a history of an ischemic stroke have not a significant impact on MPV.*

Conclusion: *Our findings do not support the hypothesis that MPV has a role in the occurrence of AIS. Besides, usage of antiplatelet and previous incident of ischemic stroke does not induce any meaningful change on MPV values.*

Keywords: *Mean platelet volume, acute ischemic stroke, cerebrovascular disease*

ÖZET

Amaç: *Büyük trombositler daha fazla protrombotik faktor içerirler ve daha kolay agrege olurlar. Bu çalışmada akut iskemik inme olgularında ortalama trombosit hacmindeki (mean platelet volume - MPV) değişikliklerin araştırılmasını amaçladık.*

Materyal ve Metod: *Akut iskemik inme tanısı ile hastaneye yatırılan ve yaş ortalaması 72.1 ± 12.9 olan 57 hasta (25 kadın, 32 erkek) çalışmaya alındı. Akut iskemik inmenin başlangıcından altı saat içinde alınan kan örneklerinde ortalama trombosit hacmine bakıldı. Bulgular, yaş ortalaması 59.3 ± 15.1 olan 28 sağlıklı kişi (14 kadın, 14 erkek) ile karşılaştırıldı. Ayrıca inme olguları antiplatelet kullanımı ve eski inme varlığına göre ayrılarak kendi içinde MPV değerleri yönünden karşılaştırıldı.*

Bulgular: *Hasta ve kontrol grubunda yaş ortalaması ve cinsiyet dağılımı yönünden anlamlı fark saptanmadı. MPV değerleri ve trombosit sayısı yönünden hasta ve kontrol grubu arasında anlamlı fark bulunmadı. İnme grubu kendi içinde antiplatelet kullanımı ve eski inme öyküsüne göre ayrıldığında MPV değerleri açısından anlamlı fark yoktu.*

Sonuç: *Elde edilen bulgular akut iskemik inme ile MPV ilişkisini desteklememektedir. Ayrıca antiplatelet kullanımı ve eski inme öyküsü ile MPV değerleri arasında anlamlı ilişki yoktur.*

Anahtar Kelimeler: *Ortalama trombosit hacmi, akut iskemik inme, serebrovasküler hastalık*

Contact Information:

Corresponding Author: *Eren Gözke*
Address: *FSM Teaching and Research Hospital, Dept. of Neurology, İstanbul, Turkiye*
Phone: *+90 532 616 5452*
E-mail: *egozke@hotmail.com*
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INTRODUCTION

Cerebrovascular diseases (CVD) rank first among all neurological diseases seen in adults with respect to frequency and significance, and they are among the most important etiological factors of morbidity and mortality. Age, gender, hypertension, diabetes, hyperlipidemia, cardiac rhythm disorders, previous coronary artery disease and cerebrovascular accidents (CVA), smoking, excessive alcohol usage have important roles in the pathogenesis of CVD (1-3). Platelets play a major role in vascular pathologic processes, and mean platelet volume (MPV) is a hemodynamically significant physiologic variable. Larger platelets are more reactive, produce larger amounts of prothrombotic factors, and aggregate more rapidly. They contain denser granules and secrete serotonin and 3-thromboglobulin in larger quantities. It was recognized that the dimensions and configuration of a platelet is determined during thrombopoiesis, and its shape do not alter once it entered into systemic circulation (4-8). Previous studies have documented that MPV increases in acute myocardial infarction, acute cerebral ischemia, and transient ischemic attack, in contrast platelet counts decrease, and increased MPV is suggestively an independent risk factor for recurrent vascular events (9-19).

In this study, our aim was to investigate the role of MPV in the occurrence of acute ischemic stroke (AIS)

MATERIAL AND METHOD

Fifty-seven patients (25 female, and 32 male) who hospitalized with diagnoses of AIS were enrolled in the study. The data obtained was compared with those of the drug-naive, healthy controls (n=28; 14 female and 14 male). Detailed medical history was obtained from all cases and controls, and they were subjected to physical and neurological examinations. As risk factors hypertension (HT), diabetes mellitus (DM), hyperlipidemia, smoking and alcohol usage, coronary artery disease, previous ischemic stroke, atrial fibrillation (AF) were investigated. Antiplatelet drug usage was inquired. Besides, routine biochemical and serologic tests were performed. Immediately after their referrals to the hospital (within 6 hours from the onset of ischemic stroke) the blood samples were drawn from antecubital veins into tubes containing ethylenediamine tetraacetic acid (K_2EDTA) salt.

For hematologic tests DANAM Excell 22 (Multi-Dimensional Optical System) analyzer was used. The blood samples were analyzed within one hour after collection under room temperature (24°C). In this technique a bundle of light rays passes through the cells and scattering of the bundle of rays further on is proportional to the dimensions of the particles. From data obtained histograms of the platelets were plotted, and calculated according to the following MPV formula: MPV (fL) = Pct (%) x 1000 / Plt (x 10^3/uL). AIS patients were divided in to two groups according to usage of antiplatelet drugs and presence of previous stroke. Mean MPV values compared between groups and healthy controls.

Student-*t* test and Mann-Whitney U tests were used to compare MPV values with platelet counts. In the patient group the impact of previous history of stroke or usage of antiplatelet drugs on MPV at the time of referral to the hospital was investigated with Student-*t* test.

Table 1. Demographic data of the patients and the control group, and distribution of risk factors.

