

# Increased mean platelet volume in patients with vestibular migraine

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## ABSTRACT

**Objectives:** The purpose of this study was to investigate relation between mean platelet volume, platelet distribution width, platelet-to-lymphocyte ratio, neutrophil-to-lymphocyte ratio and vestibular migraine.

**Methods:** This study was planned in prospective manner and conducted in Ankara Polatlı State Hospital between April 2017 and May 2018. Thirty patients diagnosed with vestibular migraine and thirty healthy, age and sex-matched subjects were enrolled to the study. Mean platelet volume, platelet distribution width, platelet count, neutrophil count and lymphocyte count in blood samples were measured.

**Results:** The mean age of the patients with vestibular migraine was  $39.90 \pm 7.16$  and the study group consisted of 11 males and 19 females. The mean platelet volume and platelet distribution width values in patients with vestibular migraine were significantly higher than the control group ( $p < 0.001$ ). There were no difference on mean neutrophil/lymphocyte ratio and platelet/lymphocyte ratio values between patient group and control group.

**Conclusions:** We found a positive relation of increased levels of mean platelet volume and platelet distribution width with vestibular migraine. Higher mean platelet volume is associated with atherosclerosis and thromboembolism. Vascular pathologies are blamed for both headache syndromes like migraine and vertiginous syndromes. This theory supports our study but pathophysiological mechanism is not clear.

**Keywords:** Hematologic parameters, mean platelet volume, neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio, vestibular migraine

Vestibular migraine is an important clinical syndrome characterised by migraine type headaches accompanied with vertigo. Relation between migraine and vertigo is a complex issue and not well understood. Migraine and vertigo are common problems and a patient may have both of them by chance [1]. Thirty eight percent of migraine patients have vertigo [2-3].

Also many vertiginous pathologies are associated with migraine epidemiologically. Benign paroxysmal positional vertigo, Meniere disease, motion sickness and cerebellar disorders are associated with migraine [1]. So differentiation of vestibular migraine from these pathologies is a clinical challenge. Vestibular migraine is one of the frequent causes of both headache and ver-

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tigo. Migraine prevalence is 16% and vertigo prevalence is 7% [1]. According to these values expected comorbidity of vertigo and migraine is 1.1% but Neuhauser *et al.* [4] showed vestibular migraine prevalence as 3.2%. In the view of such information many authors think vestibular migraine as a specific clinical entity rather than coincidental coexistence of vertigo and migraine.

Diagnosis of vestibular migraine is a challenge because pathophysiology is not well understood and there is no specific examination finding, biological marker or laboratory test [2]. Detailed and careful history is important and high index of suspicion is needed for clinician. Because of difficulties about diagnosis important part of patients are misdiagnosed [3].

Mean platelet volume (MPV) is average size of platelets and included in complete blood count. MPV gives information about platelet production rate. If platelet production accelerates in bone marrow MPV gets higher. Enlarged platelets have higher activity and produce vasoactive substances, so high MPV levels are associated with vasospasm and thrombosis [5]. Increased levels of MPV, Platelet Distribution Width (PDW), Platelet-to-Lymphocyte Ratio (PLR) and Neutrophil-to-Lymphocyte Ratio (NLR) are also associated with inflammatory pathologies and vascular pathologies such as atherosclerosis, thromboembolism [6].

There are many theories for explanation of pathophysiology of vestibular migraine. One of these theories is reversible vasospasm of the internal auditory

artery or its branches. This vasospasm causes the ischemia of the labyrinth and then resulting in cochleovestibular dysfunction and vertigo experienced in vestibular migraine [7-9].

MPV, PDW, PLR and NLR values in vestibular migraine have not been investigated yet and we aimed to show if there is a relation of these parameters with vestibular migraine.

## METHODS

This study was approved by the local ethics committee for non-invasive research and conforms to the principles of the Declaration of Helsinki. Written informed consent was obtained from all patients at the beginning of the study.

This study was planned in prospective manner and conducted in Ankara Polatlı State Hospital between April 2017 and May 2018. Thirty patients diagnosed with definite vestibular migraine according to the modified Neuhauser criteria by Lempert *et al.* [10] (Table 1) and thirty healthy, age and sex-matched subjects were enrolled to the study. Patients were diagnosed with vestibular migraine by neurology specialist and referred to otolaryngology clinic. All patients underwent a detailed otolaryngologic and neurologic examination. Brain and ear magnetic resonance imaging with using gadolinium as a contrast medium were obtained from all patients.

