A Study of Association of Mean Platelet Volume with Risk and Severity of Ischaemic Stroke in One Hundred Cases

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ABSTRACT

BACKGROUND

'Stroke' is an abrupt onset of a neurologic deficit that is attributable to a focal vascular cause. Because of the rise in ageing population, the burden of stroke is likely to increase exponentially in the near future. Mean Platelet Volume (MPV), a marker and possibly a determinant of platelet function is a physiological variable of haemostatic importance. Platelet count is an index of haemostasis. Changes in MPV play a more important role in haemostasis than platelet count. So far, very few studies have looked at the association between platelet size and its relation to causation of ischaemic stroke. This study was carried out to determine as to whether elevated mean platelet volume level is an independent risk factor for ischaemic stroke and also to evaluate its relationship with severity of ischaemic stroke using modified Rankin Scale.

METHODS

One hundred patients above 18 years of age, irrespective of sex admitted with first episode of ischaemic stroke within 24 hours of onset of symptoms, diagnosed based on clinical and radiological features, were included in the study. Mean platelet volume was measured on admission before administration of antiplatelet drugs and severity of the stroke was assessed using modified Rankin Scale at the time of presentation.

RESULTS

Out of hundred patients, 61% were males and 39% were females. Patients in the age group of 40 to 60 years were 39%, while 38% were aged between 60 - 80 years. The comorbid conditions present were hypertension in 44% and diabetes mellitus in 20%. MPV was same among all the age groups with a mean value of 10.30, and the 'p' value was 0.952 which is statistically not significant. The clinical severity of stroke at presentation as determined by the modified Rankin Scale was severe disability in 53% of the cases. The relation of MPV to severity of stroke was also statistically not significant. There was no mortality in this study group.

CONCLUSIONS

MPV levels has got no statistically significant correlation with ischaemic stroke. This study also did not find a statistically significant correlation between clinical severity of stroke and mean platelet volume.

KEYWORDS

Stroke, Mean Platelet Volume, modified Rankin's Scale, Severity

BACKGROUND

Stroke is one of the common causes of morbidity and mortality. It is associated with increased long-term mortality; Stroke is the most common cause of death after cardiac disease and cancer. They cause around 200,000 deaths in United States and 334-424/ 100,100 deaths each year in India and a major cause of disability. About 15% to 25% of stroke survivors become disabled permanently, while 20% remain in institutional care for three months after their stroke. The incidence of stroke increases with age and the number of strokes is projected to increase as the elderly population grows, with a doubling in stroke deaths in the India by 2030. It ranked as the sixth leading cause of disability-adjusted years (DALY; one DALY is one of the lost year of healthy life) in 1990 and is projected to rank fourth by the year 2020.[1] Because of the rise in the number of ageing population, the burden of stroke is likely to increase unprecedently in the near future. Most patients with stroke manifest with the abrupt onset of a focal neurologic deficit which results in residual physical, cognitive, and behavioural impairments. Mean Platelet Volume (MPV), a marker and possibly a determinant of platelet function is a physiological variable of haemostatic importance.[2] Large platelets are more reactive, produce more prothrombotic factors and aggregate more easily in response to agonists such as ADP (adenosine diphosphate) and collagen.[3,4,5] They also contain more dense granules and release more serotonin and beta-thromboglobulin than do small platelets[6]

Mean platelet volume, as well as platelet count, are an index of haemostasis. Changes in MPV play a more important role in haemostasis than platelet count. Platelet volume is regulated by various intrinsic and extrinsic factors. The mean lifespan of light platelets is shorter than that of heavy platelets.[7] Perturbed Megakaryocyte Platelet Haemostatic Axis (MPHA), results in the formation of hyper-functional platelets, which may contribute to the development of vascular disease or an acute thrombotic event such as ischaemic stroke.[8] Increase in platelet volume has been reported as a risk factor for acute cerebral ischaemia.[9,10] Higher levels of MPV in patients with acute ischaemic stroke have been demonstrated than in control subjects.[11] The severity and poor outcome of ischaemic stroke patients with increased MPV has been reported in the literature.[1,12,13] Patients with Ischaemic stroke with higher MPV tend to have poor outcome than their counterparts with low MPV. Mean platelet volume has been identified as an independent predictor of the risk for stroke. The majority of research have found that the MPV is significantly increased in acute ischaemic stroke. The exceptions to this include a study by Tohgi et al[10] wherein MPV was no longer notably associated in patients with Ischaemic Stroke than in controls.

