



A STUDY OF PLATELET INDICES IN ACUTE ISCHEMIC STROKE AND ITS CORRELATION WITH STROKE SEVERITY AND CAROTID DOPPLER STUDIES

Neurology

Dularijith. D* Postgraduate, Institute of Neurology, Madras medical college. *Corresponding Author

L. A. Ravi Assistant Professor, Institute of Neurology, Madras medical college.

V.

Chandramouleeswaran Professor, Institute of Neurology, Madras medical college

Lakshmi

Narasimhan Professor, Institute of Neurology, Madras medical college.

Ranganathan

ABSTRACT

Background. Platelets are an important linkage between inflammation, thrombosis and atherogenesis. Platelet indices are markers of platelet function and activation. Mean platelet volume (MPV) has been identified as an independent predictor of the risk of stroke among high-risk individuals with a prior cerebrovascular disease history. Platelet indices may interpret the net pathophysiological effects of a number of cerebrovascular disease risk factors and therefore represents as a broad biomarker of risk of stroke and carotid atherosclerosis. Platelet indices panel is easily available in hemogram and hence can be used with cost effectiveness. Very few studies have looked into this association especially in south Indian population. **Aims and objectives:** To study the association between platelet indices and acute ischemic stroke and its correlation with clinical severity and carotid doppler studies in south Indian population. **Methodology:** This Case control study was done in the Institute of neurology of madras medical college. Case group consisted of 152 willing consecutive patients admitted with acute ischemic stroke. Patient with comorbidities likely to interfere with platelet function or morphology were excluded from the study. The control group consisted of age and sex matched 152 controls. Detailed history taking, Modified Rankin score, clinical examination and CT/MRI imaging done. Carotid artery Doppler study was used to measure the carotid intima media thickness. **Results and conclusions:** From our study we concluded that MPV and platelet count is higher in patients with acute Ischemic stroke and it correlates with its clinical severity. By ROC curve analysis, when MPV level was taken as 11.3 femtoliter, a sensitivity of 80.3% and specificity of 80.3% were found in risk stratification of stroke. There was no association between platelet indices and carotid intimal median thickness

KEYWORDS

Platelet Indices, Carotid Intima Thickness, Stroke Severity

INTRODUCTION:

Platelet activation and aggregation are critical in the pathogenesis of acute ischemic stroke [1]. Larger platelets are metabolically more active, produce more thrombotic factors, aggregate more easily [2]. There exist parameters to monitor platelets and their changes, namely; Mean Platelet Volume (MPV), Mean Platelet Count (MPC), Plateletcrit (PCT), and Platelet Distribution Width (PDW)]. Together, the above-mentioned parameters comprise the platelet indices. Mean Platelet Volume (MPV) is a marker of platelet function and a physiological variable of hemostatic importance [1]. Increase in platelet volume has been reported as a risk factor for acute cerebral ischemia [3]. PDW represents variation in platelet size. Larger PDW also indicates a prothrombotic status [4]. Staszewski et al conducted a study whose results suggest that patients with elevated MPV on admission represent the highest risk for larger infarcts on admission [5]. The severity and the poor outcome of ischemic stroke patients with raised MPV has been reported in the literature [6]. Platelet indices may interpret the net pathophysiological effects of a number of cerebrovascular disease risk factors and therefore represents as a broad biomarker of cerebrovascular disease risk. Platelet indices panel is easily available in hemogram and hence can be used with cost effectiveness. Very few studies have looked into this association especially in south Indian population.

METHODOLOGY

This is a case control study done on 152 consecutive ischemic stroke cases admitted in the wards of neurology in madras medical college Chennai and 152 age and sex matched controls. The study was conducted during the time period from August 2021 to June 2023 after obtaining the Institute ethical committee clearance. All patients with acute ischemic stroke confirmed by history, neurological examination, imaging and willing to give written informed consent were included in the study. Age and sex matched controls satisfying the exclusion criteria were selected from the outpatient care. Patient with comorbid medical illness likely to interfere with platelet function or morphology like chronic kidney disease, chronic liver disease, active infection, autoimmune disease, patient receiving medication likely to interfere with platelet morphology or function like aspirin and other NSAID,

statins, CT brain showing hemorrhagic stroke were excluded from the study. The blood samples drawn for hematological investigations were used for the purpose of the study thereby avoiding exclusive blood withdrawal. 2ml of blood sample was obtained from the antecubital vein of the patient. Samples collected in EDTA vials and fed in to auto analyzer for obtaining the platelet indices. Carotid intima media thickness was calculated by doppler studies and stroke severity was documented by Modified Rankin score (MRS). MRS of 0,1,2 was considered as minor stroke and 3 and above were considered as major stroke.

Statistical Analysis: Data entered in to Microsoft excel sheet and analyzed using SPSS package. 2 sample independent T test for Age (normally distributed), Mann Whitney U test: other continuous variables (non- normally distributed) Chi square for qualitative variable. Statistical Significance at $p < 0.05$.

