Section: Neurology

Original Research Article

STUDY OF MEAN PLATELET VOLUME IN ACUTE ISCHEMIC STROKE AND ITS CORRELATION WITH STROKE SEVERITY AND CAROTID ARTERY DISEASE.

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ABSTRACT

Background: Platelets play a major role in inflammation, thrombosis and atherogenesis. Platelet size and function is measured by Mean platelet volume (MPV). Platelet activity is accentuated in acute ischemic stroke due to blood vessel occlusion that leads to ischemia, endothelial damage. MPV has been identified as independent predictor of stroke in high-risk individuals and in carotid atherosclerosis. Platelet indices panel is readily available in hemogram and can be used with cost effectiveness. In South Asian population very few studies are available on this association. Present study conducted to study association between MPV and acute ischemic stroke and its correlation with clinical severity and carotid artery disease.

Materials and Methods: This case control study was done in department of neurology of NRI Medical college. 150 cases of acute ischemic stroke patients and age and sex matched controls were considered. Patients on antiplatelet drugs were excluded from study. CT/MRI brain imaging done. Modified Rankin score(MRS) and NIHSS score were noted during admission. Carotid artery Doppler study was used to measure the carotid intima media thickness(IMT) and percentage of stenosis.

Results: MPV was significantly higher in acute ischemic stroke patients (12.8 +/- 1.2) compared to controls (9.29+/-0.7). Platelet count was 1.93 in cases and 1.84 in controls. MPV was significantly higher in patients with high MRS scores. MPV in small infarct group is 10.47+/-0.9 and in large infarct group is 12.79+/-1.47. MPV in normal IMT(<1mm) group is 10.31+/-1.06 and in IMT >1mm with mild stenosis group is 11.32+/-1.36 and in moderate to severe stenosis group is 12.8+/-1.2.

Conclusion: MPV and platelet count was higher in patients with acute ischemic stroke and it correlates with clinical severity. In this study there is significant association between mean platelet volume and carotid intima media thickness.

Keywords: Platelets, MPV, MRS score, NIHSS score.

INTRODUCTION

Stroke is defined as an abrupt onset of neurologic deficit that is attributable to a focal vascular cause. The incidence of stroke in India is 84-262/1,00,000 population per year, [1] and prevalence of stroke ranged from 334-424/1,00,000 population. From 1990 to 2019 there has been a 70% increase in stroke incidence, 102% increase in stroke prevalence.[2] Platelets play a major role in inflammation, thrombosis and atherogenesis. Platelet size and function is measured by Mean platelet volume(MPV).[3] The new younger platelets are larger in size due to increase in alpha granules and the presence of platelet factor 4. Platelet activity is accentuated in acute ischemic stroke due to blood vessel occlusion that leads to ischemia, endothelial damage and new platelet formation.[4] MPV has

been identified as independent predictor of stroke in high-risk individuals and in carotid atherosclerosis. [5,6] Possible reasons are platelets with larger MPV contain more thromboxane A2, express more glycoprotein receptors such as IIb and IIIa receptors, have stronger chemotaxis, adhesion, and aggregation functions. In addition, larger platelet volume can release more active factors such as platelet factor 4 and P selectin, which can aggravate vascular endothelial cell damage and inflammation, promoting progression of atherosclerosis. [7,8,9,10] The most important modifiable risk factors that contribute to stroke are, systemic hypertension, diabetes, dyslipidaemia, smoking, heart disease. Platelet indices panel is readily available in hemogram and can be used with cost effectiveness. Doppler ultrasound examination is convenient, fast, affordable, suitable screening for carotid artery disease. Stroke is the most common neurological disorder worldwide and a leading cause for death and disability in world population after coronary artery disease. Acute ischemic stroke (AIS) contributes to 87% of cases, primary intracerebral haemorrhage (ICH) for 10%, and subarachnoid haemorrhage (SAH) for the remaining 3%. The present study was conducted to analyse the MPV in patients who have suffered an acute ischemic stroke when compared to a control population, to study association between MPV and severity of ischemic stroke and carotid artery disease.

MATERIALS AND METHODS

The preset study was a case control study, we have conducted for 6 months period (NOV 2022 to MAY 2023), in Department of Neurology, NRI Medical College and Hospital, Guntur. We have included the patients admitted with first episode of acute ischemic stroke confirmed by radiographic imaging. We have selected 150 cases and 150 age and sex matched controls. After taking consent, the patients and controls were subjected to detailed history, clinical examination and investigations, MRS and NIHSS score were noted during admission, for measurement of MPV 2ml of blood sample was collected in EDTA tube and sent for analysis. Carotid artery examination was done using doppler ultrasound system and assessment of intima-media thickness, presence or absence of atherosclerotic plaques in blood vessel and whether there is stenosis and degree of stenosis. In present study we have included cases with first episode of ischemic stroke confirmed by imaging studies and excluded the cases of hemorrhagic stroke, recurrent stroke, patient already on antiplatelet drugs thrombocytopenia. We used SPSS 23 version statistical software, for statistical analysis. The measured data are expressed as mean, standard deviation and independent sample t test were used.

