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ORIGINAL PAPER

Relationship between mean platelet volume and central serous chorioretinopathy

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Abstract The aim of this study was to investigate the mean platelet volume (MPV) of patients with central serous chorioretinopathy (CSCR). Thirty patients were included in the study. Thirty healthy volunteers were recruited as the control group. All patients and control subjects underwent complete ocular examination. Hemoglobin, hematocrit, white blood cell, neutrophil, lymphocyte, platelet count, and MPV of the participants were recorded. Data of patients with CSCR were compared with the control subjects. Patients with CSCR had significantly higher MPV values (9.76 ± 1.36 fL) compared with the control subjects (8.37 ± 0.72 fL) ($p = 0.004$). No significant difference was found in platelet counts between the CSCR group and the control group (259 ± 53.75 and 243 ± 52.11 K/Ul, $p = 0.253$). According to the receiver operator characteristics curve analysis, the optimal cut-off value of MPV to predict the CSCR was >9.4, with 60.0 % sensitivity and 93.3 % specificity. Our results demonstrated that the MPV values were significantly higher in patients with CSCR. MPV may be used as a predictive tool for identifying risk for CSCR.

Keywords Central serous chorioretinopathy · Mean platelet volume

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Introduction

Central serous chorioretinopathy (CSCR) is characterized by serous retinal detachment and/or retinal pigment epithelial detachment due to focal leakage of choroidal interstitial fluid because of a breakdown of the retinal pigment epithelium (RPE) [1, 2]. CSCR is a disease of the retina, which may impair vision at a level of frequency only less common than age-related macular degeneration, diabetic retinopathy, and branch retinal vein occlusion [3]. Genetic predisposition, uncontrolled systemic hypertension, sympathetic–parasympathetic imbalance, use of sympathomimetic drugs, pregnancy, glucocorticoid levels, type A personality, psychological stress, gastroesophageal reflux, and sleep disorders are among the risk factors for the development of CSCR [4–11].

Mean platelet volume (MPV), which can easily be evaluated with a routine complete blood count, is an indicator of platelet size and has been known to be a potentially useful biomarker of platelet activity. Large platelets are metabolically and enzymatically more reactive and have stronger prothrombotic effects [12]. MPV has been shown to be related with many systemic diseases, and in recent years, it has also been shown to be related with ocular disorders, such as occlusion of the retinal vein, retinopathy of prematurity, pseudoexfoliation syndrome, and diabetic retinopathy [13–16].

The ethiopathogenesis of CSCR has not been completely clarified; however, the choroid plays a key role in its pathogenesis. The choroid gains hyperpermeability in patients with CSCR, because of the stasis, ischemia, or inflammation [17]. Focal occlusion in the choriocapillary mesh may cause decompensation of the RPE [18–21]. In a recent study, increased platelet aggregation in the choriocapillaris and impaired fibrinolysis have been considered to play a role in the pathogenesis of CSCR [2]. To the best of our knowledge, no study exists in the literature that evaluates the value of MPV in patients with CSCR. The objective of the current study was to investigate a possible link between the MPV levels and the CSCR.

Materials and methods

This retrospective study comprised patients diagnosed with CSCR in the Retina Unit of our hospital, from June 2012 to July 2015. All participants underwent a complete ocular examination, including the best corrected visual acuity (BCVA), slit lamp biomicroscopy, applanation tonometry, and fundus biomicroscopy. The patients were also given optical coherence tomography and fluorescein fundus angiography. The patients who underwent analysis of total blood count during the initial diagnosis were included in the study. The control group consisted of healthy subjects who had undergone routine ophthalmic examinations.

Patients with diabetes mellitus, hypertension, current smoking, renal failure, hyperthyroidism, hypothyroidism, chronic obstructive pulmonary disease, hepatic disorders, anemia, malignancy, any cardiovascular disease, acute infectious disease, chronic systemic inflammatory disease and stroke, and those using nonsteroidal anti-inflammatory drugs, anticoagulant medications, and oral contraceptives were excluded from the study. In addition, cases with any retinal-choroidal disease that could be confused with a diagnosis of CSCR or those existing with a chronic eye disease (i.e., glaucoma, uveitis) were also excluded from the study.

Blood samples were withdrawn from the antecubital vein. Complete blood counts and white blood cell subtypes were analyzed using a Beckman Coulter Automated CBC Analyzer (Beckman Coulter, Inc., Fullerton, California). The MPV, platelet count, white blood cell, lymphocyte, neutrophil, hemoglobin, and hematocrit values were recorded.

The Ethical Committee of the Cumhuriyet University School of Medicine approved the study protocol, and the study was conducted in accordance with the Declaration of Helsinki.