O'Malley et al[11] described that platelet modifications were no longer related to clinical results after 6 months while D' Erasmo et al [12] identified an appreciably decrease platelet in patients who died. It has been discovered that patients that do badly (determined as death or dependency) have a substantially increased MPV in the extreme section of stroke than those who do well.

A persistently raised MPV following ischaemic stroke may well be associated with recurrent vascular events and death. This has been assessed as a sub study of the PROGRESS trial.[14]

Severity of the stroke is evaluated with the help of modified Rankin Scale (mRS) which is internationally accepted scoring scale. The modified Rankin Scale (mRS) is a 7-level ordered categorical scale capturing levels of patient functional independence following a stroke, with scores ranging from 0 (fully independent) to 7.[15] The mRS has been reported to be a valid and reliable endpoint in randomised clinical trials[16] It is a common and recommended outcome measure in studies related to acute ischaemic stroke.[17]

METHODS

The hospital based cross sectional study included all the patients above 18 years of age admitted in critical care unit of BLDE (Deemed to University) Shri B. M. Patil Medical College Hospital and Research centre, between November 2017 to October 2019 with history of sudden onset of weakness in one half of the body irrespective of sex, having stroke for first time and have reached hospital within twenty four hours. The informed consent was taken, and all the participants were assured about the confidentiality of the data. The sociodemographic data, presence of comorbid condition, clinical examination findings, investigations like Mean Platelet Volume, Computer Tomography and MRI of Brain, and modified Rankin's Scale were documented. This study has got clearance from ethical committee of the institution.

The patients with thrombocytopenia, haemorrhagic stroke, taking medications that can reduce the platelet count like hydroxyurea, antineoplastic agents, and patients unable to communicate because of severe stroke, aphasia or dementia without a valid surrogate respondent were excluded for the study.

7 Grades in Modified Rankin Scale

0 - No symptoms at all, 1- No significant disability despite symptoms; able to carry out all usual duties and activities , 2- Slight disability; unable to carry out all previous activities, but able to look after own affair without assistance, 3 - Moderate disability; requiring some help, but able to walk without assistance, 4 - Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance, 5- Severe disability; bedridden, incontinent and requiring constant nursing care and attention 6- The patient has expired (during the hospital stay or after discharge from the hospital) and 7- Unable to contact patient/caregiver.

Data is presented using Mean ± SD and percentages. The association of MPV and stroke using modified Rankin Scale will be carried out using Chi-square test. The data was analysed by IBM SPSS version 23 PC software system.

RESULTS

A Total of 100 patients with stroke admitted to the medical wards, meeting the eligibility criteria were included in the study. The mean age for the cases was 62.70 ± 15.6. The maximum number of cases in this study were in the age group between 40-60 years which was followed by age group of 60-80 years. The males were predominant with 61% while females were 39%. The male to female ratio was 1.6:1. The youngest patient was 18 years old female while the oldest was 92 years old male patient. (Table 1)

Age (Yrs.)	Male		Female	
	N	%	N	%
25-40	05	8.2%	05	12.8%
40-60	27	44.3%	12	30.8%
60-80	21	34.4%	17	43.6%
>80	08	13.1%	05	12.8%
Total	61	100.0%	39	100.0%

Table 1. Age and Sex Distribution

The commonest risk factor found was hypertension in 44%, while other risk factors were diabetes mellitus in 20% followed by Chronic obstructive pulmonary disease and Ischaemic heart disease in one each. (Table 2).

Comorbidities	N	%
Hypertension	44	44
Diabetes Mellitus	20	20
Chronic Obstructive Pulmonary Disease	01	01
Ischaemic Heart Disease	1	1

Table 2. Distribution of Risk Factors

The echocardiography was done in all the cases under study and it revealed ischaemic heart disease in 10% of the cases followed by pulmonary arterial hypertension in 5% while left ventricular hypertrophy and rheumatic heart disease with mitral stenosis in 4% respectively and Aortic regurgitation in one. (Table 3)

Echo Findings	N	%
Ischaemic heart disease	10	10
Pulmonary arterial hypertension	05	05
Left ventricular hypertrophy	04	04
Rheumatic heart disease with Mitral stenosis	04	04
Aortic Regurgitation	01	01

Table 3. Distribution of Cases According to Echocardiography Findings

Stroke and modified Rankin Scale (mRS)

The clinical severity of stroke at presentation was determined by the modified Rankin's Scale and severe disability was seen with 53% of the cases. 21% of the cases had moderately severe disability, 15% with moderate disability and 10% with slight disability. (Table 4) The high occurrence of severe disability reflects the impact on out come in patients with stroke and quality of life that they will be leading here after.