	AIS (n=57) n (%)	Controls (n=28) n (%)
Female	25 (43.85)	14 (50.0)
Male	32 (56.14)	14 (50.0)
Mean ages (years)	72.1 ± 12.9	59.3 ± 15.1
History of ischemic stroke	13 (22.80)	-
LDL cholesterol>130mg/dL	8 (14.04)	4 (14.29)
Smoking	17 (29.82)	11 (39.29)
Alcohol usage	5 (8.77)	1 (3.57)
Diabetes	20 (35.09)	-
Hypertension	36 (63.16)	-
Coronary Artery Disease	18 (31.58)	-
Antiplatelet Usage	22 (38.5)	-
Atrial fibrillation	8 (14.04)	-

AIS: Acute Ischemic Stroke

RESULTS

Twenty-five female (43.8%) and 32 male (56.2%) patients who had ischemic stroke, and a control group consisting of 14 female (50 %) and 14 male (50 %) subjects were included in the study. Mean ages of cases with AIS, and those of the control group were 72.1 ± 12.9, and 59.3 ± 15.1 years, respectively. A significant difference was not detected between the patients, and the control group as for gender, and mean ages. Demographic data and distribution of risk factors are shown in **Table 1**. When MPV values and mean platelet count of AIS patients and healthy controls were compared, any statistically significant difference could not be found between groups (Table 2, p=0.94 and p=0.64 respectively). Twenty-two (38.5%) cases who had AIS were using antiplatelet drugs when they referred to the hospital. Mean MPV value in the group who were using antiplatelet was 9.05 ±1.17 fL, while the corresponding mean value for antiplatelet - naive group was 9.26 ± 1.13 fL. Any significant difference between mean MPV values of both groups could not be found (p=0.51). Thirteen cases with AIS had suffered from at least one previous episode of stroke. Mean MPV values of the group with and without a history of stroke were 9.25 ± 0.85 fL, and 9.16 ± 1.22 fL, respectively. Any significant difference did not exist between mean MPV values of two groups (p=0.80).

DISCUSSION

Platelets are heterogeneous in their sizes, densities and reactivities. These differences emerge before or during thrombopoiesis (4-6). Size of a platelet is a determinant of its function. Larger platelets are more reactive per unit volume relative to smaller ones, and they produce greater amounts of prothrombotic factors as thromboxane A_2 (7, 8). As turnover frequency of platelet production cycle increases, MPV supposedly enhances under the influence of cytokines (8). In previous studies performed on patients with risk factors who experienced acute stroke or myocardial infarction, and chronic vascular disease, MPVs were reportedly above mean values (9-19). However, it is unclear whether increased platelet size is a cause or a consequence of thrombosis. O'Malley et al. compared mean MPV estimates and platelet counts of 58 patients within 48 hours after the onset of ischemic symptoms with eligible, age and sex matched 50 controls, and reported significantly higher MPVs and lower platelet counts in the patient group (12). In the same study, the authors could not find any difference between MPVs of the patients with and without a past episode of ischemic stroke. Moreover, Greissenger et al investigated MPV values of 1322 patients with TIA/ischemic stroke, and compared the severity of ischemic strokes of the patients in the lowest and the highest quantiles. The authors found that the severity scores of stroke in the patients in the highest quantile are 2.6 times higher than that of the lowest quantile (13).

McCabe et al. investigated the impact of risk factors on MPV during the early and late (6 months after CVD) phases of CVD, and couldn't find any significant difference between early and late phases (14). In our study a significant difference was not detected between patients with stroke and controls with respect to mean MPV values. MPV values of 25 (43.85%) patients with ischemic stroke were above 95 % CI which were noteworthy. Platelet counts of patients with ischemic stroke and controls did not differ. Also any significant difference between patients with and without a history of stroke as for MPV values was not revealed. Also MPV values of patients with or without a history of antiplatelet usage did not differ significantly. Muscari et al showed that platelet volume is not stable during the acute phase in non-lacunar ischemic strokes, as it increases early in the most severe forms, and later in the remaining subtypes. Some studies aimed to determine the association of MPV with the

Table 2: MPV values of the patients and the control group.

	MPV Values min. - max. (mean ± SD)	Mean Platelet Count (mean ± SD)
AIS	6.90-12.00 fL (9,18 ± 1,14fL)	252.98 ± 65.65x10^3/uL
Control Group	7.20-10.00 fL (8,81 ± 0,85fL)	254.50 ± 62,54 x 10^3/uL
	p=0.94	p=0.64

AIS: Acute Ischemic Stroke **MPV:** Mean Platelet Volume

development of stoke in patients with or without atrial fibrillation (AF). The results of this study show that MPV was a predictive marker for stroke; its predictive power for stroke was independent of age, gender and stroke risk factors in patients with or without AF. They suggested that anticoagulation may be needed in patients with a high MPV, even if they have low to intermediate traditional thromboembolic risk factors (15). In a more recent study, Ntatios et al found that MPV, assessed within 24 hours after ischemic stroke onset, is not associated with stroke severity or functional outcome (20). Biino et al searched for associations between platelet parameters and thrombosis by a population-based study in 11,084 inhabitants of an Italian genetic isolate. But they failed to identify such a role for MPV. Thus, they suggested that the increased MPV previously described in subjects with acute thrombosis was a consequence instead of a cause of thrombosis (21).

In conclusion; though studies supporting both higher reactivity and prothrombotic factor content of larger platelets in comparison with the smaller ones, and also relatively more effective role of larger platelets in the pathogenesis of CVD are available, this issue has not been clearly elucidated. Further studies performed on larger patient populations might lead the way to better understanding their role in the pathogenesis and prognosis of CVD.

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