ORIGINAL RESEARCH PAPER
Volume-9 | Issue-4 | April-2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A CASE-CONTROL STUDY ON ROLE OF MEAN PLATELET VOLUME AND PLATELET COUNT IN ACUTE ISCHEMIC STROKE

General Medicine

Dr. Dandapantula Sushrutha Postgraduate, Department of General Medicine, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh 534005, India

Dr. P. Kesava Rao* Associate Professor, Department of General Medicine, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh 534005, India *Corresponding Author

Dr. Raghavaram Namburu Assistant Professor, Department of General Medicine, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh 534005, India

ABSTRACT

Introduction: Thrombotic occlusion of a stenosed atherosclerotic vessel is one of the main causes of ischemic stroke. Platelets play a pivotal role in atherothrombotic events during evolution of acute ischemic stroke. Mean Platelet volume (MPV) is a variable of platelet function with larger platelet being more reactive.
Aims and objectives: To determine the association between incidence of ischemic stroke and MPV, platelet count.
Material and methods: The study was conducted in 50 cases with age, sex matched controls between December 2018 to November 2019 at ASRAM Medical College, Eluru, Andhra Pradesh.
Inclusion criteria: All patients more than 18yrs of age presenting with ischemic stroke less than 48hrs of onset.
Exclusion criteria: Haemorrhagic stroke, duration of stroke more than 48hrs, patients having diseases and/or taking drugs causing platelet abnormalities
Results: MPV in cases was 7.45±0.81fL and in controls was 6.84±0.59fL (p value <0.005) Platelet count in cases and controls was 2.6±0.5lakh/ µL and 2.7±0.85lakh/µL respectively (p value >0.005)
Conclusion: Increased MPV is independently associated with increased incidence of acute ischemic stroke.

KEYWORDS

MPV- Mean Platelet volume, IS- Ischaemic stroke, fL - femtolitre

Introduction:
Cerebrovascular diseases include some of the most common and devastating disorders: ischemic stroke and hemorrhagic stroke. Stroke is the second leading cause of death worldwide, with 6.2 million dying from stroke in 2015, an increase of 830,000 since the year 2000. While stroke has grown in incidence worldwide, it is declining among the affluent and rising among those with less access to medical care. In the United States, the incidence of stroke has declined steadily since at least 1958, and stroke is currently the fifth leading cause of death with 133,000 dying in 2014. Despite this progress, however, stroke remains the most common disabling disease in the United States and in many forms is preventable.

A stroke, or cerebrovascular accident, is defined as an abrupt onset of a neurologic deficit that is attributable to a focal vascular cause. Thus, the definition of stroke is clinical, and laboratory studies including brain imaging are used to support the diagnosis.

Cerebral ischemia is caused by a reduction in blood flow that lasts longer than several seconds. Neurologic symptoms are manifest within seconds because neurons lack glycogen, so energy failure is rapid. If cessation of flow lasts for more than a few minutes , infarction or death of brain tissue results. Ischemic stroke (IS) accounts for about 85% of cases, primary intracerebral haemorrhage (ICH) for 10% and subarachnoid haemorrhage (SAH) for the remaining 5%. Thrombotic occlusion of a stenosed atherosclerotic vessel is one of the main causes of ischemic stroke.

Platelets play a pivotal role in atherothrombotic events during evolution of acute ischemic stroke. Initially platelets adhere to the damaged vessel, resulting in recruitment of further platelets, followed by aggregation, formation of a platelet plug and finally thrombotic occlusion.

Platelets are enucleate, heterogeneous regarding their size, density and haemostatic potential For example; large platelets contain more dense granules, undergo greater in vitro aggregation in response to agonists such as ADP and collagen, and release more serotonin and b-thromboglobulin (b-TG). In normal individuals the platelet count is inversely proportional to MPV; platelet mass (the product of MPV and platelet count) is a near constant. Mean Platelet volume (MPV) is a variable of platelet function with larger platelet being more reactive

AIMS AND OBJECTIVES

- To determine the association between incidence of ischemic stroke and MPV, platelet count
- To determine whether an association exists between mean platelet volume and severity of stroke.

MATERIAL AND METHODS

- The study was conducted in 50 consecutive caseswithin forty eight hours of onset of symptoms and satisfying the inclusion and exclusion criteria with age, sex matched controls between December 2018 to November 2019 at ASRAM medical college, Eluru, Andhra Pradesh.
- Mean Platelet Volume was measured using an automated analyzer in both EDTA and citrate samples.

