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Original Article

A Prospective Study of Role of Mean Platelet Volume in Predicting Stroke Type and its Severity

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Abstract
Background: *Mean platelet volume (MPV) has emerged as an important laboratory marker which is associated with platelet function and activity. Increased MPV in thromboembolic disease is reflected as an important risk factor.*
Aims and Objective: *To evaluate MPV in stroke patients with clinical presentation, risk factors and stroke sub type.*
Materials and Methods: *Hundred stroke patients (Case group) were compared with 100 healthy subjects (Control group) at JA group of Hospital, Gwalior between 2016 to 2017. After a thorough clinical examination all patients were subjected to complete blood count and mean platelet volume estimation. CT scan was done for finding the stroke subtype. Stroke severity was assessed using modified Rankin score.*
Results: *Male preponderance (61% in control and 59% in cases) was observed in both the groups. MPV between cases and control with risk factors of stroke including age, gender, smoking, hypertension and diabetes mellitus was comparable ($p>0.05$). MPV was significantly higher in patients with previous stroke history compared to patients with no history ($p<0.001$). MPV in cases was higher (12.33±2.36 FL) compared to control group (10.85±1.44 FL) ($p<0.001$). MPV in patients with ischemic stroke (12.71±2.22 FL) was higher compared to haemorrhagic stroke (11.13±2.33 FL) ($p=0.002$).*
Conclusion: *MPV is independent of age, sex, smoking status, systemic hypertension and diabetes mellitus in stroke patients. MPV was higher in ischemic stroke patients compared to haemorrhagic stroke. MPV might act as an additional tool to identify people at high risk.*
Keywords: *Ischemic stroke, MPV, stroke severity, haemorrhagic stroke.*

Introduction

Stroke is defined as sudden loss of neurologic function resulting from focal disturbance of cerebral blood flow due to ischemia or hemorrhage.[1] Several authors have worked on to find the relationship between platelet and pathophysiology of stroke. Reports have shown that platelet play a role in ischemic stroke pathophysiology by developing intravascular

thrombus after erosion or rupture of atherosclerotic plaques.[2]

Platelet volume is considered as one of the important marker of platelet function and activation that can be measured as mean platelet volume (MPV). MPV is positively associated with platelet reactivity.[3-5]

Bigger platelet comprises of more dense granules and more active than small platelet metabolically. Also bigger platelets are having higher potential for thrombosis. [6-8] Hence present study was performed to investigate relationship of MPV with the stroke subtype, its risk factors and stroke severity in patients with stroke.

Materials and Methods

A Prospective study was performed on 100 stroke patients at JA group of Hospital, Gwalior from February 2016 to August 2017. Hundred (Control group) age and sex matched who was not having any symptoms of stroke were taken as controls for comparison (Case group).

All cases of either sex having symptoms of stroke who were admitted in the Department of Medicine and Neurology having age ≥15 years were included. Patients with age <15 years and head injury, taking drugs which are likely to interfere with platelet morphology, already suffering from platelet disorders and with comorbidities which are likely to affect platelet morphology (mean platelet volume) were excluded from the present study

Each patient had undergone a thorough clinical examination to diagnose stroke as per the World Health Organization (WHO) definition. They were also subjected to CBC and mean platelet volume and all other relevant investigation like RBS, RFT and lipid profile.

To classify in to stroke subtype all subjects underwent CT/MRI. Stroke severity was assessed using modified Rankin score in patients on a scale of 0–6, with 0 being asymptomatic and 6 being dead. Scores of 0–2 are considered as ‘‘good” stroke consequences; in that these patients are able to lead fairly independent lives and are able to return to work in almost all cases. Scores of 3 or greater indicate that the patient will need considerable help with their daily activities.

All the data was analyzed using IBM SPSS ver. 20 software. Data is expressed as percentage if and otherwise explained. Cross tabulation and frequency distribution was used to prepare tables. Two way ANOVA and independent sample t test was used to analyze quantitative data; categorical data was analyzed using Chi square test. Level of significance was assessed at 5% level.

Results

Mean age of case and control group was 59.75±13.64 and 60.72±9.26 years (p=0.557). There were 61% male and 39% female in Control whereas in Case group, there were 59% male and 41% female (p=0.773).

Table 1: Comparing MPV between Cases and Control with risk factors of stroke

Parameter		Cases (n=100) (FL)	Control (n=100) (FL)	P Value
Age	20-39	11.88±1.48	12.57±2.31	NS
	40-49	11.85±1.61	11.65±2.36	
	50-59	10.38±1.55	11.27±2.45	
	60-69	9.50±0.70	10.60±2.70	
	>70	8.94±1.51	9.14±2.36	
Gender	Male	12.39±2.30	10.82±1.54	NS
	Female	12.15±2.46	10.90±1.29	
Smoking	Yes	11.84±2.54	10.67±1.20	NS
	No	12.36±2.29	10.91±1.51	
Hypertension	Yes	11.92±2.45	10.89±1.39	NS
	No	12.59±2.17	10.83±1.48	
Diabetes mellitus	Yes	12.00±2.56	10.75±1.39	NS
	No	12.33±2.28	10.88±1.44	

Data is expressed as mean± standard deviation (SD), NS; not significant, p value of <0.05 is considered as significant.

