Original Research Article

Role of mean platelet volume in a patient with ischemic stroke: A cross sectional study

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Abstract

Background: Hypertension and diabetes mellitus, both of which increase the risk of vascular disease, are associated with an increase in platelet size.The larger platelets have more dense granules, have more powerful activity and hence more prone to thrombosis than smaller platelets.A newly emerging risk factor for atherosclerosis is MPV, a predictor of platelet function. It is an index of platelet size & correlates positively with platelet activation. There is paucity of studies in our setting hence we have undertaken this research to see if there was any association in an Indian population. **Methods:** Present study was cross sectional in nature conducted among 134ischemic stroke patients. All patients fulfilling inclusion criteria and exclusion criteria were taken up for the study. Study was carried out over a period of 1.5 years. **Results:** Majority of the patients was in the age group of 40-60 years and most of them were male. Association of mean platelet volume & risk factor has shown that diabetes mellitus was significantly associated with reduced platelet volume while alcohol addiction & hyperlipidemia were associated with increased platelet volume ($p<0.05$). Other risk factors i.e. CHD was associated with reduced mean platelet volume while smoking & HTN were associated with increased platelet volume but the association was not significant ($p>0.05$). **Conclusion:** There was association between increased MPV & the risk of ischemic stroke.

Key words: increased MPV, ischemic stroke.

Introduction

Numerous debilitating conditions are associated with abnormalities of the central nervous system (CNS). Stroke is one of the leading causes of morbidity and mortality after heart disease and cancer. Approximately 4 million people worldwide are estimated to suffer from stroke each year. Stroke mortality and morbidity rates vary widely among countries, but the poorest nations are the most severely hit[1].

Stroke might be hemorrhagic or ischemic, depending on the severity of the bleeding. A thrombosis or embolism-induced stroke is more common than a hemorrhagic stroke[2]. There are a number of identified risk factors for stroke. High blood pressure, heart disease, atrial fibrillation, diabetes, and hyperlipidemia are the most serious of these[3]. Hypertension and diabetes mellitus, both of which increase the risk of vascular disease, are associated with an increase in platelet size. Platelet granules in the bloodstream are governed by a single hormone and do not alter during the platelet's life span. The larger platelets have more dense granules, have more powerful activity and hence more prone to thrombosis than smaller platelets[4]. Large platelets have a higher pro-thrombotic potential because of their increased metabolic and enzymatic activity[5].

A newly emerging risk factor for atherosclerosis is MPV, a predictor of platelet function. It is an index of platelet size & correlates positively with platelet activation[6]. Hemostasis is more dependent on changes in MPV than platelet count. MPV levels were shown to be higher in patients who had recently suffered an acute ischemic stroke in several studies in the western countries[7-9] but there is paucity of studies in our setting hence we have undertaken this research to see if there was any association in an Indian population.

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Objectives

To determine association of mean platelet volume (MPV) with ischemic stroke.

Materials and Methods

This was a cross sectional study, protocol of which was approved by the Institutional Ethical committee of the medical college. Written informed consent was taken from all study subjects.

Patient suffered recently from ischemic stroke constituted our study subjects. All patients fulfilling inclusion and exclusion criteria admitted in general medicine ward of Dr. PDMMC,Amravati and tertiary care hospital were taken up for the study until the required sample size fulfilled. Sampling method used was universal sampling. Study was carried out over a period of 1.5 years from July2021 to October 2022.

All patients with acute ischemic cerebrovascular accident presenting within 48 hours, identified based on clinical as well as radiological evaluation (CT and MRI) were included in the study.Exclusion criteria's were patients with hemorrhagic stroke, hereditary disorder of large platelets, thrombocytopenia, patients with previous history of TIA/CVA, liver disease, familial hypercholesterolemia and hypothyroidism, patients taking hypolipidemic drugs, anti-platelet Drugs.

Sample size was calculated with $n = [DEFF*Np(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$ using OPENEPI software version 3.

Assuming a 50% prevalence of higher mean platelet volume in patients with ischemic stroke, with a 95% confidence interval, and a 5% error rate, the minimum determined sample size was 134 cases.

Method of assessment

Acute ischemic stroke defined operationally as a syndrome of rapidly developing clinical signs of focal and neurological disturbance lasting for more than 24 hours.

Pre-validated, pretested, semi structured questionnaire was used as data collection tool. Thorough systemic and general examination was done for clinical evaluation.

After the primary data collection patients underwent the investigations like complete blood count, HDL, LDL, serum triglycerides, total cholesterol & blood sugar.

Two ml of blood were drawn from the antecubital vein and placed in an EDTA test tube for analysis in an automated cell counter in order to determine the mean platelet volume. This was done with the KX21 Sysmex. Patients with ischemic stroke had their blood tested at admission, one week later, and one month later.

Reference range of normality for the mean platelet volume was taken as8.0 – 11.0 fl.

Data was entered in Microsoft Excel and analyzed using SPSS Software.

