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Original Article

Can the Mean Platelet Volume Be a Risk Factor for Vasculogenic Erectile Dysfunction?

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Purpose: The mean platelet volume (MPV) is a marker of the platelet activity and is reported to increase in vascular diseases. We aimed to investigate the association between MPV and vasculogenic erectile dysfunction (ED).

Materials and Methods: MPV and platelet (PLT) levels were measured in 50 cases of ED and 40 healthy controls. The diagnosis of vasculogenic ED was based on a detailed sexual history, physical examination, laboratory assessment, and color Doppler ultrasonography. The results are given as mean±standard deviation of the mean.

Results: The mean ages of the patient and the control groups were 53.70±12.39 years (range 24~77 years) and 53.85±9.5 years (range 30~73 years), respectively ($p=0.947$). The MPV and PLT values were significantly higher in the patients with ED than those of the controls (7.49±1.4), (6.85±1.2), (262.97±68), (252.89±82) respectively, $p<0.001$). However, the MPV values were not statistically significantly different in the patients with severe ED according to the International Index of Erectile Function than in those with mild ED, $p>0.05$), and there was no correlation between MPV and either age of patients ($p=0.905$) or duration of ED ($p=0.583$).

Conclusions: The platelet count and MPV was detected to be increased in patients with vasculogenic ED. This finding suggests a role for platelets in the pathogenesis of vascular complications and that the MPV would be useful in monitoring disease progression.

Key Words: Erectile dysfunction; Impotence, vasculogenic; Platelet

INTRODUCTION

Erectile dysfunction (ED) is a common medical disorder that primarily affects men older than 40 years of age. A recent extensive analysis of published work on the prevalence of ED [1] reported by the International Consultation Committee for Sexual Medicine on Definitions/Epidemiology/Risk Factors for Sexual Dysfunction, showed that the prevalence of ED was 1% to 10% in men younger than 40 years of age. Moreover, the worldwide prevalence of ED has been predicted to reach 322 million cases by the year 2025 [2,3]. Several epidemiological studies have reported

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that ED is a marker of cardiovascular disease (CVD) [4-6]. A 2011 meta-analysis of 12 prospective cohort studies provided strong evidence that ED is indeed significantly and independently associated with an increased risk of not only CVD but also coronary heart disease, stroke, and all-cause mortality [7]. Clearly, ED is now regarded as a major health problem for the increasingly healthy ageing population.

In the etiology of ED, generally, organic and psychogenic factors come together. However, if the penis is considered as a specialized vascular bed, it is well-known that vascular reasons dominate in the etiology of ED [8]. During the last 20 years, many new facts about the basic physiology and pathology of ED have been determined, especially at the molecular level. However, researches have been focusing on a number of unanswered questions, one of them being the potential association between the mean platelet volume (MPV) and the etiopathogenesis of ED.

The MPV, the most commonly used measure of platelet size, is a potential marker of platelet reactivity. Larger platelets are metabolically and enzymatically more active and have greater prothombotic potential. Elevated MPV is associated with other markers of platelet activity, including increased platelet aggregation, increased thromboxane synthesis, and increased expression of adhesion molecules [9]. Furthermore, a higher MPV is may take place in vascular pathologies and increase the risk of CVD. In addition, a higher MPV is observed in patients with diabetes mellitus [9,10], hypertension, hypercholesterolemia, smoking, and obesity [11-13], suggesting a common mechanism by which these factors may increase the risk of CVD and ED.

In this study, we aimed to investigate the association between the platelet volume and in patients with the diagnosis of vasculogenic ED, in comparison with a control group.

MATERIALS AND METHODS

The study protocol was approved by the institutional ethics committee of the School of Medicine, Harran University, Turkey. All of the individuals gave their informed consent. The MPV levels were measured in 50 cases with ED and 40 volunteer, healthy, sexually active, married, and age-matched men who had an ED domain score ≥26 according to the short form of the IIEF, who were selected as the control group. The diagnosis of vasculogenic ED was based on a detailed sexual history, physical examination, laboratory assessment, and color Doppler ultrasonography, and was defined as the inability to attain or maintain a penile erection sufficient for successful vaginal intercourse. We did not need to perform color Doppler ultrasonography in the control group because this would be an invasive procedure unncessary for healthy, sexually active men who do not have ED. None of the subjects were using anti-platelet or anticoagulant drugs. Patients with neurogenic or endocrinological ED, a history of pelvic surgery and pelvic trauma, or other vascular risk factors for ED such as diabtes, smoking, or hypertension, recently diagnosed coronary artery disease (CAD) or hematological disorder, active infectious disease, malignancy, immunological disease, or renal or hepatic failure were excluded. The severity of ED was classified from mild to severe, according to the International Index of Erectile Function.

Blood samples were drawn from the antecubital vein at 08:00～10:00 a.m. after an overnight fasting period. The blood samples were collected in tubes containing dipotassium ethylenediaminetetraacetic acid. All of the measurements were performed immediately after venipuncture to prevent *in vitro* platelet activation. The MPV parameters were measured by using commercially available assay kits (Abbott Laboratories, Abbott Park, IL, USA) with an autoanalyzer (Aeroset; Abbott, Abbott Park, IL, USA). The other biochemical analyses were determined by standard methods. The total blood count, including hemoglobin, white blood cell, platelet (PLT), and MPV parameters were measured in both groups.

Statistical analysis was performed with SPSS for Windows version 11.5 (SPSS Inc., Chicago, IL, USA). Intergroup comparisons were performed using the Mann-Whitney *U* test, and the chi-squared (χ^2) test was used to assess the relationship between categorical variables in the patient groups. Pearson's correlation was performed between MPV and the age of the patients and duration of ED. $p<0.05$ was used as a threshold for statistical significance. Data were presented as means±standard deviation.