Modified Rankin's Scale	N	%
1	01	01
2	10	10
3	15	15
4	21	21
5	53	53
Total	100	100

Table 4. Distribution of Cases According to mRS

Stroke Severity and Mean Platelet Volume (MPV)

The MPV observed with mRS of above 4, was higher in value than with mRS score below 4. The stroke severity was greater among individuals with higher measurements of MPV as evident by 53% of cases had significant disability with MPV 10.26, and 10% had no significant disability. The platelet mass being a product of platelet count and MPV is almost constant with p value of 0.842 which is statistically not significant. (Table 5)

mRS	N	MPV		P Value
		Mean	SD	
1	1	10.40	0.00	
2	10	10.22	1.34	
3	15	10.11	0.85	0.842
4	21	10.55	1.49	
5	53	10.26	1.12	
Total	100	10.30	1.18	

Table 5. Association of MPV and Stroke Severity

Mortality

There were no deaths recorded during hospital stay among participants. The mean duration of stay in hospital was 4.6 days.

DISCUSSION

In this study, one hundred patients with ischemic stroke were included, among which 61% of males and 39% in females. These findings suggest male preponderance in acute ischaemic stroke patients which was consistent with studies by Shah PA et al[18] and Khan et. Al[19] Age is an important non-modifiable risk factor for stroke. In, the present study nearly one third of the study patients were aged between 40 to 60 years followed by 60 to 80 years. In this study the mean age among patients was 62.7 ± 15.6 years. These observations showed that, acute ischaemic stroke in this study was common in middle age group. A study to assess the role of MPV in ischaemic stroke by Shah PA et al[19] has reported mean age as 58 years which is lower compared to our study. Out of the many risk factors for stroke, hypertension was noted in 44% of the patients, apart from diabetes Mellitus, Chronic Obstructive Pulmonary Disease and Ischaemic Heart Disease.

The hypertension was the most prevalent risk factor in study by Pikija et al[20] with 82.7% while Vizioli L et al[21] with 84.7%. The MPV has got no statistically significant correlation with ischaemic stroke among the participants with a "p" value of 0.842. The result of our study was contrary to study by Neki et al[22] which said that high MPV has got significant correlation with acute ischaemic stroke as independent risk factor. In, our study the association of MPV

level with Ischaemic Stroke was discord when compared to other studies. Findings in the PROGRESS Trail[15] collaborative group, the stroke rates were greater among individuals with higher measurements of MPV, and the study identified MPV as an independent predictor of the risk by stroke among high-risk individuals. Slavka et al.[23] showed that subjects with higher MPV (>11.01 fL) had 1.5 times higher vascular mortality risk than patients with low MPV (<8.7fL) value. The association of MPV with severity of stroke was determined by comparing the modified Rankin Scale with corresponding mean values of MPV in each group. MPV showed a 'p' value of 0.842 which was statistically insignificant. In a study by O' Malley[11] no statistical significance between MPV and stroke was obtained. Butterworth et al[13] studied patients who were dead or dependent at 3 months, using the Lindley score, and they had a significantly higher mean platelet volume, as compared with those who fared well. However statistical significance was not found.

Our study showed no statistical significance between MPV and severity of stroke which was similar to study by Neki et al[22] and Thankappan PK et al.[24] The study done by Sridharan M et al[25] showed that MPV is independent of age, sex, smoking status, systemic hypertension and diabetes mellitus in patients with stroke while MPV was higher in ischaemic stroke patients compared to haemorrhagic stroke. (Table 6)

Study	Neki et al[23]	Thankappan PK et al[25]	Sridharan et al[26]	Current Study
MPV association with stroke	Yes /ischaemic stroke	Yes/ thrombotic stroke	Yes	Yes
MPV in stroke	Elevated	Elevated	Elevated	Not elevated
MPV and severity stroke	Not significant	Not significant	Significant	Not significant
Table 6. Comparison of MPV among Various Studies				

CONCLUSIONS

The study did not find MPV as an independent predictor of the risk for stroke among high-risk individuals. This study also did not find a statistically significant correlation between clinical severity of stroke and mean platelet volume.

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