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Research Article

Mean Platelet Volume in Retinal Vein Occlusion

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Abstract

Objective: To evaluate the levels of mean platelet volume (MPV) in patients with retinal vein occlusion (RVO) secondary to thromboembolic occlusion.

Design: Prospective case control study.

Participants: A total of 104 patients were enrolled in the study including 52 consecutive patients with recent episode (less than one month) of retinal vein occlusion (central, hemi-central and branch retinal vein occlusion) who visited a tertiary eye institute in India from August 2014 to June 2015 and 52 patients were age and gender matched controls. Both hypertensives and non-hypertensives were included.

Methods: Ophthalmic evaluation at initial visit included snellen's best corrected visual acuity (BCVA), intraocular pressure assessment and detailed ocular examination. Optical Coherence Tomography (OCT) was done at the first visit for each patient and fundus fluorescein angiography (FFA) was done at 3 months if required. Complete hemogram and MPV was estimated at the first visit for every patient. A morning sample of blood was collected of all 104 patients and sent for complete hemogram and MPV evaluation to a single laboratory.

Results: The mean platelet volume was higher (10.402 ± 1.9 femtolitre (fl) in the patients having RVO versus the control group (10.242 ± 1.9 fl) but the difference was not found to be statistically significant (t-test, p value 0.838)

Keywords: Mean Platelet Volume; Retinal Vein Occlusion

Introduction

Retinal vein occlusion (RVO) is the second most common retinal vascular disorder after diabetic retinopathy. The prevalence and 5-year incidence of retinal branch vein occlusion were each 0.6% according to Beaver Dam Eye Study [1]. In the Central India Eye and Medical Study, the prevalence of retinal vein occlusion was observed to be 0.8% in adults above 30 years of age [2]. The estimated 15 year cumulative incidence of RVO was found to be to be 2.3% in a population based study [3].

The etiopathogenesis of RVO is multifactorial in origin and is not fully established. Multiple local and systemic factors are accountable for vascular oc¬clusion. The extensively accepted theory regarding the pathogenesis of RVO appears to be the Virchow's triad: compression of the vein at the arteriovenous crossing, degenerative changes of the vessel wall and abnormal hematological factors, all leading to a thrombus formation within the vessel. Thrombosis and thrombolysis are involved in every RVO; therefore, an understanding of these biochemical pathways is important. Platelet activation and aggregation are known to play a pivotal role in thrombus formation or platelet adherence after a venous compression. Thus, each patient with RVO may have a unique combination of systemic and local factors which finally result in an occlusive vascular event.

Mean platelet volume is a parameter of platelet activation and function. It is the average size of a platelet and is calculated in a freshly drawn sample using automated hematology analyzers. The normal value of MPV ranges from 5 - 11 fl. An elevated MPV suggests that the blood has a greater tendency to coagulate, which can increase the risk of thrombosis, stroke and cardiovascular disease. Increased MPV is seen in patients with hypertension, hypercholesterolemia, diabetes mellitus, acute myocardial infarction, acute ischemic stroke, and coronary artery calcification. Thus, a high MPV may indicate impedance in ocular blood flow leading to progressive occlusive thrombosis and vein occlusion.

Materials and Methods

Ours is a prospective study comprising of consecutive patients of retinal vein occlusion that were diagnosed at a tertiary eye institute in India between August 2014 and June 2015. All patients diagnosed with any type of retinal vein occlusion (RVO) of recent onset (less than one month) were included in the study. It included both hypertensive and non-hypertensive patients. An informed written consent was taken from all patients. The study complies with the declaration of Helsinki and was approved by the institutional review board.

Fifty two consecutive patients of newly diagnosed retinal vein occlusion were included in the case arm and fifty two patients - age and gender matched, served as controls. Central retinal vein occlusion (CRVO) is characterized by disc edema, dilatation and tortuosity of all retinal veins, widespread deep and superficial hemorrhages, cotton wool spots, retinal edema and capillary non-perfusion in all four quadrants of the retina with or without macular edema. Branch retinal vein occlusion (BRVO) and hemi central retinal vein occlusion (HCRVO) have similar findings confined to the quadrant of the fundus drained by the affected vein. Patients with diabetes, cardiovascular diseases, renal failure and hepatic failure were excluded from the study. Any patient with history of malignancy, glaucoma and ocular trauma were also excluded from the study.

