

## A HOSPITAL BASED COMPARATIVE STUDY OF SERUM MEAN PLATELET VOLUME IN ISCHEMIC STROKE PATIENTS.

Dr. Atul Baid<sup>1</sup>, Dr. Chhavi Raman Baid<sup>2</sup>

<sup>1</sup>Associate Professor, Department of Medicine, Mata Gujri Memorial Medical College and Lions Seva Kendra Hospital, Kishanganj, Bihar, India.

<sup>2</sup>Assistant Professor, Department of Obstetrics and Gynaecology, Mata Gujri Memorial Medical College and Lions Seva Kendra Hospital, Kishanganj, Bihar, India.

**Article Info:** Received 24 August 2019; Accepted 20 September. 2019

**DOI:** <https://doi.org/10.32553/ijmbs.v3i9.554>

**Corresponding author:** Dr. Atul Baid

**Conflict of interest:** No conflict of interest.

### Abstract

**Objectives:** This study was evaluated the association of serum means platelet volume, functional outcome and various parameters in patients of ischemic stroke.

**Methods:** Detail history clinical examinations and relevant investigations were performed to all subjects. Lab parameters included as platelets counts, mean platelet volume and others were performed. The diagnosis of ischaemic stroke was made clinically with the evidence of acute lesions (infarct) confirmed by brain CT or MRI within the first 24 h of presentation of symptoms. Each patient condition was assessed by modified Rankin Scale.

**Results:** Data was analyzed using SPSS version 26 software. Related-Samples Wilcoxon Signed Rank Test was applied. Mean and standard deviation were calculated. P value was taken less than or equal to 0.05 for significant differences ( $p \leq 0.05$ ).

**Conclusions:** There was no significant difference seen in platelet count of ischemic stroke cases with control. Mean platelet volume was significantly higher in ischemic stroke cases than normal subjects. Majorities of ischemic stroke cases had moderate disability, required some help but able to walk without assistance. MPV was higher in ischemic stroke cases that had higher Modified Rankin scale. Hence, serum MPV can be used as meaningful laboratory findings for early detection of ischemic stroke.

**Key words:** Ischemic stroke, mean platelet volume, platelet count, modified Rankin score

### Introduction:

The mean platelet volume (MPV) is one of the most commonly used laboratory markers related platelet functions [1, 2]. Stroke results in more than 5 million deaths each year and at least 1 of 6 patients who survive will suffer another stroke within 5 years [3].

MPV is an indicator of platelet activation that is accepted to be associated with systemic inflammatory responses. The relationship between ischemic stroke and MPV has been thoroughly examined in numerous publications. In earlier studies, it was generally accepted that increased platelet activation is related to cerebral infarction and coronary heart disease [4].

Platelet activation plays a key part in the process of atherosclerosis and then its potentially major adverse clinical outcomes, such as ischemic stroke and myocardial infarction (MI) [5, 6]. It is well documented that there is a direct relationship

between the platelet physiology and ischemic stroke by a number of observations, including the appearance of platelet thrombi on atheroma, and certain antiplatelet agents (e.g., aspirin) significantly reduce the incidence of ischemic stroke after initial transient ischemic attacks [7,8]. Objectives of our study were to evaluate the association of serum mean platelet volume, functional outcome and various parameters in ischemic stroke patients.

### MATERIALS & METHODS

This present study was conducted in Department of Medicine, Mata Gujri Memorial Medical College and Lions Seva Kendra Hospital, Kishanganj, Bihar during a period from January 2019 to August 2019. Attendant of entire subjects signed an informed consent approved by institutional ethical committee of Mata Gujri Memorial Medical College, Kishanganj, Bihar, India was sought.

This present study consist two groups. Group A was case group who 30 subjects of ischemic stroke with

age 40 to 70 years. Group B was control group who had 30 normal subjects with age 40 years to 67 years no clinical evidence of any active or old cerebrovascular accidents, malignant causes and not on any drugs (medications) affecting the function of the platelets.

**Procedures:**

A random sampling method was used for data collection with irrespective of sex.

Detail history clinical examinations and relevant investigations were performed to all subjects. Patients who had peripheral vascular disease, previous stroke patients, acute bacterial/viral infections, any inflammatory conditions, pregnancy, acute myocardial infarction, malignancies symptoms of cerebrovascular diseases were excluded from this study.

