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The Relationship between Raised Mean Platelet Volume and Severity of Newly Diagnosed Acute Ischaemic Stroke

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Abstract **Original Research Article**

***Introduction and Objective*:** Stroke is one of the leading causes of mortality and long-term disability throughout the world. Mean platelet volume (MPV), a marker of platelet activation, is calculated and provided by automatic blood cell count equipment during routine complete blood count analysis is a surrogate marker of platelet function and a potential mediator of the association between inflammation and thrombosis. So, to investigate MPV in ischaemic stroke and its role to discriminating more severe stroke from mild one the current study was done. ***Methods*:** This observational case control study was carried out in Department of Medicine, Dhaka Medical College Hospital (DMCH) from July 2015 to June 2016. 100 patients with attack of ischaemic stroke who presented within 24 hours of symptoms onset were divided into 2 groups (group-1: mRS score 0-2, and group-2: mRS score 3 or more) based on severity. Severity of ischaemic stroke was assessed by the modified Rankin Scale. At the same time 100 age and sex matched controls were taken. Blood samples were collected from both groups and MPV was measured. The results were statistically compared by SPSS 22.0. Statistical significance was accepted at <0.05. ***Results*:** The MPV values were more in case group in comparison to control group (10.88±1.23 vs 10.03±1.03; z score-5.31; p value <0.01). Comparison between the 2 groups revealed that MPV value was higher and more significant in group 2 of cases than group 1(10.15± 0.739 in group 1 versus 11.63± 1.04 in group having 2; z score-7.7, p value <0.001). 6 patients of group 2, who could not overcome the situation and died within 24 hours of admission had MPV value of 12.92±0.30. After controlling the risk profiles associated with ischaemic stroke by means of binary logistic regression model, the effect of MPV in ischaemic stroke remained statistically significant (OR: 4.418, 95% CI 2.468-7.908, p= 0.000). ROC curve was 0.85 and standard error 0.039 (95% CI: 0.779-0.932; p<0.01), which indicating that MPV is a good predictor of severe ischaemic stroke from a mild one based on modified Rankin Score. ***Conclusion*:** From this study, it is concluded that MPV is raised in ischaemic stroke and more severe disease can be predicted early by interpreting it. So, the measurement of MPV may add a useful tool for the clinicians in managing and predicting prognosis in newly diagnosed ischaemic stroke patients.

Keywords: Raised Mean Platelet Volume, Severity, Acute Ischaemic Stroke.

INTRODUCTION

The World Health Organization (WHO) has defined stroke as a clinical syndrome occurring due to sudden cerebral dysfunction producing focal rather than global neurological deficit persisting for more than 24 hours or the patient dies within 24 hours, vascular in origin, non-epileptic and non-traumatic in nature [1]. Stroke is one of the major healthcare problems that cause long-term disability. It is the third most common cause of death in developed countries after coronary heart disease and cancer [2]. Stroke results in more than 4.4 million deaths each year world wide and one out of six patients who survive, will suffer another stroke within 5 years [3]. In a survey conducted in Bangladesh in 2010, revealed crude prevalence of stroke is 3 per 1000 population. The prevalence of stroke was found significantly higher in the middle age and older age groups [4]. Stroke is classified into Ischemic (85%) stroke and hemorrhagic (15%)