Patients were excluded from the study if they had

**Table 1. Vestibular migraine diagnostic criteria [10]**

A. At least 5 episodes with vestibular symptoms of moderate or severe intensity, lasting 5 minutes to 72 hours
B. Current or previous history of migraine with or without aura
C. One or more migraine features with at least 50% of the vestibular episodes
1. headache with at least two of the following four characteristics:
a) one sided location
b) pulsating quality
c) moderate or severe pain intensity
d) aggravation by routine physical activity
2. photophobia and phonophobia
3. visual aura
D. Not better accounted for by another vestibular or ICHD diagnosis

acute inflammation, infection, pneumonia, chronic obstructive pulmonary disease (COPD), asthma, the diagnosis of acute or chronic pulmonary thromboembolism, coronary artery disease, congestive heart failure, renal and hepatic dysfunction, hematological diseases, cancer, auto-immune diseases, diabetes mellitus, systemic hypertension, obstructive sleep apnea, connective tissue diseases, inflammatory bowel diseases, the use of antithrombotic agents, and smoking history.

**Biochemical analyses**

MPV, PDW, platelet count, neutrophil count and lymphocyte count in blood samples were measured. Venous blood samples were obtained from antecubital vein at the time of vertigo attack and collected into tubes containing ethylenediaminetetraacetic acid (EDTA) at 9 am. following an overnight fast. To avoid platelet swelling measurements were done shorter than 30 minutes after sampling. An automated blood cell counter was used for these measurements (Horiba ABX Pentra DX 120).

**Statistical Analysis**

Continuous data were summarized as mean±standard deviation, and categorical data were as frequency and percentage. Independent sample t test was used to compare groups for continuous variables. Relation between categorical variables were analyzed by Chi-Square test. Statistical analyses were

done with SPSS v.22.0 for Windows statistical package, and statistical significance level was considered as 0.05.

**RESULTS**

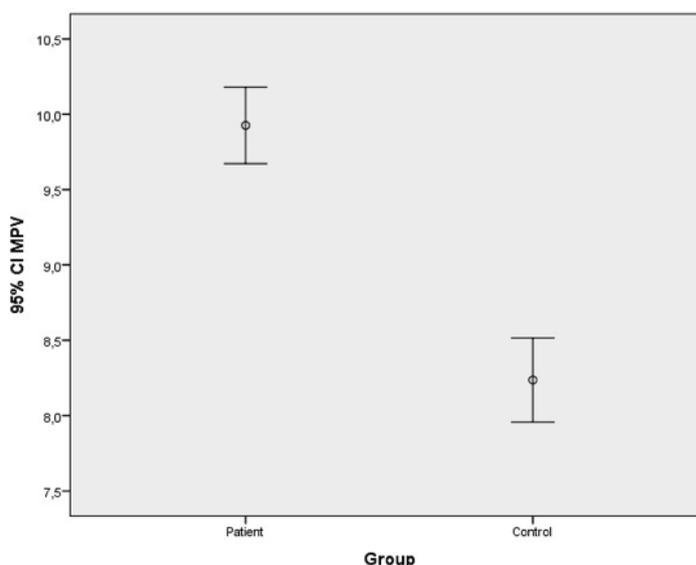
The mean age of the patients with vestibular migraine were  $39.90 \pm 7.16$  years and  $37.93 \pm 7.62$  years for the control group. The study group consisted of 11 males and 19 females and the control group consisted of 17 males and 13 females. There was no significant difference between age or gender in two  $p = 0.307$  and  $p = 0.121$ , respectively) (Table 2).

The mean MPV values were  $9.93 \pm 0.68$  fl in vestibular migraine patients and  $8.24 \pm 0.75$  fl in the control group. The mean MPV values in patients with vestibular migraine were significantly higher than the

**Table 2. Demographic data of the study and the control groups**

	Study group	Control group	p value
Age	$39.90 \pm 7.16$	$37.93 \pm 7.62$	0.307
Sex			
Female	19 (63.3%)	13 (43.3%)	0.121
Male	11 (36.7%)	17 (56.7%)	

The data are expressed in mean ± standard deviation or in numbers and percentages.