CASES:
INCLUSION CRITERIA:
All patients of ischaemic stroke of less than 48hrs from onset
Patients aged above 18yrs of age

EXCLUSION CRITERIA:

1. Thrombocytopenia.
2. Known cases of hereditary disorders of large platelets.
3. Medications that can reduce the platelet count (hydroxyurea, antineoplastic agents, and inhibitors of the platelet integrin αIIbβ3)
4. Hemorrhagic stroke.
5. Patients who couldn't communicate because of severe stroke, aphasia or dementia without a valid surrogate respondent.
   (A valid surrogate respondent is considered a spouse or first degree relative that is living in the same home or is self- identified as aware of the participant's previous medical history and current therapies)
6. Patients presenting 48hrs after the onset of neurological symptoms.
7. Peripheral smear showing platelet aggregates.
8. Recurrent stroke

Controls:
Controls were primarily hospital based. Each control was matched for sex and age (+/- 5 years). There was at least one control for each caserecruited.

Inclusion criteria:
1. Relative of a patient from ward.
2. Unrelated Visitor of any patient.
3. Patients attending the hospital or outpatient clinic for other illness.

Exclusion criteria:
1. Individuals with a previous history of stroke.
2. Thrombocytopenia
3. Peripheral smear showing platelet aggregates.

INVESTIGATIONS DONE:
1) Haemoglobin
2) Total Leukocyte count / Differential count
3) Mean Platelet Volume
4) Platelet Count
5) Peripheral smear
6) Random blood sugar
7) Lipid Profile
8) CT/MRI Brain (cases)

MODIFIED RANKIN'S SCALE USED TO ASSESS CLINICAL SEVERITY OF STROKE
Score Description:
1 No symptoms at all
2 No significant disability despite symptoms; able to carry out all usual duties and activities
3 Slight disability; unable to carry out all previous activities, but able to look after own affair without assistance
4 Moderate disability; requiring some help, but able to walk without assistance
5 Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance.
6 Severe disability; bedridden, incontinent and requiring constant nursing care and attention
7 Dead

This scale is used to access severity of stroke.

The MPV (Mean platelet volume) is directly derived from the analysis of the platelet distribution curve. The volume of each platelet is plotted in a histogram and the mean of it is taken.

RESULTS:
AGE DISTRIBUTION
The mean age for the cases was 58.10±13.67 when compared to 57.50±13.82 for the controls. The maximum No of cases in this study were in the age group between 51- 60 which was followed by age group of61-70.

GENDERDISTRIBUTION
Cases and controls are gender matched with males 76% and females 24%

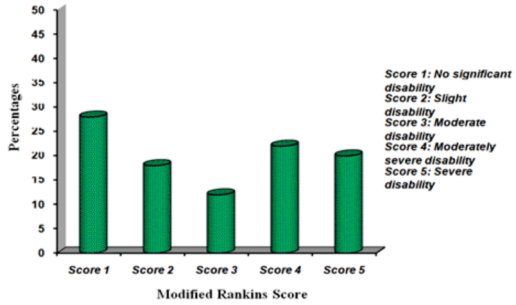
RISK FACTOR PROFILE
Out of the many risk factors for stroke metabolic syndrome was the most prevalent in this study group with a percentage of 74 among cases and 48 among controls with a significant p value of .008. Hypertension came second with percentage of 52 among cases and 34 among controls with a trend towards significance with a p value of .069.

COMPARISON OF BLOOD PARAMETERS IN CASES AND CONTROLS

Blood parameters	Cases	Controls	Significance
Hemoglobin (g/dl)	13.37±2.21 (7.10-18.60)	12.49±1.71 (8.30-16.00)	t=2.256; P=0.026*
Total count (%)	9728.00±2966.96 (4300-15900.0)	9638.00±3168.39 (4200-18000)	t=0.145; P=0.884
Platelet count (%)	2.6±0.5lakh (1.43-4.40)	2.7±0.85 (1.60-5.40)	t=0.881; P=0.380
Neutrophil (%)	71.14±12.02 (39-89)	75.86±9.79 (48-96)	t=2.152; P=0.034*
Lymphocyte (%)	23.98±9.98 (7-44)	20.74±11.11 (3-70)	t=1.535; P=0.128
Eosinophil (%)	3.20±2.72 (1-16)	2.51±1.79 (1-10)	t=1.422; P=0.159
Monocyte (%)	2.70±1.19 (1-6)	2.56±1.23 (1-5)	t=0.496; P=0.621

Results are presented as Mean ± SD (Min-Max)

STROKE CLINICAL SEVERITY SCORE



COMPARISON OF MPV IN CASES AND CONTROLS

MPV (fL)	Cases	Controls	Significance
MPV(EDTA)	**7.86±0.82** (6.50-10.00)	**7.58±0.70** (5.90-9.00)	**t=1.834;P=0.074+**
MPV(CITRATE)	**7.45±0.81 (6.10-9.60)**	**6.84±0.59 (5.80-8.20)**	**t=2.894 P=0.005****

Results are presented as Mean ± SD (Min-Max)

MULTIVARIATE LOGISTIC REGRESSION ANALYSIS TO PREDICT STROKE
It is demonstrated by multiple logistic regression analysis that MPV with a p value of 0.009and an adjusted OR (Odds ratio) of 8.10, it is one of the most important risk factors associated with stroke only second to hypertension which had a p value of<0.001 and adjusted OR of 10.10.

