

Study of Mean Platelet Volume in Ischemic Stroke

¹Dr Vikash Kumar Agarwal, Junior Specialist, SK Govt. Medical College, Sikar

²Dr Ravi Kumar Bansal, Medical officer, CHC, Bhiwadi, Alwar

³Dr Swati Agarwal, Gynaecologist Sikar

Corresponding Author: Dr Vikash Kumar Agarwal, Junior Specialist, SK Govt. Medical College, Sikar

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Abstract

Background: Mean platelet volume, as well as platelet count, are an index of haemostasis and its dysfunction i.e. thrombosis. Aim of this study is to investigate the association between mean platelet volume (MPV) & acute ischemic stroke.

Methods: This retrospective cross-sectional study included 200 patients admitted to the emergency & general opd (medicine & pediatric) of a tertiary care hospital in JLN Medical College Ajmer from Aug. 2020 to Nov 2020. The data were evaluated according to MPV levels, National Institutes of Health Stroke Scale (NIHSS) scores. The patients were divided into groups based on MPV level ≤ 7.5 , 7.6-10.0, 10.1-12.5, ≥ 12.6 .

Results: In our study, a significant association was found between severity of stroke (according to NIHSS criteria) and MPV in male and female populations ($p < 0.0001$ and $p < 0.0001$ respectively). A significant difference was found between MPV values of all 3 categories ie patients of severe stroke had higher value of MPV than those of mild and moderate stroke and patients of moderate stroke had higher values than those of mild stroke.

Conclusion: This is a simple and cost effective test which can be easily done at any primary care centre and can serve as a useful marker to differentiate ischemic stroke from hemorrhagic stroke.

Keywords: Ischemic stroke, Mean platelets volume,

Introduction

A stroke, or cerebrovascular accident, is defined as an abrupt onset of a neurologic deficit that is attributable to a focal vascular cause¹ Worldwide, stroke is the commonest cause of mortality after coronary artery disease, and the third overall leading cause of morbidity, according to the global burden of diseases (GBD) study in 1990.² 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.

Platelet indices (Mean Platelet Volume)

Platelet size (MPV), a marker (and possibly a determinant) of platelet function is a physiological variable of haemostatic importance. Large platelets are metabolically more reactive, produce more prothrombotic factors and aggregate more easily. They also contain more dense granules and release more

serotonin and beta thromboglobulin than do small platelets. Mean platelet volume, as well as platelet count, are an index of haemostasis and its dysfunction i.e. thrombosis.³ The severity and poor outcome of ischemic stroke patients with increased MPV has been reported in the literature.⁴

Arikanoglu A et al⁵ reported that MPV are higher in the patients with ischaemic stroke who died in comparison to those who survived. The inflammation seems to be related with the pathogenesis of cerebral infarction.⁶

Assessment of severity in acute ischemic stroke

The NIH Stroke Scale (NIHSS)⁷ measures neurological function in patients with signs and symptoms of stroke. The NIHSS neurologic examination includes 15 individual elements. The elements are summed to provide an overall assessment of stroke severity, with the score ranging from 0 to 42.

- 0-No stroke symptom
- 1-4 Minor strokes
- 5-15 Moderate strokes
- 16-20 Moderate to severe stroke
- 21-42 severe strokes

National Institutes of Health Stroke Scale (maximum = 42)

Response	(Score)	Response	(Score)
Level of consciousness		Motor arm (left and right)	
alert	(0)	no drift	(0)
drowsy	(1)	drift before 10 seconds	(1)
stuporous	(2)	falls before 10 seconds	(2)
coma	(3)	no effort against gravity	(3)
		no movement	(4)
Response to level of consciousness questions*		Motor leg (left and right)	
answers both correctly	(0)	no drift	(0)
answers one correctly	(1)	drift before 5-10 seconds	(1)
answers neither correctly	(2)	falls before 5-10 seconds	(2)
		no effort against gravity	(3)
		no movement	(4)
Response to level of consciousness commands†		Ataxia	
obeys both correctly	(0)	absent	(0)
obeys one correctly	(1)	one limb	(1)
obeys neither	(2)	two limbs	(2)
Pupillary response		Sensory	
both reactive	(0)	normal	(0)
one reactive	(1)	mild	(1)
neither reactive	(2)	severe loss	(2)
Gaze		Language	
normal	(0)	normal	(0)
		mute or global aphasia	(3)
Visual fields		Facial palsy	
no visual loss	(0)	normal	(0)
partial hemianopsia	(1)	minor paralysis	(1)
complete hemianopsia	(2)	partial paralysis	(2)
bilateral hemianopsia	(3)	complete paralysis	(3)
Dysarthria		Extinction/inattention	
normal	(0)	normal	(0)
mild	(1)	mild	(1)
severe	(2)	severe	(2)

* Level of consciousness questions: "How old are you?" "What month is this?"

† Level of consciousness commands: "Squeeze my hand" (using nonparetic hand), "Close your eyes."

NIHSS is a useful tool for early prognostication and serial assessment. In a trial by Adams HP et al. comparing various stroke outcome and severity scales⁸, the NIHSS was found to be superior to all other scales.

