

Original Research Article

Mean platelet volume as an indicator of severity of hypertensive retinopathy in hypertensive subjects

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ABSTRACT

Background: Hypertensive retinopathy (HR) represents the ophthalmic findings of end-organ damage secondary to systemic arterial hypertension. Platelets play a crucial role in the pathogenesis of atherosclerotic complications, contributing to thrombus formation or apposition after plaque rupture. The aim of our study was to investigate whether Mean platelet volume (MPV) is associated with the severity of hypertensive retinopathy in hypertensive patients.

Methods: This cross-sectional study was conducted in Department of Medicine of SAMC and PGI, Indore. Total 250 adult hypertensive patients (BP >140/90 mm Hg or taking antihypertensive drugs) recruited for the study.

Results: Of the 250 subjects, 158 (63.2%) were male and 92 (36.8%) were female. Elevated MPV >11.5 femtoliter was observed in 84 cases (33.6%). There was statistically significant relationship between the grade of retinopathy and elevated MPV in hypertensive subjects. ($r = 0.52$, $P < 0.001$).

Conclusions: We described a relation between MPV and HR (probably first time in Indian patients). Measurement of MPV is easy to establish and therefore might serve as a valuable predictor of a worse outcome in microvascular complications.

Keywords: Atherosclerosis, Hypertension, Platelets

INTRODUCTION

Hypertension is one of the most common worldwide diseases afflicting humans and is a major risk factor for stroke, myocardial infarction, vascular disease, and chronic kidney disease.

Despite extensive research over the past several decades, the etiology of most cases of adult hypertension is still unknown, and control of blood pressure is suboptimal in the general population. Due to the associated morbidity and mortality and cost to society, preventing and treating hypertension is an important public health challenge. Fortunately, recent advances and trials in hypertension

research are leading to an increased understanding of the pathophysiology of hypertension and the promise for novel pharmacologic and interventional treatments for this widespread disease.

Hypertensive retinopathy represents the ophthalmic findings of end-organ damage secondary to systemic arterial hypertension. Although its name implies only retinal involvement, changes in both the choroid and the optic nerve are observed, depending on the chronicity and severity of the disease. Clinical changes from hypertensive choroidopathy are directly related to the release of endogenous vasoconstrictor agents during systemic hypertension. Platelets play a crucial role in the

pathogenesis of atherosclerotic complications, contributing to thrombus formation or apposition after plaque rupture.¹ Mean platelet volume (MPV) is a marker of platelet function, i.e., large platelets contain more dense granules and produce more thromboxane A₂. Normal range for MPV is given as 7.5-11.5 fL.

Elevated MPV levels have been identified as an independent risk factor for myocardial infarction. Moreover, increased platelet size has been associated with other vascular atherosclerotic risk factors such as diabetes, hypercholesterolemia, and smoking and in patients with renal artery stenosis.^{2,3} The aim of our study was to investigate whether MPV is associated with the severity of hypertensive retinopathy in hypertensive patients.

METHODS

This cross sectional study was conducted in Department of Medicine of SAMC & PGI, Indore. Total 250 adult hypertensive patients (BP > 140/90 mm Hg or taking antihypertensive drugs) recruited for the study. An inclusion criterion was systemic hypertension with hypertensive retinopathy. Exclusion criteria were presence of diabetes mellitus, dyslipidemia, obesity, smoking, and on drug therapy that might interfere with MPV (e.g., warfarin).

Blood samples were drawn after a fasting period of 12 hours and collected in citrate (1:4 v/v) in order to reduce platelet swelling induced by ethylene diamine tetra acetic acid (EDTA). The test was performed in the Sysmex Autoanalyzer within 30 minutes after the collection of a sample to reduce the variations in results due to sample aging. The direct ophthalmoscopic examinations were done after dilatation of pupils with tropicamide 1% eye drops for the evaluation of HR.

The Statistical Package for Social Sciences (SPSS, version 16.0) was used to enter and analyze the data in the form of tables and graphs. Mean, frequencies, percentages, and p-values were calculated.

Ethical consideration

Prior to conduct of the present study, the protocol of the study was submitted to ethical and scientific committee of hospital. After getting due approval from these two committees, the present study was initiated. Also prior to conduct of study related procedure / investigation, a voluntary written informed consent was taken from the patient /legally acceptable representative.

Financial input and funding: The patient underwent procedures as per protocol laid down by our institution for management of such patients. Hence there was no financial burden on patient or institution. This project was not funded by any of pharmaceutical/diagnostic industry.