Lab parameters included as platelets counts, mean platelet volume and others were performed. The diagnosis of ischaemic stroke was made clinically with the evidence of acute lesions (infarct) confirmed by brain CT or MRI within the first 24 h of presentation of symptoms. Each patient condition was assessed by Rankin Scale. Severity of ischaemic stroke was Modified Rankin scale that scores on a scale of 0–6,

with 0 as patients with no symptoms and 6 being dead. Patients with scores 1 are no significant disability and able to carry out all usual activities despite some symptoms. Patients with scores of 2 are considered slight disability and able to look after own affairs without assistance, but unable to carry out all previous activities. Patient with Scores of 3 or greater considered as more severe and need support to lead their daily life. Patients with scores 4 are considered as moderately severe disability and unable to attend to own body needs without assistance and unable to walk unassisted. And patients with scores 5 are considered as severe disability, requires constant nursing care and attention, bedridden, incontinent.

**STTISTICAL ANALYSIS**

Data was analyzed using SPSS version 26 software. Related-Samples Wilcoxon Signed Rank Test was applied. Mean and standard deviation were calculated. P value was taken less than or equal to 0.05 for significant differences ( $p \leq 0.05$ ).

**OBSERVATIONS**

This present study consists of two groups. Group A (case group) had 30 subjects with ischemic stroke. And group B (control group) had 30 normal subjects with no history of ischemic stroke.

**Table 1: Sex**

Gender wise distribution	Case (N=30)		Control (N=30)	
	Male	Female	Male	female
No. of subjects	22(73.34%)	8(26.66%)	21(70%)	9(30%)

In this present study majorities of cases were male. 73.34% and 70% males were seen in group A and group B respectively.

**Table 2: Parameters**

Parameters	Case (N=30) Mean ± S.D	Control (N=30) Mean ± S.D	P - value	
Age	55.600 ± 7.261	61.533 ± 6.801	0.000	Significant
Platelet	245916.200 ± 58706.974	255281.867 ± 63085.427	0.544	Non significant
MPV	9.633 ± 1.098	5.867 ± 1.074	0.000	Significant

In this present study, mean age of group A (case) was 55.600±7.261 and group B was 61.533 ± 6.801 years. And it was significantly differenced ( $p=0.000$ ). Mean platelet count of group A and group B was 245916.200 ± 58706.974 and 255281.867 ± 63085.427 respectively. And it was no significant difference ( $p= 0.544$ ). Mean platelet volume of group A and group B was 9.633 ± 1.098 and 5.867 ± 1.074 cells/mm<sup>3</sup> respectively. And it was significantly differenced ( $p=0.000$ ).

**Table 3: Modified Ranking scores of stroke patients**

Modified Ranking Scores	Stroke patients	Percentage of patients
2	4	13.33%
3	12	40%
4	9	30%
5	5	16.67%
Total No.	30	100%

In this present study, among all ischemic stroke cases, Modified Rankin scores of majorities of cases 12(40%) were 3. 9(30%), 5(16.67%) and 4(13.33%) cases were 4, 5 and 2 scores respectively.

## DISCUSSIONS

Acute ischemic stroke (AIS) has been clinically defined as a sudden-onset loss of focal cerebral function that persists for more than 24 hours. Worldwide, it is the second most prevalent reason for death and the most common reason for long-term incapability. The mechanism of stroke is largely described as any disease course that impedes oxygen and nutrient rich blood stream to the brain tissues and leads to focal neurologic syndromes that are related to interruption of substrates, such as oxygen and glucose, essential for production of high-energy phosphate compounds and the existence of mediators of secondary ischemic cellular injury. When a cell consumes the oxygen and substrates, death of cell are activated via pro-apoptotic genes, cell loses vitality and dies eventually [9, 10]. In our study, ischemic stroke was commonly seen in males than females and mean age of ischemic stroke was  $55.600 \pm 7.261$  years.

These findings were in concordance with the study done by Javed Akhter Rathore et al [11] and R P Eapen et al[12] where maximum frequency of stroke was seen between ages 55-74 years and 51-60 years.

Age is the single most important risk factor for stroke. For each successive 10 years after age 55, the stroke rate doubles in both men and women [13,14].

Study done by V.R Bhatt el al [15] and R P Eapen [16] also suggest that incidence of stroke events are more in males than in females. The most common gender difference in stroke is due to lifestyle factors such as cigarette smoking and alcohol consumption in males.

MPV has been identified to be of clinical importance in thromboembolic diseases. Increment in the mean platelet volume (MPV) level has been observed in patients with stroke [17] and acute myocardial infarction [18] than in control subjects. Aleksandra Korniluk et al. [19] found that MPV and MPV/PC ratio was significantly higher in patients presenting with cerebrovascular stroke compared to a control group. Similarly, O'Malley et al. [20] found greater MPV values in patients with acute ischemic stroke than in controls. Conversely, Cho et al. did not find any significant difference between patients and controls in relation to MPV values, [21] but most of the

studies proved that MPV levels were higher in stroke patients [19].