A detailed history of all patients including ocular history, medical history, smoking history and family history was elicited. All patients underwent a complete ophthalmological evaluation including snellen's best corrected visual acuity, pupillary reaction, intraocular pressure, anterior segment and fundus examination. Optical coherence tomography (OCT) was performed using Optovue RTvue version 5.1.090 and fundus fluorescein angiography (FFA) was done using Topcon Imagenet 2000 version 2.5x. Blood samples for total blood count with MPV were collected from the antecubital vein and investigated by a single pathological laboratory to avoid reporting bias.

Statistical analysis was performed using SPSS statistical software (SPSS version 21. Inc, Chicago, IL, USA). Chi- square and Paired t-test were used to compare the two groups. Data was expressed as mean ± standard deviation (x ± SD). Statistical significance was defined at a level of 5% ($p < 0.05$).

Results

The patients included in the study were divided into 2 groups; Group A included 52 patients with diagnosed Retinal Vein Occlusion, Group B included 52 patients of subjects who were age and gender matched to the first group.

The mean age of patients in group A was 50.98 ± 12.70 years (yrs) and in Group B was 52.69 ± 12.48 yrs respectively. The difference in age between the groups was statistically not significant [p value = 0.693 (t-test)] (Table 1). Of the 104 patients; 33 patients were female and 71 were males.

	Group Distribution	N	Mean	Standard deviation	p-value
Age	Group A	52	50.98 years	12.698	0.738
	Group B	52	52.69 years	12.475	
MPV	Group A	52	10.402 fl	1.9118	0.838
	Group B	52	10.242fl	1.9351	
MPV	BRVO	52	10.526 fl	1.8983	0.993
	CRVO	52	10.031 fl	1.9809	

Table 1: Age and mean platelet volume (MPV) in the study groups.

Blood pressure recording was done for both groups in the sitting position. Of the total of 104 patients, 43 were hypertensive; 22 in group A and 21 in group B. Twelve patients were smokers in group A and 10 in group B. There was no statistically significant difference for hypertension (chi-square test, p value 0.842) or smoking (chi-square test, p-value 0.631) in the two groups (Table 2). Thus, both the groups were matched for demographic and systemic parameters.

	Smoking		p-value	Hypertension		p-value
	Yes	No		Yes	No	
Group A	12	40	0.631	22	30	0.842
Group B	10	42		21	31	
Total	22	82	104	43	61	104

Table 2: Smoking and hypertension among patients in Groups A and B.

All 52 patients in group A were affected by retinal vein occlusion. Branch retinal vein occlusion was the most common type of RVO in our study with 38 patients being affected. Superotemporal BRVO was the most commonly involved quadrant followed by inferotemporal BRVO. One patient had an inferior HCRVO.

The mean platelet volume was 10.402 ± 1.91 fl in the patients having RVO. It was found to be marginally higher than in the control group (10.242 ± 1.93 fl) (Table 1). On comparison, however, the difference was not found to be statistically significant (t-test, p value 0.838). The mean MPV value in the BRVO patients (10.52 ±1.90 fl) was higher than in the patients with CRVO (10.031 ± 1.98 fl).

Discussion

Retinal vein occlusion is the second most common retinal vascular etiology which can affect the vision significantly. Branch retinal vein occlusion is more common in occurrence than CRVO. The exact mechanism of thrombosis leading to RVO has not been elucidated; particularly the relation between thrombocyte aggregation and RVO. The role of platelet indices has been evaluated in different studies as platelets play a pivotal role in arterial thrombosis. Platelet activation is an important link in the pathophysiology of diseases involving thrombosis and inflammation. Mean platelet volume is an indicator of platelet size and activation. Young platelets are recently released from the bone marrow, are larger, more dense and metabolically and enzymatically more active with greater prothrombotic potential [4,5].