RESULTS

Of the 250 subjects, 158 (63.2%) were male and 92 (36.8%) were female. Elevated MPV >11.5 femtoliter (fl) was observed in 84 cases (33.6%). Among 84 cases with elevated MPV, 50 cases were males and 34 cases were females.

Table 1: Mean platelet volume in different grades of hypertensive retinopathy.

HR Grade	Subjects with elevated MPV	Subjects with elevated MPV
1	66	19 (22.3%)
2	84	44 (34.3%)
3	12	15 (55.5%)
4	4	6 (60%)
Total	166	84 (33.6%)

Figure depicts the linear relationship between the grade (severity) of HR and frequency of elevated MPV, derived from the data in Table 1. There is a strong, positive, and statistically significant correlation (Pearson's product-moment correlation coefficient, $r = 0.998$, $P < 0.001$) between an increase in HR grade and an elevated MPV.

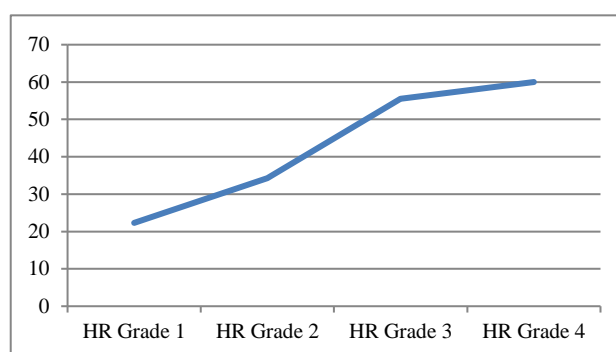


Figure 1: Linear relationship between frequency of elevated MPV and increasing grade of HR.

In addition, in patients of Grade 1 HR, the MPV was 10.6 ± 0.6 fl. In Grades 2, 3, and 4 HR, the values of MPV were 11.8 ± 0.5 fl, 12.6 ± 0.3 fl, and 13.2 ± 0.6 fl, respectively ($P < 0.05$ by Analysis of Variance (ANOVA)), indicating a positive near linear correlation ($r = 0.52$).

DISCUSSION

Globally, an estimated 26% of the world's population (972 million people) has hypertension, and the prevalence is expected to increase to 29% by 2025, driven largely by increases in economically developing nations.⁴ The high prevalence of hypertension exacts a tremendous public health burden. As a primary contributor to heart disease and stroke, the first and third leading causes of death worldwide, respectively, high blood pressure was the top

modifiable risk factor for disability adjusted life-years lost worldwide in 2013.^{5,6}

Hypertension is the most important modifiable risk factor for coronary heart disease, stroke, congestive heart failure, end-stage renal disease, and peripheral vascular disease. The pathogenesis of essential hypertension is multifactorial and complex.⁷ Multiple factors modulate the blood pressure including humoral mediators, vascular reactivity, circulating blood volume, vascular caliber, blood viscosity, cardiac output, blood vessel elasticity, and neural stimulation. A possible pathogenesis of essential hypertension has been proposed in which multiple factors, including genetic predisposition, excess dietary salt intake, and adrenergic tone, may interact to produce hypertension. Although genetics appears to contribute, the exact mechanisms underlying essential hypertension have not been established. Untreated hypertension is notorious for increasing the risk of mortality and is often described as a silent killer. Mild to moderate hypertension, if left untreated, may be associated with a risk of atherosclerotic disease in 30% of people and organ damage in 50% of people within 8-10 years after onset.

The results demonstrated a statistically significant and linear relationship ($r = 0.52$, $P < 0.001$) between the grade of retinopathy in hypertensive subjects and frequency of elevated MPV. These findings concur with the result of a previous study.⁸ Thus, it is a highly relevant finding that MPV in patients with hypertension is significantly higher than in normotensive control subjects.⁹

There is growing evidence that increased platelet activation, a common finding in hypertension, may contribute significantly to these complications with serious vascular atherosclerotic diseases, such as stroke, coronary artery disease, and retinopathy. Thus, it is important to assess the role of platelet activation in the disease process as well as to evaluate its use as a predictor for complications, including HR.

CONCLUSION

From the present study it was described a relation between MPV and HR (probably first time in Indian patients). Measurement of MPV is easy to establish and therefore might serve as a valuable predictor of a worse outcome in microvascular complications. Prospective studies investigating the effects of various drugs, including anti-platelets drugs and non-antiplatelet drugs

(eg, statins, ACE-I) on platelet size and reactivity and treatment effect should follow.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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