RESULTS

The mean ages of the patient and the control groups

Table 1. Study parameters in the ED and control groups

	ED (n=50)	Control (n=40)	p value
Age (yr)	53.70±12.39	53.85±9.5	NS
IIEF	12.8±0.4	27.51±1.6	S
MPV (fL)	7.49±1.4	6.85±1.2	S
WBC	6.59±1.12	6.96±1.88	NS
Hb (g/d/L)	14.21±1.15	14.34±1.49	NS
PLT (k/μL)	262.97±68	252.89±82	S
PSV (cm/s)	21.18±1.83	—	—

Values are presented as mean±standard deviation.
$p<0.05$, t-test for independent samples, statistically significant.
ED: erectile dysfunction, IIEF: International Index of Erectile Function, MPV: mean platelet volume, WBC: white blood cells, Hb: hemoglobine, PLT: platelet, PSV: peak systolic velocity, NS: statistically non-significant, S: statistically significant.

were 53.70±12.39 (range 24～77) and 53.85±9.5 (range 30～73), respectively ($p=0.947$). The MPV and PLT values were significantly higher in the patients with ED than in those of the controls (MPV: 7.49±1.4, 6.85±1.2), (PLT: 262.97±68, 252.89±82), respectively ($p<0.001$). The findings are shown in Table 1. The MPV values according to the International Index of Erectile Function were not statistically significantly different in the patients with severe ED than those with mild ED, $p>0.05$). There was no correlation between MPV and the age of patients ($p=0.905$) or the duration of ED ($p=0.583$).

DISCUSSION

Vascular disease is the underlying cause of ED in the majority of cases [14]. The risk factors for ED-hypertension, smoking, abnormal lipid profile, sedentary lifestyle, obesity, metabolic syndrome, and diabetes-are also risk factors for CAD. ED, in turn, is an independent predictor of future cardiovascular events [15]. Endothelial dysfunction plays an integral role in cardiovascular and peripheral vascular disease because of the systemic and subclinical inflammatory response that is characteristic of atherosclerosis [16]. Inman and colleagues [4] suggested that ED shares the same risk factors as CAD, with endothelial dysfunction being an important underlying pathological change in both diseases. Other potential mechanisms involved in the development of endothelial dysfunction that can lead to ED and CAD include a dysfunctional L-arginine nitric oxide pathway, increased peripheral sympathetic activity, vascular structural alterations leading to decreased vascular dilatation capacity, and increased specific inflammatory mediators [17,18]. Montorsi et al [19] suggested that this phenomenon might be related to the caliber of the blood vessels. Whereas the penile artery has a diameter of 1～2 mm, the proximal left anterior descending coronary artery is 3～4 mm in diameter. Thus, an equally sized atherosclerotic plaque developing in the smaller penile arteries would more likely compromise flow, presenting itself as an ED complaint much earlier than if the same amount of plaque developed in the larger coronary artery, causing angina. The effect of increased platelet activity on vascular disorders has been noted in several studies [20]. PLTs play a crucial role in the pathogenesis of atherosclerotic complications, contributing to thrombus formation or apposition after plaque rupture. The MPV is a marker of platelet function and large platelets contain more dense granules and produce more thromboxane A2 [13].

In several studies, increased MPV has been noted with cardiovascular risk factors such as smoking, diabetes, obesity, hypertension, and hyperlipidemia [13]. In subjects with established CVD, elevated MPV may be a marker for adverse cardiovascular events. However, most studies found no significant association between increased platelet count and the incidence of acute myocardial infarction, restenosis, or long-term mortality [21,22]. Bozkurt et al [23] found that an increase in MPV was independent of the disease, and the increase in the varicocele grade was associated with a higher MPV in varicocele patients. In light this result, they reported that the etiopathogenesis of varicocele may be associated with platelet activation and/or vascular endothelial cell injury.

In our study, we found that the MPV and PLT values were significantly higher in patients with ED than in the controls. Several studies have reported that increases in platelet volume are often associated with decreases in platelet count [13,24], perhaps as a result of small platelets being consumed in order to maintain a constant platelet functional mass. Conversely, we have found that the platelet count and platelet volume both increase in ED patients. Like our study, another study found that the platelet count and platelet volume both increased during stimulated

thrombopoiesis, indicating that the platelet count and volume may be regulated by independent mechanisms. They also noted that the relationship between the MPV and platelet count is not completely understood [13]. However, increased MPV levels are usually considered to be a vascular risk factor. Stokes and Granger [25] reported new data supporting platelet activation along with that of leukocytes and vascular endothelial cells in vascular and microvascular dysfunction. In light of this information and the results of our study, it can be concluded that the etiopathogenesis of vasculogenic ED may be associated with platelet activation and/or vascular endothelial cell injury. Among the limitations to the present study, were the fact that a small number of patients were included. There was a lack of data on other markers of platelet activation and aggregation, such as beta thromboglobulin and platelet factor 4, and the fibrinolytic and thrombotic status.

CONCLUSIONS

We concluded that patients with ED have higher MPV values, indicating a tendency toward platelet aggregation regardless of the etiology, when compared to controls. On the basis of the importance of the vascular component (endothelial dysfunction) in the pathophysiology of ED, this finding suggests a role for platelets in the pathogenesis of vascular complications. However, further large-scale studies are required to clarify whether patients with ED having high MPV values are at greater risk of thromboembolism and whether they may benefit from anti-platelet therapy.

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