stroke. Cerebral infarction accounts for the vast majority of strokes. Embolic, thrombotic or thromboembolic occlusion of large arteries has been identified as the main cause of ischemic stroke, but other causes include abrupt occlusion of small penetrating arteries, arteritis, arterial dissection, venous occlusion and profound anemia or hyper viscosity. Unfortunately, about 35 all ischemic events remain classified as cryptogenic [5]. Platelets play a crucial role in the pathogenesis of atherosclerotic complications contributing to thrombus formation or apposition after plaque rupture. Mean platelet volume (MPV) is considered as a determinant of platelet activity. Larger platelets contain more dense granules and produce more thromboxane A2 and other prothrombotic agents, which have been associated with greater Platelet aggregation in response to ADP and collagen in vitro [6]. The association of MPV is directly linked with the risk of acute Myocardial infarction, and sub-sequent life-threatening events. MPV is a parameter calculated and provided by automatic blood cell count equipment during routine blood analysis. Although MPV is not generally taken into consideration by clinicians, it could be a marker of platelet activation in terms of platelet reactivity, aggregation and production thrombogenic factors [7]. High MPV-levels have been defined as a risk factor for myocardial infarction in patients with coronary heart disease. Patients with a severe stroke significantly more often have higher MPV levels on admission to the hospital. An increased MPV could also predict the risk of a second stroke event in those with a history of cerebrovascular events [8]. Though MPV is increased in certain vascular risk factors like, Hypercholesterolemia, Hypertension, Smoking, diabetes mellitus which are also risk factors for ischemic stroke, still worldwide various studies have found that a raised MPV is related, as a parameter for predicting stroke in risk group patients. MPV is also associated with different subtypes and severity of ischemic stroke, both in the acute phase and long after disease occurrence predicting the risk of a second stroke event and with anti-platelet drug resistances. Thus, elevated MPV has become a subject of keen interest in predicting poor outcome for ischemic brain stroke as independent to other clinical parameters such as lipid profile and other biochemical parameters [9]. So, it is aimed to carry out this study, in our population to determine whether an association exists between MPV and stroke patients and also relation of raised MPV with severity of new onset ischemic stroke. In future by means of this simple parameter we can not only predict the severity of ischemic stroke but also guide our treatment protocol and further follow up.

MATERIALS AND METHODS

Study design: This is an observational case control study.

Place of study: This study was carried out in the Department of Medicine, Dhaka Medical College Hospital (DMCH), Dhaka, Bangladesh.

Study population: The Patient admitted in department of medicine with new onset featuressuggestive of Stroke was the study population.

Period of study: July 2015 to June 2016.

Sample size (n): Sample size= 200 (case=100 and control=100).

Selection Criteria:

Inclusion Criteria:

- Patients admitted with signs and symptoms of acute ischemic stroke.
- Patients diagnosed as a case of acute ischemic stroke by CT scan of brain
- Age & sex matched healthy subjects with no history of stroke or no history of taking anti platelet drugs.
- Patients who are willing to participate in the study after knowing details of the study giving informed written consent.

Exclusion Criteria:

1. Patients below 18 years of age.
2. History of use of anti-coagulant, anti-platelet, anti-lipids, angiotensin-converting enzyme drug for any reason.
3. Patient history of TIA or previous ischaemic and/or hemorrhagic stroke.
4. Patient with history of peripheral vascular disease, acute infection, positive C-reactive protein or inflammatory conditions, Acute myocardial infarction, malignancies, cranial traumas or arteriovenous malformation were excluded.
5. Patient not willing to participate in the study.

Study Procedure:

The study was conducted at the inpatient department of Medicine, Dhaka Medical College Hospital. According to the standard protocol after admission of the patients through outpatient department (OPD) or through emergency department and were transferred to the ward. The aims and objectives of the study was discussed separately with each physician working as attending doctor in each admission unit by focus group discussion to facilitate the screening of the subjects for the study prior to initiation of the study. Attending physician screened the patients and immediate contact was done to principal investigator (PI). Patients with features suggestive of stroke presenting within 24 hours to the Department of Medicine of Dhaka Medical College Hospital were the study population in this study. After admission this patient were assessed by history and appropriate clinical examination and also assessment of stroke was done on the basis of “Rosier Scale” (43). If the score suggested that the patient is a case of stroke, then CT scan was done to confirm the diagnosis. Then the patients were informed about the study and if they

agreed then Informed consent were taken from all cases or from the legal guardians. New onset confirmed Ischemic stroke patients fulfilling the inclusion and exclusion criteria were enrolled as study sample. Once a patient had been selected as study sample detailed clinical history, risk factors and relevant data were collected in a preformed data sheet for each patient by the investigator. At the same time age and sex matched controls were selected. They were also informed and consent was taken.

Severity of ischemic stroke was assessed by "Modified Rankin scale" (44) that scores patients on a scale from 0 to 6, with 0 being asymptomatic and 6 being dead. Two groups were made (44). Group 1 included scores of 0-2 are considered "good" stroke outcomes; in that these patients were able to lead fairly independent lives and were able to return to work in almost all cases. Group-2 included scores of 3 or greater indicate that the patient needed considerable help with their daily activities.