RESULTS

Characteristics	Cases (N=150)	Controls (N=150)	p value
Age(years)	55.08 ± 11.22	53.96 ± 8.5	0.95
Gender(M:F)	91:59	87:63	0.84
Smoking history	25	22	1
hypertension	42	38	0.84
alcohol	26	23	0.95
Mean fasting blood glucose(mg/dl)	90 ± 5.2	87 ± 6.5	0.15

Table 1: Showing Cases and controls were matched for age, gender, diabetes, hypertension

MPV of control and cases was compared and resulted as follows. [Table 2& Figure 1]

COMPARISION OF MPV IN CASES AND CONTROLS

- MPV in stroke patients was significantly higher than controls.
- P value was <0.001
- There is no significant difference in MPV on day 1, day7 and day 28.

MPV	CONTROL	CASES DAY 1	CASES DAY 7	CASES DAY 28
MEAN	9.29	12.28	12.30	12.27
STANDARD DEVIATION	0.7	2.55	2.50	2.57

COMPARISION OF MPV	P VALUE	INFERENCE
CONTROLS VERSUS CASES	<0.001	SIGNIFICANT
DAY 1 VERSUS DAY 7	0.98	NOT SIGNIFICANT
DAY 1 VERSUS DAY 28	0.92	NOT SIGNIFICANT

Table 2: Comparison of MPV in cases and controls

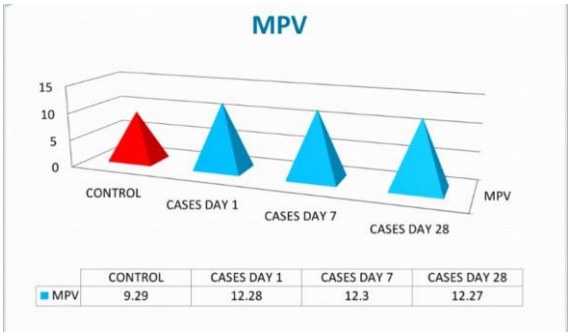

Figure 1: Showing Levels of MPV

Comparison of platelets in cases and controls as follows. [Fig 2]

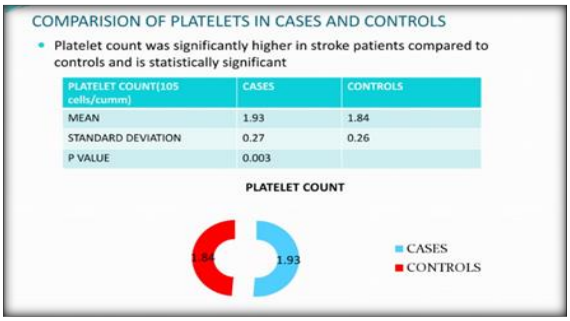

Figure 2: Comparison of platelets in cases and controls

Comparison of MPV between small and large infarct group as follows [Figure 3]

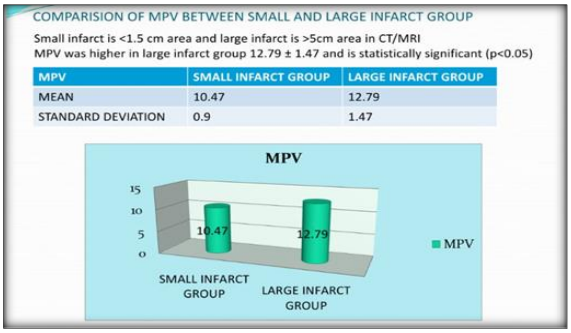

Figure 3: Comparison of MPV between small and large infarct group.

Correlation between MPV and Modified Rankin score as follows. [Figure 4]

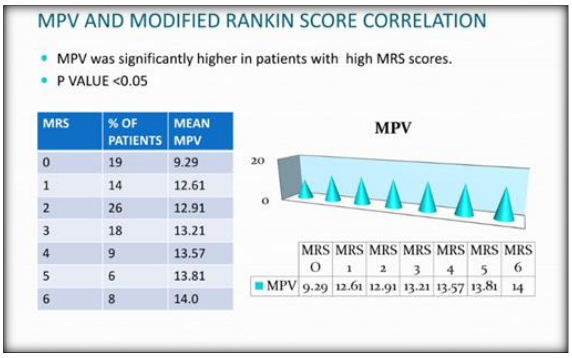

Figure 4: Correlation between MPV and Modified Rankin score.