Study design- Comparative cross sectional study

Inclusion criteria

200 Patients with clinical and/or radiological evidence of cerebral infarction regardless of age, sex, religion or ethnicity admitted within 24 hours of onset of neurological signs and symptoms including-

- A. Patients in whom the neurological signs and symptoms resolved within 24 hours with NO radiological evidence (transient ischemic attack)
- B. Patients with clinical radiological evidence of lacunar infarcts.
- C. Patients matching above criteria who gave written and informed consent for the study

Exclusion Criteria

- 1. Patients with known or suspected source of sepsis
- 2. Patients with known pre-existing inflammatory or connective tissue disorders (Rheumatoid Arthritis, TB, etc) or malignancy
- 3. Severely anaemic patients (Hb less than 7.0 gm/dl)
- 4. Patients with radiological evidence (CT/MRI) of Hemorrhagic stroke/ extra dural hematoma/ sub dural hematoma/ intra cranial space occupying lesion.
- 5. Patients with known or suspected thrombo-embolic disorder
- 6. Patients on medication causing thrombocytopenia (NSAIDs/ antiplatelet agents) or leucopenia (anti-cancer agents, anti-thyroid medications, immunosuppressants) for at least 6 months⁹
- 7. Patients who refused to give consent for investigations

Statistical analysis

The statistical software used was SPSS version 17.0 (for windows) and Graphpad software. The description of data was in the form of mean (\pm) SD .Student-t Test (t) and was used for comparison between two groups While X² (Chi-square) test was used for categorical (quantitative) data

Results were considered significant if **P \leq 0.05.**

Observations

Table 1: Age distribution of cases (males & female)

Age in years	Male	Female
<20 y	2	6
21-30y	1	6
31-40y	5	7
41-50	22	18
51-60	21	15
61-70	35	27
71-80	13	18
81-90	1	3
>90 y	0	0
Total	100	100

Average age for males 57.87 \pm 13.44, female 58.18 \pm 11.886 & P value is 0.8630, which is not significant.

Table 2: Severity of stroke in male & female patients according to NIHSS

Score	Description	Male	Female
0	No stroke	0	0
1-4	Minor stroke	10	11
5-15	Moderate stroke	67	65
>/16	Severe stroke	23	24

Table 3: mean platelet volume (MPV) In Male & Female

Range	Male	Female
<= 7.5 fL	5	03
7.6-10.0 fL	38	41
10.1-12.5 fL	47	45
>=12.6 fL	10	11
Total	100	100

Average MPV in males is 10.28 ± 1.568 & in females is 10.41 ± 1.549 & p value is 0.5549 which is not significant.

Figure 1

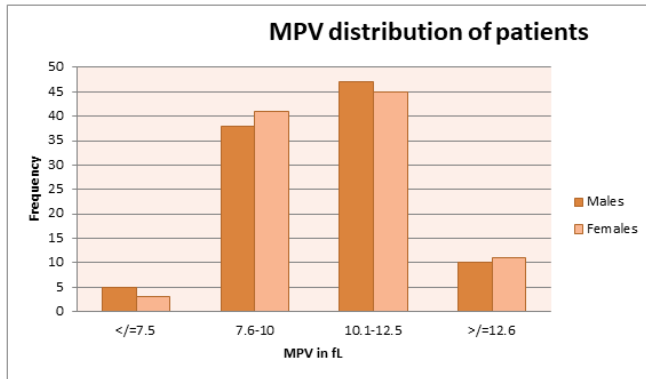


Table 4: Corelation of severity of stroke with MPV Male

	Mild stroke	Moderate stroke	Severe stroke
N	10	67	23
ΣX	89.3	658.9	279.8
Mean	8.93	9.8343	12.1652
ΣX^2	803.75	6589.47	3418.32
S.D	0.8367	1.2888	0.8116

p is <0.00001 (extremely significant)

In Females

	Mild stroke	Moderate stroke	Severe stroke	total
N	11	65	24	100

ΣX	99.9	650.7	290.6	1041.2
Mean	9.0818	10.0108	12.1083	10.412
ΣX^2	929.05	6614.85	3534.8	11078.7
S.D	1.4757	1.2553	0.8371	1.5496

p is <0.00001 (extremely significant)

Table 5: Comparison of results in males and females

Category	T value	Df (degree of freedom)	Std error of difference	95% Confidence interval	P value	Interpretation
Mild stroke	0.2825	19	0.469	-1.264139 to 0.961439	0.7806	Not significant
Mod stroke	0.221	130	0.221	-0.614102 to 0.262102	0.4282	Not significant
Sev stroke	0.2286	45	0.241	-0.429531 to 0.539531	0.8202	Not significant

No significant difference in MPV level was found in male and female patients

Discussion:

In our study, a significant association was found between severity of stroke (according to NIHSS criteria) and MPV in male and female populations. (p<0.0001 and p<0.0001 respectively). A significant difference was found between MPV values of all 3 categories ie patients of severe stroke had higher value of MPV than those of mild and moderate stroke and patients of moderate stroke had higher values than those of mild stroke.

Conclusion

In our study, we found that MPV is a specific hematological marker which is exclusively and significantly elevated in patients of acute ischemic stroke.

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