Risk factors for stroke like hypertension, smoking, dyslipidaemia, diabetes mellitus, family history of stroke and obesity were noted from all cases & controls. Drug history was taken regarding anti-hypertensive, anti-diabetic, lipid lowering drugs, antiplatelet & etc.

Then blood was be collected for complete blood count (CBC) including mean platelet volume (MPV) following the admission day from the cases. For the measurement of CBC and MPV 5ml blood was collected to the EDTA (ethylenediamine tetra acetic acid) tubes and the sample was sent to the haematology department of DMCH within 2hr of venipuncture. There these samples were analyzed by automated hemogram device branded with ABX Pentra Dx 120 (HORIBA). Other necessary laboratory investigations (RBS/FBS, Fasting lipid profile, S.Creatinine, ECG etc.) were done and recorded. Blood in the same method was collected from the control group and was sent for analysis.

Data from each patient and control were collected in structured data sheets individually. Finally, all data compiled together and statistical analyses was carried out by using the Statistical Package for Social Sciences version 21.0 for Windows (SPSS Inc., Chicago, Illinois, USA).

RESULTS

Table-1: Distribution of age in the study and control groups

Age Groups (in years)	Case (Ischemic stroke group) n=100(%)	Control Group N=100(%)	z score	p value
18-39	7 (7)	6 (6)		
40-49	15 (15)	16 (16)		
50-59	51 (51)	52 (52)		
60-69	21 (21)	20 (20)		
>70	6 (6)	6 (6)		
Total	100 (100)	100 (100)		
Mean ± SD	56.14±8.24	56.42±8.37	0.239	>0.05

Distribution of age is shown in Table-1. A total of 100 cases and 100 controls were included in the study. The mean (±SD) of ages were 56.14±8.24 and 56.420±8.37 in the ischemic stroke and control group respectively. The age difference was not statistically significant (z=0.239; p=>0.05) between the two groups.

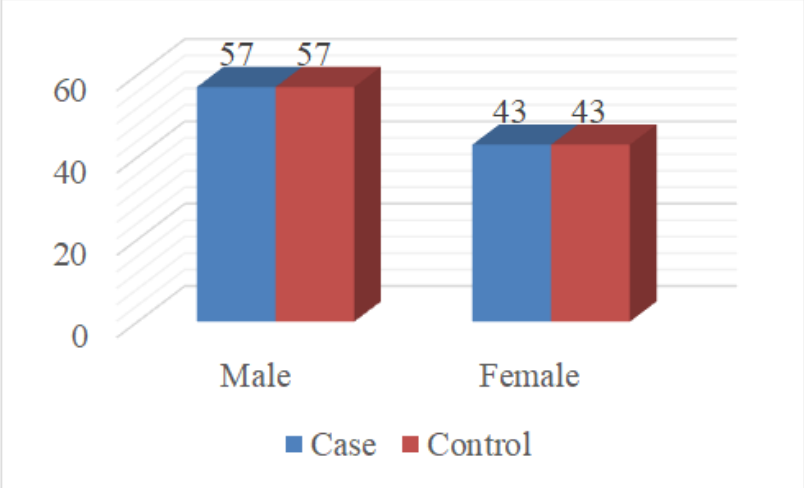

Figure-1: Distribution of the cases and control by sex

The study comprises equal number of male 57 (57%) and female 43(43%) in both the case and was no significant difference in sex between two groups (x^2= 0.000; p=0.99).

Table-2: Distribution of the study subjects according to risk factors (N=100)

Characteristics	Case		Control		X^2	p-value
	n	%	n	%		
Hypertension	53	43	38	38	4.520	<0.05^s
Diabetes mellitus	23	23	24	24	0.026	>0.05^{ns}
Smoking	54	54	49	49	0.498	>0.05^{ns}
Dyslipidemia	62	62	26	26	26.00	<0.01^s
Obesity	08	08	09	09	0.064	>0.05^{ns}
Family history of CAD	35	35	40	40	0.534	>0.05^{ns}

S= Significant, NS= Not Significant, P value reached from Chi-square test

The above table-2 shows the risk factors of the study group and it was found 53(53%) and 38(38%) patients had HTN in case and control respectively. Smoker was found 54(54%) in case and 49(49%) in control. Diabetes mellitus was found 23(23%) and 24(24%) in case and control respectively. Obesity and dyslipidemia was found 08(08%) and 62(62%) in case and 09(09%) and 26(26%) in control group respectively. Family history of CAD was 35(35%) in case and 40(40%) in control. Hypertension and Dyslipidemia was statistically significant (p<0.05) between two groups but others were not significant (p>0.05) in chi square test.