In our present study, platelets count of ischemic stroke patients and normal subjects were  $245916.200 \pm 58706.974$  and  $255281.867 \pm 63085.427$  respectively. And it was no significant difference ( $p=0.544$ ). Mean platelet volume of ischemic stroke patients and normal subjects were  $9.633 \pm 1.098$  and  $5.867 \pm 1.074$   $\text{cu/mm}^3$  respectively. And it was significantly differenced ( $p=0.000$ ). We found that mean platelet volume was significantly increased in ischemic stroke patients with respect to control.

Vizoli et al reported that platelet volumes are determined in bone marrow by thrombopoetin, cytokines and growth factor that may explain changes in MPV value in vascular and inflammatory events [22,23]. Increased MPV is considered an indicator of platelet function and an independent predictor of coronary artery disease (CAD), severity of CAD, larger infarct volume in stroke patients and severity of strokes [24,25]. Slavka et al [26] showed that subjects with higher MPV ( $>11.01$  fL) had 1.5 times higher vascular mortality risk than patients with low MPV ( $<8.7$  fL) value. In the same study, significant positive relationship between high MPV and the risk of ischaemic heart disease was identified. Arevalo-Lorido et al [27] reported that higher MPV levels in stroke patients are associated not only with overall morbidity and mortality, but also their cardiovascular mortality.

Butterworth et al. [28] reported that there was lower platelet count in the stroke group, whereas some studies showed that patients with acute ischaemic stroke had higher platelet counts than the control groups [29,30] In our study there was not significant changes was seen in platelets count of case with control ( $p=0.544$ ).

The mechanisms by which elevated MPV might play a,role in the development or progression of cardiovascular diseases are not completely understood, but there are some possible explanations. First, platelet reactivity is increased with ischemic stroke as evidenced by the increased levels of soluble platelet P-selectin and increased levels of thromboxane A2 which are considered as atherogenic factors [31, 32]. Second, cytokines such as interleukin-3 or interleukin-6 which plays an important role in the pathophysiology of ischemic stroke influence megakaryocyte ploidy which in turn affect the platelet size and can lead to the production

of more reactive, larger platelets [33] and so the proinflammatory condition before the ischemic stroke may lead to a higher MPV which in turn lead to prothrombotic condition. Finally, large platelets may be a consequence of secretion and metabolism of biologically active substances during aging, diabetes, high blood pressure, and obesity and consequently cause increased risk of ischemic stroke [34].

Functional outcomes, which are measured by means of disability and an individual's loss of independence in activities of daily living, are considered to be among the most meaningful patient outcomes [35]. In this study modified Rankin scale (mRS) is used as a measure to assess the functional outcome in neurologic patients. It is a clinician reported measure of global disability and has been widely applied for evaluating stroke patient outcomes, degree of disability or dependence in daily activities [36].

The present study evaluated the role of MPV for expecting severe and extensive acute ischaemic brain stroke from its mild status, and it showed that measuring MPV within the first 24 h of brain stroke occurrence was strongly associated with the severity of disease, and could effectively distinguish a severe condition from a milder degree of the disorder, this present study also revealed that MPV increases early in the strokes characterized by more neurological impairment in comparison with those with less compromised categories according to modified Rankin score. This may indicate more release of reactive platelets in the circulation in reaction to mediators coming from the peripheral ischaemic sites. In this current study, majorities of ischemic stroke cases (40%) had 3 modified Rankin score. They had moderate disability, required some help but able to walk without assistance. 30% ischemic stroke cases had 4 modified Rankin scores. They had moderately severe disability, unable to walk without assistance and unable to attend to own bodily needs without assistance.

Elsayed AM et al [37] were supported the findings of our study. They stated that MPV value was higher and more significant ( $p= 0.011$ ) in patients' group with high Rankin scale (P3) in comparison with those with lower scores.

## CONCLUSIONS

There was no significant difference seen in platelet count of ischemic stroke cases with control. But mean platelet volume was significantly higher in ischemic

stroke cases than control. Majorities of ischemic stroke cases had moderate disability, required some help but able to walk without assistance. MPV was higher in ischemic stroke cases that had higher Modified Rankin scale. Hence, serum MPV can be used as meaningful laboratory findings for early detection of ischemic stroke.

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