Statistical analyses

Parametric data were expressed as the mean ± SD and categorical data as percentages. SPSS 14.0 (SPSS, Inc., Chicago, Illinois) was used to conduct statistical procedures. Independent parameters were compared via the independent samples *t* test, and if there was no normal distribution, the parameters were compared using the Mann–Whitney *U* test. Categorical data were evaluated using the Chi-square test, as appropriate. The receiver operator characteristics (ROC) curve analysis was carried out to identify the optimal cut-off point of MPV (at sensitivity and specificity that would be at a maximum) for the prediction of CSCR. The areas under the curve (AUC) were calculated as measures of the accuracy of the tests. The researchers compared the AUC by the use of the Z-test. A P value <0.05 was accepted as statistically significant.

Results

A total of 30 patients diagnosed as central serous chorioretinopathy (24 males and 6 females with a mean age of 38.8 ± 7.5 years) and 30 healthy individuals as control group (26 males and 4 females with a mean age of 39.3 ± 5.8 years) were included in the study. There were no statistical differences in age and gender between the groups ($p > 0.05$).

The mean duration of symptoms was 4.0 ± 4.4 weeks in patients with CSCR. There was no statistically significant difference between the two groups, regarding the values of hemoglobin, hematocrit, white blood cell (WBC), neutrophil, lymphocyte, and platelet count (all *p* values >0.05). The clinical features and characteristics of laboratory analyses in patients with CSCR and the control group are shown in Table 1.

The mean MPV value was significantly higher in patients with CSCR, compared with the control group (9.76 ± 1.36 vs. 8.37 ± 0.72 fL, $p = 0.004$, Fig. 1). The mean platelet count was higher in the CSCR group, compared to control group (259 ± 53.75 and 243 ± 52.11 K/Ul, respectively; $p = 0.253$).

According to the receiver operator characteristics curve analysis, the optimal cut-off value of MPV to predict CSCR was >9.4, with a 60 % sensitivity and 93.3 % specificity [areas under the curve (AUC) 0.815, 95 % CI 0.694–0.904, Fig. 2].

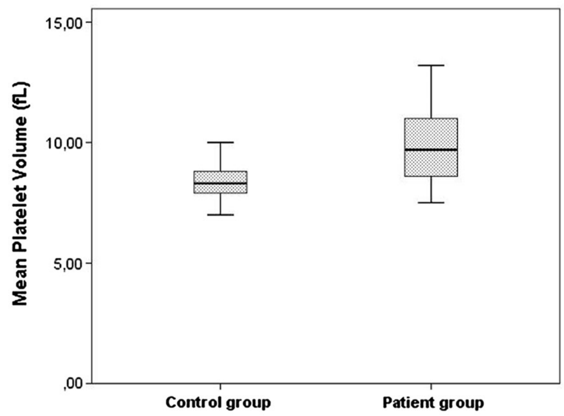

Fig. 1 Comparison of MPV levels between the two groups

Discussion

The present study demonstrated that MPV was significantly higher in patients with CSCR, and a high MPV value might be an independent predictor of the development of CSCR. To the best of our knowledge, no study thus far has investigated the MPV values in the CSCR patients in the literature, and this is the first paper that indicates a relationship between higher MPV values and CSCR.

CSCR is a relatively common retinal-choroidal disease that more commonly affects younger patients and is associated with and characterized by decreased, distorted visual acuity with symptoms, including metamorphopsia [22]. Its pathogenesis has not been completely clarified; however, it has been demonstrated to be related with type A personality, increased glucocorticosteroid and serum catecholamine levels, pregnancy, untreated hypertension, bone marrow or organ transplantation, and vasculitides [5, 7, 9, 23–27].

Thrombocytes play important roles in thrombogenesis and atherogenesis [28–30]. MPV is an indicator of platelet size and activity. Large platelets are metabolically and enzymatically more reactive and they have stronger prothrombotic effects [12]. In addition, elevated MPV is associated with increased platelet aggregation, increased thromboxane synthesis and β-thromboglobulin and serotonin release, and increased expression of adhesion molecules [31]. Higher MPV is observed in patients with diabetes mellitus, hypertension, acute myocardial infarction, acute ischemic cerebrovascular events, and deep venous thrombosis [30, 32–35]. Besides macrovascular diseases, high MPV values have also been reported to be related with microvascular diseases like

Table 1 The demographic and clinical features of the CSCR and the control groups

	CSR	Control	*p* value
Age (years)	38.8 ± 7.5	39.3 ± 5.8	0.985
Gender (F/M)	6/24	4/26	0.365
Visual acuity (snellen)	0.63 ± 0.26	1.0 ± 0.0	<0.001
Hb (g/dl)	15.03 ± 1.32	15.11 ± 1.30	0.815
Hct (%)	44.95 ± 3.89	44.86 ± 3.49	0.912
White blood cell ($\times 10^3$)	15.03 ± 1.32	15.11 ± 1.30	0.360
Lymphocyte ($\times 10^3$)	2.38 ± 0.86	2.45 ± 0.87	0.732
Neutrophil ($\times 10^3$)	4.78 ± 1.43	4.50 ± 1.11	0.392
Plt (K/Ul) ($\times 10^3$)	259 ± 53.75	243 ± 52.11	0.253
MPV (fL) ($\times 10^3$)	9.76 ± 1.36	8.37 ± 0.72	0.004