Table-3: Clinical presentation of the cases during admission.

Presentation during admission	Frequency	Percentage
Hemiplegia (Right/Left)	38	19.09
Hemiparesis (Right/Left)	27	13.57
Speech Disturbance	47	23.61
Coma	22	11.06
Convulsion	8	4.02
Others	7	3.51
Multiple symptoms	50	25.14
Total	199	100.0

Multiple symptoms (such as hemiplegia with speech problem) were the leading cause of admission in the hospital (25.14%). Speech disturbance (23.61%), Hemiplegia (19.09%), Hemiparesis (13.57%), Coma (11.06%), Convulsion (4.02%) and Others (3.51%) were the causes of admission. There were rapid progression of symptoms in 54% cases. Rest of the cases progressed either slowly (24%) or progression time was not determined (22%).

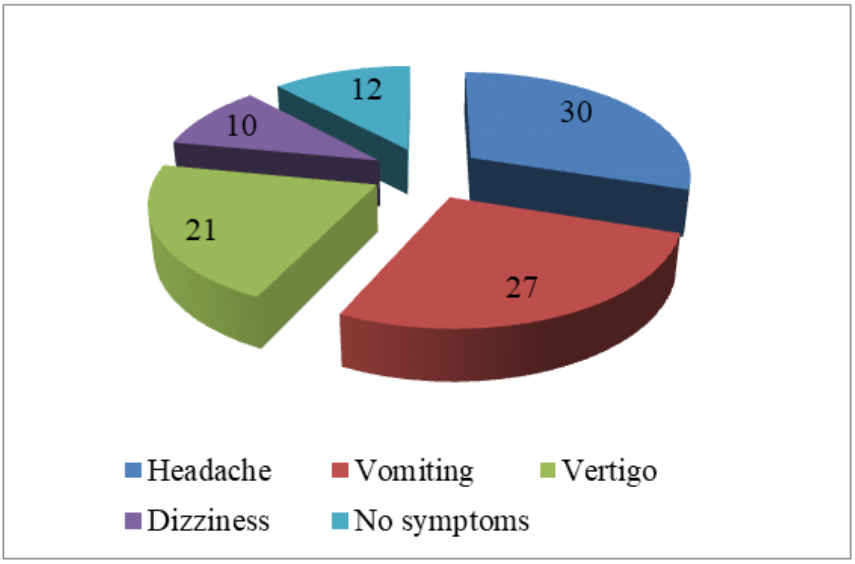

Figure-2: Premonitory symptoms in the case subjects

Headache (38%) and Vomiting (27) were the main two premonitory symptoms complained by the patients. Others symptoms were vertigo and dizziness. However, 12% patients did not complain any symptoms.

Table-4: Neurological findings in the case group during admission

Variables	Case Subjects N=100(%)
GCS score	
Score 8-15	78 (78)
Score <8	22 (22)
Speech Involvement	
Normal	38 (38)
Dysarthria	32 (32)
Dysphasia	30 (30)
Cranial Nerve involvement	36 (36)
Motor Abnormalities	
Hemiplegia	38 (38)
Hemiparesis	27 (27)
Monoplegia	00 (00)
Sensory Abnormalities	19 (19)
Cerebellar dysfunction	09 (09)

Table-4 shows neurological findings in the case group. Level of consciousness was observed in all patients by means of GCS score. A score of 8-15 was found in 78% patients and a score <8 was observed in 22% patients. 38% patients had no difficulty in speech, while 32% patients had dysphasia and 30% patient had dysarthria. Cranial nerve lesion was found in 36% patients. Motor function abnormalities, sensory abnormalities and cerebellar dysfunction were present in 65%, 19% and 09% patients respectively. The MPV values were more in case group in comparison to control group (10.88±1.23 vs 10.03±1.03; z score-5.31; p value <0.01). Comparison between the 2 groups revealed that MPV value was higher and more significant in group 2 of cases than group 1(10.15± 0.739 in group 1 versus 11.63± 1.04 in group having 2; z score-7.7, p value <0.001). 6 patients of group 2, who could not overcome the situation and died within 24 hours of admission had MPV value of 12.92±0.30. After controlling the risk profiles associated with ischaemic stroke by means of binary logistic regression model, the effect of MPV in ischaemic stroke remained statistically significant (OR: 4.418, 95% CI 2.468-7.908, p= 0.000). ROC curve was 0.85 and standard error 0.039 (95% CI: 0.779-0.932; p<0.01), which indicating that MPV is a good predictor of severe ischaemic stroke from a mild one based on modified Rankin Score.