DISCUSSION:
- MPV assessment using EDTA and Citrate has been done only in one other study i.e. Butterworth et al and the values were 8.04 ±1.04 (7.69±0.83) for EDTA and 7.35±1.05(7.09±0.74) for citrate.
- The values were comparable even though these studies have been done in different populations.
- All the other studies have used EDTA as the anticoagulant and there is no uniformity in the collection method, time of analysis, transport of the specimen or the storage.
- O'Malley study has performed the test after 24hrs of storage in room temperature.
- Only study with a *lower MPV* in cases compared to controls is Tohji et al. did not specify the time after which samples were analyzed or temperature.
- In our study, the *platelet count is showing a slightly lower trend in the cases as compared to controls* with values of 2.6±0.5lakh/ µL and 2.7±0.85lakh/µL respectively (p value >0.005)
- This trend is not statistically significant. This pattern has been seen in all the other case control studies which included O'Malley et al, Butterworth et al and Tohji et al.
- The association of MPV with severity of strokewas determined by comparing the modified Rankin's score with corresponding mean values of MPV in each group. MPV – EDTA showed a p value of 0.283 and MPV –citrate showed a pvalue of 0.318, both of which were statistically insignificant.
- O' Malley conducted similar studies and divided the outcomes as independent and dependent. No statistical significance with MPV was obtained.
- MPV has been compared with the various risk factors for stroke.
- Multiple logistic regression done of the baseline risk factors showed that hypertension was the most common risk factor involved in stroke with a p value of <0.001and adjusted OR of 10.10.MPV was higher in patients with stroke
- Diabetes mellitus had a suggestive significance (0.022) when compared to controls.
- MPV in female gender was higher when compared to males with a p value of 0.034 in citrated samples.

CONCLUSION:

- This study has shown an elevation of MPV in acute phase of ischemic stroke. Within this relationship and adjusting for other significant variables in multivariate regression analysis, it can be stated that an increase in MPV is independently associated with stroke
- This study did not find a statistically significant correlation between clinical severity of stroke and mean platelet volume.
- No statistical correlation was obtained when MPV was compared to the various subtypes of stroke
- The study did not find correlation between platelet count and stroke.

REFERENCES:

1. Harrison's principles of internal medicine , 20th edition
2. O'Malley T, Langhorne P, Elton R, Stewart C. Platelet size in stroke patients. Stroke 1995;26:995–999.
3. Pathansali R, Smith NM, BathPM. Prothrombotic megakaryocyte and platelet changes in hypertension are reversed following treatment: a pilot study. Blood 2001;12**:**144-149.
4. Tohgi H, Suzuki H, Tamura K, et al. Platelet volume, aggregation, and adenosine triphosphate release in cerebral thrombosis. Stroke 1991;22: 17–21.
5. Bath PMW, Butterworth RJ. Platelet size: measurement, physiology and vascular disease. Blood1996; 7: 157–61.
6. Muscari A, Puddu GM, Cenni A, Silvestri MG, Giuzio R, Rosati M, et al. Mean platelet volume (MPV) increase during acute non-lacunar ischemic strokes. Thromb Res 2008, doi:10.1016/j.thromres.2008.03.025
7. Pikija S, Cvetk D, Hajduk M, TrkuljaV . Higher mean platelet volume determined shortly after the symptom onset in acute ischemic stroke patients is associated with a larger infarct volume on CT brain scans and with worse clinical outcome. Clinical Neurology and Neurosurgery 2009; 111:568–573.
8. Bonita R, Beaglehole R. ―Modification of Rankin Scale: Recovery of motor function after stroke. Stroke 1988 ; 19(12):1497-1500
9. Lippi G, Salvagno GL, Targher G and Guidi GC. Relationship between Mean Platelet Volume and Bichemical Components of metabolic syndrome. Clin Drug Invest 2007; 27 (10): 731-732.
10. Butkiewicz AM, KemonaH ,Dymicka-Piekarska V, Matowicka-Karna J, Radziwon P and Lipska A. Platelet count, mean platelet volume and thrombocytopoietic indices in healthy women and men. Thrombosis Research 2006; 118(2):199-204. (Abstract).
11. Muscari A, Puddu GM, Cenni A, Silvestri MG, Giuzio R, Rosati M, et al. Mean platelet volume (MPV) increase during acute non-lacunar ischemic strokes. Thromb Res 2008, doi:10.1016/j.thromres.2008.03.025.