MPV levels in patients with different degrees of carotid artery stenosis as follows. [Figure 5]

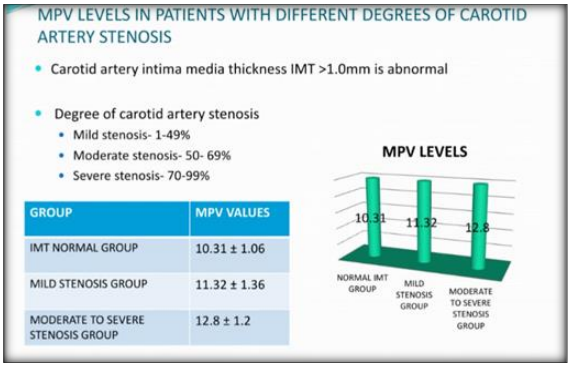

Figure 5: MPV levels in patients with different degrees of carotid artery stenosis.

DISCUSSION

The mean platelet volume (MPV) is one of the most commonly used laboratory markers related to platelet functions. Because of their greater content in granules, large platelets are more reactive than ordinary size platelets, produce more prothrombotic factors, and show greater aggregation to adenosine diphosphate (ADP), collagen or adrenaline and secrete more thromboxane A2 (TxA2). Increased platelet size has been described in patients with vascular risk factors such as diabetes, Hypercholesterolemia, metabolic syndrome and in patients with renal artery stenosis. Higher mean platelet volume (MPV) values have been established in patients with stroke, than in control subjects.[11]

In our study we observed MPV is significantly elevated in ischemic stroke patients compared to controls. Philips Bath, Bernhard et al in-progress trail showed similar findings.[3] Elevation of MPV in first day is associated with worst outcome. In this study MPV level remained to be constant for about a month with factors like drugs not influencing it. Platelet count was significantly elevated in acute stroke patients (1.93 ± 0.27) compared to controls (1.84 ± 0.26). O' Malleyet al, Butter et al in their study showed platelet count was significantly elevated in acute stroke patients.[12] S.Greisengger et al in their study showed elevated MPV was associated with higher MRS scores and worst outcome. Correlation of MPV with severity of stroke using MRS showed statistically significant elevation.[13] In present study we observed MPV in small infarct group is 10.47 ± 0.9 and in large infarct group is 12.79 ± 1.47. Platelets have been known as the pathological basis of atherosclerosis for long time. MPV in normal IMT(<1mm) group is 10.31 ± 1.06. MPV was significantly elevated in patients with IMT >1mm and in moderate to severe carotid artery stenosis group is 12.8 ± 1.2. E.G.Grant, C.B. Benson et al in their study showed significant MPV elevations in severe carotid artery stenosis group.[14]

Bath et al[15] in a sub study of the progress trial followed 3134 individuals for an average of 3.9 years and assessed the association of MPV with the risk of stroke and found significantly raised MPV in such patients. Studies done by Bassiouny et al[16] showed MPV was an independent predictor of poor short-term outcome of acute stroke after controlling for confounders like diabetes mellitus. Staszewski et al[17] conducted a study whose results suggest that patients within middle or high tertiles(MPV >7.29fl) of MPV on admission represent the highest risk for larger infarcts on admission and worse outcome[18]. In studies of NtaiosG[19]D'Erasmo E[20] did not find any significant relation between MPV and stroke outcome and the causes for these inconsistent findings could be explained by small numbers of patients and the use of different methodological measures of platelet indices and different outcome scales in these studies. This study identified MPV as an independent predictor of the risk of stroke among high-risk individuals. The measurement of MPV may add useful prognostic information for clinicians managing patients with a history of cerebrovascular disease.

CONCLUSION

- MPV and platelet count was higher in patients with acute ischemic stroke compared to controls.
- MPV was significantly elevated in patients with large infarcts.
- MPV remain elevated at least for a duration of 4 weeks after the onset of stroke.
- The patients who had a higher MPV on day 1 compared to other patients had a high risk of adverse outcome.
- In our present study there is significant association between mean platelet volume and carotid intima media thickness.

MPV is an independent predictor of the risk of stroke among individuals with a history of stroke or transient ischemic attack. The measurement of MPV may add useful prognostic information for clinicians managing patients with a history of cerebrovascular disease.

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