Hb hemoglobin, *Hct* hematocrit, *Plt* platelet count, *MPV* mean platelet volume

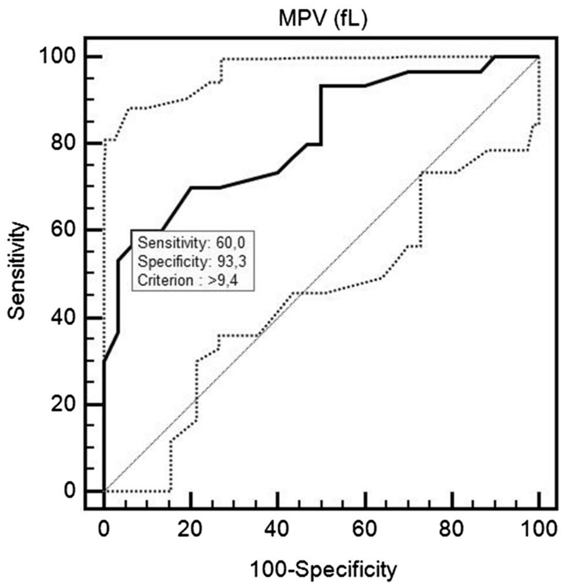

Fig. 2 Receiver operator characteristic curve of MPV level for the development of central serous chorioretinopathy

retinopathy and microalbuminuria, which exist in patients with diabetes mellitus [32, 36]. In recent years, the number of studies about the relation between ocular disorders and MPV has been increased [37, 38]. Sahin et al. [39] found an increased MPV volume in nonarteritic anterior ischemic optic neuropathy patients, and they suggested the possible role of large thrombocytes in the pathogenesis of the disease. In another study, Sahin et al. [40] found a significant increase in the MPV values in patients with retinal artery occlusion.

Choroid and RPE play important roles in the pathogenesis of CSCR. Staining visualized in the inner choroid in the mid phase of ICG angiography supports increased choroidal permeability in patients with CSCR [19, 41]. Increased tissue hydrostatic pressure, caused by choroidal hyperpermeability, leads to damage in RPE and subretinal fluid accumulation [42, 43]. However, the cause of increased choroidal hyperpermeability is not yet completely understood. In the study by Iijima et al. [44], the plasminogen-activator inhibitor-1 level was found to have increased in patients with CSCR, compared with controls. Caccavale et al. [2] have administered a low-dose aspirin treatment in patients with CSCR and reported more rapid visual rehabilitation and lower levels of recurrence of the disease compared with an untreated group. The authors concluded that the efficacy of low-dose aspirin treatment was connected with increased thrombocyte aggregation in the choriocapillaris and impaired fibrinolysis. We devised this study by taking into consideration that choroidal hyperpermeability in patients with CSCR might be a result of microthrombus development in the choroidal vessels, which is related with increased thrombocyte aggregation. The results of our study revealed that the value of MPV, which is a strong indicator of thrombocyte activity, was significantly higher in patients with CSCR, compared with the control group.

The retrospective design of the study and the relatively small number of patients could be considered as two of the limitations of the current study. The study included only those patients with hemogram analyses at diagnosis, and strict exclusion criteria were considered, which led to the relatively low number of patients being included. Another limitation of our study was the absence of physiological evaluation of patients according to the study by Canan et al. that shows the association of MPV with DSM-IV major depression in a large community-based population. They showed increased MPV levels compared with control group [45]. And also it has been shown that the CSCR patients have poor quality of life and more physiological problems [46]. Another factor affecting the MPV values is smoking. Varol et al. [47] found an increased value of MPV in regular smokers, and they showed a significant decrease of MPV at the third month of quitting smoking. Türkcü et al. [48] reported a worse visual acuity and the need for longer treatment in CSCR patients who are smokers. Thus, we excluded the smoking patients in our study. Although we screened for situations like hypertension, which may affect MPV, the absence of the biochemical parameters, including lipid profiles of the patients, is another limitation of our study.

In conclusion, the present study revealed that the patients with CSCR have higher MPV values compared with the control group. Furthermore, it also demonstrated that a MPV value higher than 9.4 has 93.3 % specificity for predicting the CSCR. Therefore, in the future, MPV may be used as a predictive tool for identifying the risk for CSCR. Further studies with larger cohorts are needed to confirm the predictive value of MPV for the risk of CSCR.

Compliance with ethical standards

Conflict of interest None of the authors declared a conflict of interest. The authors have no proprietary or financial interests in the products mentioned in this study.

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