**Fig. 1. The mean MPV values of the patients with migrainous vertigo and the control group.**

**Table 3. Comparison of the mean MPV, PDW values and platelet counts of the study and the control groups**

	Study group	Control group	<i>p</i> value
MPV (fl)	9.93 ± 0.68	8.24 ± 0.75	< <b>0.001*</b>
PDW (%)	18.67 ± 1.53	14.08 ± 2.06	< <b>0.001*</b>
Platelet count (10 <sup>3</sup> /mm <sup>3</sup> )	274.83 ± 64.58	306.00 ± 106.32	0.175

The data are expressed in mean ± standard deviation. MPV = mean platelet volume, PDW = platelet distribution width.

\**p* < 0.05 value was regarded as significant while the significant differences between the groups are shown in bold.

control group (*p* < 0.001) (Fig. 1). The mean PDW values were 18.67% ± 1.53% in vestibular migraine patients and 14.08% ± 2.06% in control group. The mean PDW values in patients with vestibular migraine were significantly higher than the controls (*p* < 0.001). The mean values of platelet count of the patients and the control group were 274.83 ± 64.58 (10<sup>3</sup>/mm<sup>3</sup>) and

306.00 ± 106.32 (10<sup>3</sup>/mm<sup>3</sup>), respectively. There were no difference on platelet count levels between groups (*p* = 0.175) (Table 3).

The mean NLR values were 2.19 ± 0.86 in the patient group and 2.15 ± 1.52 in the control group. The mean PLR values were 138.24 ± 50.83 in the patient group and 127.39 ± 45.31 in the control group. There

**Table 4. Comparison of the mean NLR and PLR ratio values of the study and the control groups**

	Study group	Control group	<i>p</i> value
NLR	2.19 ± 0.86	2.15 ± 1.52	0.902
PLR	138.24 ± 50.83	127.39 ± 45.31	0.387

The data are expressed in mean ± standard deviation. NLR = neutrophil-to-lymphocyte ratio, PLR = platelet-to-lymphocyte ratio

were no difference on NLR and PLR between groups (*p* = 0.902 and *p* = 0.387, respectively) (Table 4).

## DISCUSSION

Pathogenesis of vestibular migraine is not well understood but there are various etiopathogenetic theories. According to cortical spreading theory cortical depolarisation wave produce vertigo [8]. Some neuropeptides are released asymmetricly and influence vestibular centers. This neuropeptid stimulation may cause vertigo at the time of migraine attack [11]. Another explanation is based on internal auditory artery spasm –may also be caused by serotonin- at the time migraine attack [7-9].

MPV and platelet count are calculated in complete blood count test routinely and MPV is unnoticed by

the clinicians most of the time. MPV and platelet count levels give information about vasospasm and thrombotic function [6]. Main finding of our study was that MPV levels were significantly higher in vestibular migraine patients than the control group.

Relation of MPV and migraine or other headache syndromes is not investigated yet and there is only single study in literature which investigated possible relation of MPV and vertigo. Celikbilek *et al.* [12] showed MPV levels significantly higher in benign paroxysmal vertigo patients than in controls.

Some authors studied MPV values in patients with inner ear diseases and showed controversial results. Kemal *et al.* [13] and Sarıkaya *et al.* [14] reported that MPV values were significantly higher in tinnitus patients than the control group. But Beyan and Beyan [15] reported that there was no relation between high levels of MPV values with tinnitus. Recent study by

Ulusoy *et al.* [16] showed that MPV values were significantly higher in tinnitus patients than the control group. MPV values were studied also in sudden sensorineural hearing loss (SSHL) patients and results were controversial like tinnitus patients. Ulu *et al.* [17] and Sagit *et al.* [18] found high levels of MPV were associated with SSHL significantly. Durmus *et al.* [19] also reported that MPV values were significantly higher in SSHL patients than the control group [19]. In other two studies by Karli *et al.* [20] and Kum *et al.* [21] mean MPV values of SSHL patients were higher than the control group but differences were not significant. Ozturk *et al.* [22] also found no difference between SSHL and control group MPV values.

This is the first study which investigates relation of mean platelet volume with vestibular migraine. In our study we found a positive relation of increased levels of MPV with vestibular migraine. But mechanism of this positive relation is not clear. We know that higher MPV is associated with vasospasm and thromboembolism [23]. Vascular pathologies are blamed for both headache syndromes like migraine and vertiginous syndromes. This theory supports our study but pathophysiological mechanism is not understood yet.

## CONCLUSION

MPV can be considered as a practical and valuable parameter for assessment of vestibular migraine. And further studies are needed for explanation of relation between MPV values and vestibular migraine.

### Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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