Results

In the present cross sectional study, we have analyzed total 134 patients. Majority i.e. 100 (74.63%) of the patients were from the age group of 40-60 years followed by 27 (20.15%) from the age group of >60 years and least 07 (5.22%) from the age group <40 years. Most i.e. 95(70.90%) of the patients were male. 57 (42.54%) gave history of addiction to alcohol &63 (47.01%) were addicted to smoking. Out of total 134 patients, majority i.e. 101 (75.37%) had hypertension followed by 81 (60.45%) were having diabetes mellitus, 77 (57.46%) hyperlipidemia&48 (35.82%) had coronary heart disease as a risk factor for the ischemicstroke. (Table 1)

Table 1: Distribution of ischemic stroke patients according to baseline characteristics.

Sr. No.	Baseline characteristic		Frequency (no.)	Percentage (%)
1	Age groups	<40	07	5.22
		40-60	100	74.63
		>60	27	20.15
2	Gender	Male	95	70.90
		Female	39	29.10
3	Addiction	Alcohol	57	42.54
		Smoking	63	47.01
4	Comorbidity	DM	81	60.45
		HTN	101	75.37
		CHD	48	35.82
		Hyperlipidemia	77	57.46

Association of mean platelet volume & risk factor has shown that diabetes mellitus was significantly associated with reduced platelet volume while alcohol addiction & hyperlipidemia were associated with increased platelet volume ($p<0.05$). Other risk factors i.e. CHD was associated with reduced mean platelet volume while smoking & HTN were associated with increased platelet volume but the association was not significant ($p>0.05$). (Table 2)

Table 2.Association of mean platelet volume and risk factors of stroke patients.

Risk factor		Mean platelet volume (Mean ± SD)fl	P value
Alcohol	Yes (n=57)	9.67 ± 1.67	**<0.001**
	No (n=77)	8.65 ± 1.43	
Smoking	Yes (n=63)	9.15 ± 1.67	0.64
	No (n=71)	9.02 ± 1.58	
CHD	Yes (n=48)	8.96 ± 1.49	0.49
	No (n=86)	9.16 ± 1.71	
DM	Yes (n=81)	9.46 ± 1.73	**<0.001**
	No (n=53)	18.59 ± 1.50	
HTN	Yes (n=101)	9.24 ± 1.72	0.06
	No (n=33)	8.61 ± 1.53	
Hyperlipidemia	Yes (n=77)	213.64 ± 35.3	**<0.001**
	No (n=57)	187.2 ± 33.9	

Discussion

In the current cross sectional study, mean age of the patients was 58.5 ± 8.84 years.Acute ischemic stroke was seen in 71% of males and 29% of females in our study. The ratio of males to females was 2.4 to 1. Stroke risk is largely determined by a person's age, which cannot be changed. Maximum (74.63%) Patients in this study ranged in age from 40 to 60 years. Acute ischemic stroke was more likely among the middle-aged participants in this study. These findings similar to Shah P. A. et al[10] findings who have reported that males comprised 59 percent of ischemic stroke patients. Similar findings also have been reported in another study by Khan et. Al[11].

Out of the many risk factors for stroke, hypertension was noted in 75 % of the patients followed by 60 % of diabetes mellitus& 57% had hyperlipidemia .Similarly hypertension was the most prevalent risk factor in study by Muscariet al[12] with 84.7% and 82.7%. In Pikijaet al[13]. Diabetes mellitus had a representation of 20% of the patients. Most previous studies have included hypertension as risk factor followed by diabetes.

Diabetes mellitus was significantly associated with reduced platelet volume while alcohol addiction & hyperlipidemia were associated with increased platelet volume ($p<0.05$). Other risk factors i.e. CHD was also associated with reduced mean platelet volume while HTN & smoking were associated with increased platelet volume but the association was not statistically significant ($p>0.05$). Butkiewicz AM et al[14] also concluded in his study that smoking is one of the risk factors in increasing mean platelet volume in patients with strokes. Cobanet al[15] and Varol et al[16] in their studies noted that in hypertensives, MPV was significantly elevated.The study conducted by Thomas Alex Kodiatte et al[17] in 300 type 2 diabetes mellitus and 300 Non Diabetes Mellitus patients, found that the MPV was higher in Diabetes is (8.29 ± 0.74 fl Versus 7.47 ± 0.73 fl) ($p = 0.001$) than non-diabetics which was similar to our study. The study by Zuberi B F et al[18] reported similar finding among diabetics.O Mallyet al[19] similar to ourstudy showed elevation of MPV in alcoholic patients.Krauss et al[20]. also reported abnormalities in lipid metabolism in patients and concluded the impact of same on the elevation of MPV.

Conclusion

Majority of the patients had hypertension;diabetes & hyperlipidemia as important risk factors for ischemic stroke. Alcohol addiction & hyperlipidemia were significantly associated with increased mean MPV (mean platelet volume) while diabetes mellitus was associated with reduced MPV.

Declaration

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