The mean of MPV in cases with previous history of stroke was significantly higher with the mean MPV of patients without pervious stroke history (p<0.001). Mean platelet count in cases and control was 2.43±0.782 FL and 2.33±0.614 FLrespectively (p=0.063). MPV in cases was higher (12.33±2.36 FL) compared to control group (10.85±1.44 FL) (p<0.001). MPV in patients with ischemic stroke (12.71±2.22 FL) was higher compared to haemorrhagic stroke (11.13±2.33 FL) (p=0.002).

MPV was significantly higher in ischemic (12.71±2.22 FL; p<0.001) and haemorrhagic stroke (11.13±2.33 FL; p=0.426) compared to control group (10.85±1.44 FL).

Table 2: Comparing Rankin score with the MPV in ischemic stroke

Parameter		MPV		Total	P value
		Elevated	Normal		
Modified RANKIN score	0-2	21 (67.7)	10 (32.3)	31 (100)	0.049
	3-6	28 (71.8)	11 (28.2)	39 (100)	
Total		49 (70)	21 (30)	70 (100)	

Data is expressed as no of patients (percentage), NS; not significant, p value of <0.05 is considered as significant.

Discussion

MPV is now considered as one of the important clinical marker in thromboembolic diseases. Increase in MPV level has been observed in stroke patients and acute myocardial infarction than in control subjects.[9, 10]

In present study we found significantly higher MPV in ischemic (12.71±2.22 FL; p<0.001) and haemorrhagic stroke (11.13±2.33 FL; p=0.426) compared to control group (10.85±1.44 FL). Similarly a study from Kuwait by Elsayed et al on 50 acute ischemic stroke patients reported that MPV was significantly higher in patients with ischemic stroke compared to control group (p=0.001).[11] Similar to present study, O'Malley et al also [12] reported greater MPV values in patients with ischemic stroke compared to control group. Whereas Cho et al did not find any significant difference between stroke and control's in relation to MPV values, [13] but most of the studies proved that MPV levels were significantly higher in stroke patients.[14, 15] PROGRESS study [16] in which 3134 individuals with prior cerebro vascular disease were studied, reported that MPV may be raised before the acute event of stroke. Study also stated that for every 1 FL increase in MPV there is an increased risk of stroke by 11%. Hence subjects with large platelets have an increased risk of ischemic stroke. Another study from Amritsar including 50 patients with stroke also revealed that that MPV was higher in ischemic stroke patients compared to control group.[17]

Elsayed et al reported that higher and more significant (p= 0.011) MPV value in patients group with high RANKIN score (≥3) in comparison with those with lower scores. [11] In agreement to this in present study elevated MPV was reported in 71% patients with modified RANKIN score between 3-6. Neki et al reported no significant association between severity of ischemic stroke and MPV, contrary to Neki et al, [17] in present study has found that most of the patients (71%) have elevated MPV who has modified RANKIN score between 3-6.

A study done by Cho et al[13] showed that MPV levels were higher in female cohort compared to male cohort whereas in present study we did not found any significant gender difference in terms of MPV. In agreement to present study Elsayed et al also did not find significant difference in MPV according to gender.[11]

Many authors have reported that risk factors such as hypertension, diabetes mellitus, coronary heart disease, smoking and hyperlipidemia have an impact on MPV.[9] But many studies have not found any influence of vascular risk factors on MPV.[18,19] Similarly in present study MPV was similar in patients with vascular risk factors such as hypertension, diabetes mellitus and smoking and patients who were not having it. This is in

accordance with study done by Fu sun et al[3] who did not report an association of MPV with coronary events.[3] Neki et al did multiple logistic regression of the baseline risk factors and showed that hypertension was the most common risk factor involved in stroke ($p<0.001$). Also MPV was higher in patients with diabetes mellitus ($p=0.022$) compared to control. But present study has not found any significant results.[17]

Present study had few limitation of being small in sample size; a large randomized clinical trial is required to strengthen the present study findings.

Conclusion

MPV in patients with stroke was an important risk factor independent of age, sex, smoking status, systemic hypertension and diabetes mellitus. MPV was higher in ischemic stroke patients compared to haemorrhagic stroke. When MPV was compared with degree of stroke severity scale (modified RANKIN score) it was found to be significantly raised in groups where the score was between 3-6. Thus the measurement of MPV level may provide useful diagnostic and prognostic information to emergency physicians caring for patients with ischemic stroke but not in haemorrhagic stroke. MPV might act as an additional tool to identify people at high risk and such patients can be given more vigilant and aggressive care that in turn lead to reduction in morbidity and mortality.

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