Mean platelet volume is a simple, inexpensive, easy to interpret, and routinely measured parameter by automated cell counters. It is modified by various biosocial and lifestyle factors such as race, age, gender, smoking, alcohol consumption, and physical activities. Standardized laboratory methods and time adjustments are essential when measuring the MPV. Increased MPV values relate to larger sized platelets, hence, provides evidence of accelerated platelet production and may be interpreted in the same way as the reticulocyte count.

Trope., *et al.* in 1983, elaborately studied the association between the hematological variables and vein occlusions. They suggested that blood viscosity, platelets, and coagulation may be involved in retinal vein occlusion and its vascular complications [6].

In recent studies, an association between MPV values and retinal vein occlusion was reported. Onder., *et al.* have shown MPV values to be high and platelet count to be low in hypertensive BRVO patients by means of logistic regression analysis. They concluded that MPV is an independent predictor for RVO [7]. In a retrospective study by Sahin., *et al.* MPV values were significantly higher in patients with RVO, suggesting that larger platelets may contribute to the pathogenesis of the RVOs [8]. Kumral., *et al*. found no relationship between BRVO and neutrophil/lymphocyte ratio and MPV values in a small cohort of thirty patients [9]. In a study by Ornek., et al. no significant correlation was observed between retinal vein occlusion and MPV and did not also support the current data that increased MPV could contribute to the development of thrombosis in RVO patients [10].

The present study shows no association of mean platelet volume and retinal vein occlusions. MPV value was found to be slightly higher in RVO group but was not statistically significant when matched to the control group. Both the groups were age and sex matched. The confounding variables like hypertension and smoking were also matched between the two groups. Also, no significant difference in MPV values was observed between BRVO and CRVO groups. Arterial disease is most commonly implicated in RVO. At the lamina cribrosa, the central retinal veins and arteries are present within the same adventitial sheath and any arterial stiffness will affect the neighboring veins, leading to CRVO. Branch retinal vein occlusion results from venous compression by an artery at the arteriovenous crossings. Compression of the veins causes increased retinal venous blood flow velocity, turbulence of blood flow, endothelial injury, and secondary thrombosis. Hence, thrombosis and inflammation have a lesser effect on pathogenesis of retinal vein occlusions.

Ingerslev., et al. concluded that complete hematological profile is unnecessary in RVO patients. He did not find a correlation between various hematologic risk factors known for systemic venous thrombosis and its role in RVO [11]. Hayreh., *et al*. reported that the negative correlation of RVO with haematological abnormalities outweighed the positive correlation [12]. In a meta-analysis by Janssen., *et al*. it was observed that atherosclerosis might be more important factor in the development of CRVO than thrombogenic factors [13]. Our findings also do not support that thrombogenic factors as suggested by increased MPV could contribute to the development RVO in patients.

In the present study, the two groups were matched for systemic diseases as well. Hypertensive patients in the two groups were matched, in order to eliminate the confounding variables. The association of value of MPV and blood pressure has not been elaborately studied. A study by Yang K., *et al*. in Beijing adult population, found that mean platelet volume was negatively associated with diastolic blood pressure and positively linked with systolic blood pressure [14].

Our study has the limitation of MPV being recorded only at the time of presentation. However, a repeat MPV during resolution of vein occlusion could be done in further studies to assess the impact on the disease process.

Conclusions

Retinal vein occlusion is an important cause of visual loss, particularly among elderly patients with multiple systemic risk factors. The present study suggests that MPV is not significantly different in patients presenting with a recent onset RVO from normal age matched controls. This implies that thrombosis plays a minor role in the etiopathogenesis of RVO and arteriosclerosis appears to be the major factor. So we can infer that anticoagulants do not play a major role in the management of retinal vein occlusions.

Further studies are required to assess whether MPV provides added value in being able to identify patients at increased clinical risk of RVO and whether therapeutic modification of this marker may help the treating physician in preventing occlusions.

Conflict of Interests

The authors do not have conflict of interests.

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