RESULTS:

The study sample comprised of 152 cases and 152 controls. Mean age of the ischemic stroke cases was 53.55 years and controls were 52.16 years. Males comprised 65.1% of study group and 61.2% of control group. The percentage of diabetes in case and control group was 55.3% and 50% respectively. 79.6% of cases were hypertensives and in control group it was 56.6%. The percentage of smokers in case group and control group was 53.3% and 28.3% respectively. Dyslipidaemia was present in 65.8% of cases and 58.6% of controls. Out of the cases minor stroke comprised of (35.6%) and those with major stroke (64.4%).

Mean platelet volume in case group ranged from (11.36-12.4) with median value of 12 and control group ranged from (10.6-11.2) with median value of 10.8. The platelet count in case group ranged from (2.73-3.6 lakhs/mm³) median value of 3 and control group ranges from (2.6-3.2 lakhs/mm³) median value of 2.8. Value of other haematological parameters are depicted in *Table 1*. High mean platelet volume and high platelet count was found in the study group in comparison to control group which was statistically significant. The median carotid intima media thickness of case group was 0.4mm (right

side) and 0.4mm (left side) and control group was 0.3mm (right side) and 0.4mm (left side) respectively and it doesn't vary significantly in minor and major stroke. Our study also showed high association of well-known risk factors like hypertension and smoking in the case group compared to the control group.

Table 1. Profile of various haematological parameters in ischemic stroke patients.

Platelet indices	Stroke		P value (Mann-Whitney U test)
	Present Median (IQR)	Absent Median (IQR)	
MPV	12(12.4-11.36)	10.8(11.2-10.6)	0.001
Platelet count	3(3.6-2.73)	2.8(3.2-2.6)	<0.001
PDW	12.8(13.2-12.8)	13(13.6-12.4)	0.020
PLCR	24(28-24)	26.6(28-22)	0.162

In terms of MPV levels and platelet count in the case population, there was a significant difference in comparison between groups with minor stroke (35.6%) and those with major stroke (64.4%). (Table 2)

Table2: Association between Platelet indices and Stroke Severity (No, Minor, Major Stroke)

Platelet indices	Stroke			P value Kruskal Wallis test
	No stroke Median (IQR)	Minor Stroke Median (IQR)	Major Stroke Median (IQR)	
Platelet Count	2.8(3.2-2.6)	2.8(3.6-2.6)	3.4(3.8-2.8)	<0.001
MPV	10.8(11.2-10.6)	10.9(11.4-10.7)	12(12.3-11.6)	0.036
PDW	13(13.6-12.4)	12.65(13.12-12)	12.8(13.2-12.4)	<0.001
PLCR	26.6(28-22)	24(28.4-22.8)	24(28-22.8)	0.362

ROC curve analysis was done, the area under the curve for MPV was 0.823(95% confidence interval,0.771-0.876) ($p < 0.001$) indicating the high discriminating value of MPV for predicting severe ischemic stroke based on Rankin score ≥ 3 from a mild stroke event. When MPV level was taken as 11.3 femtoliter, a sensitivity of 80.3% and specificity of 80.3% were found.(figure1)

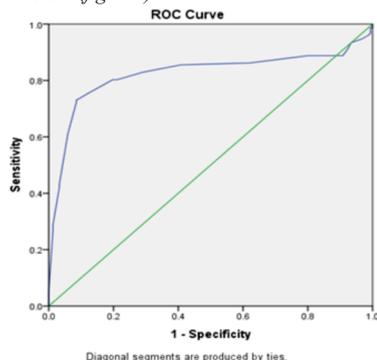


Figure 1-ROC Curve for MPV.

DISCUSSION:

In this study, patients with ischemic stroke due to presence of similar risk factors (like hypertension, diabetes mellitus, smoking) were compared with control group who have similar risk factors without history of stroke. Higher MPV levels has been observed in patients with stroke and acute myocardial infarction than in controls[7]. The fact that MPV may be raised before the acute event has clearly been demonstrated by the PROGRESS study which stated that there is 11% rise of the relative risk of stroke for every femtoliter of MPV increment in 3134 individuals with history of stroke, prospectively followed for a median period of 3.9 years[6]. This study shows that MPV and platelet count is higher in patients of acute ischemic stroke, hence it can be regarded as an independent risk factor for acute ischemic stroke. This may be due to higher concentration of dense granules with excess release of procoagulant materials [8,9,10] There was direct relationship of MPV and platelet count with the severity of stroke. Our ROC analysis verified that high discriminating value of MPV for predicting severe ischemic stroke based on Rankin score ≥ 3 from a mild stroke event. When MPV level was taken as 11.3 femtoliter, a sensitivity of 80.3% and specificity of 80.3% were found. In comparison study of Nurettin et al reported that an MPV cut off value of 9.95 femtoliter had 46.2% sensitivity and 80.0% specificity[11]. There was no association between carotid intima media thickness and platelet indices.

CONCLUSION:

Increased MPV and platelet count is related to ischemic stroke and increased MPV and platelet count correlates with severity of stroke and platelet indices can be considered as a simple cost effective and meaningful laboratory marker test for risk stratification of stroke. According to our results, we recommend further studies to investigate the role of MPV as a prognostic factor in the severity of stroke and its outcome.

Conflict Of Interest.

The authors declared that there is no conflict of interest.

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