Table-5: Hematological findings in the studied subjects

Variables	Case group (n=100)	Control group (n=100)	z score	p value
Total count of WBC	10053±3442	7446±1703	68.60	<0.01^{s}
Polymorph (%)	70±9	63±8	5.83	<0.01^{s}
Hemoglobin level	11.06±1.61	11.34±1.39	1.4	>0.05^{ns}
Platelet count	231055±45731	259660±56594	19.17	<0.01^{s}
Mean platelet volume	10.88±1.23	10.03±1.03	5.31	<0.01^{s}

Values are expressed in mean±SD

Hematological findings of the studied subjects are shown in Table-5. Hemoglobin level of both case and control groups were same (z score-1.4; p value->0.05). There were significant differences of total count of WBC (z score-68.60; p value <0.01), Polymorph (%) (z score-5.83; p value <0.01), platelet count (z score-19.17; p value <0.01) and mean platelet volume (z score-65.31; p value <0.01) in between two groups.

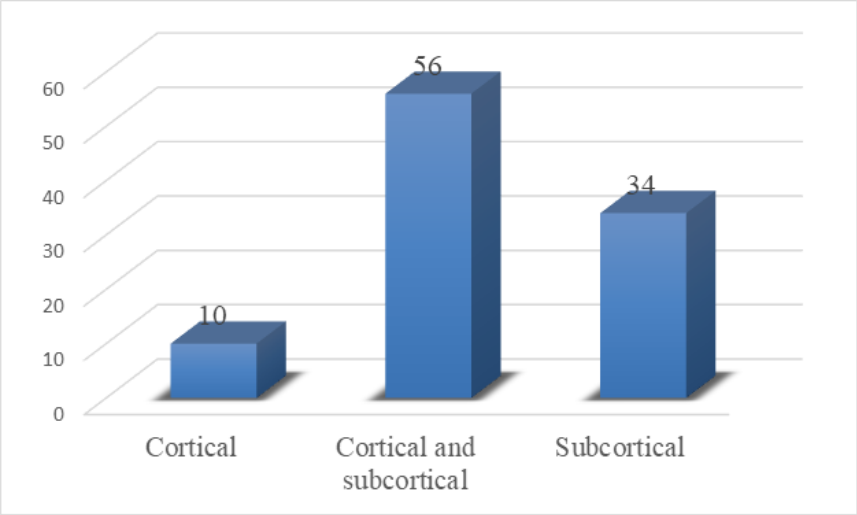

Figure-3: Findings of CT scan of the brain in the case group

CT scan of brain was performed in all patients. The study showed that both cortical and subcortical lesion was present in 56% patients. Whereas was found in subcortical lesion was found in 34% patients and cortical lesion was found in 10% patients.

Table-6: Relationship Between Mean Platelet volume (MPV) and Stroke severity on thebasis of modified Rankin Score (mRS)

Mean Platelet volume (MPV) (fl)	mRS 2	mRS 3 or more
<8	2	0
8.1-9.0	0	2
9.1-10.0	19	0
10.1-11.0	19	10
11.1-12.0	11	16
>12.1	0	21

Relationship between MPV and stroke severity by means of mRS is presented in the above table (Table-6). The mean (±SD) MPV was 10.15± 0.739 in the group mRS=2 group and 11.63± 1.04 in the group mRS 3 or more. There were significant differences in the two groups (z score-7.7, p value <0.001.

Table-7: Comparison of Mean Platelet volume (MPV) and age groups between studied subjects

Age group	Case group(n=100)		Control group(n=100)		x^2	p value
	Mean Platelet Volume		Mean Platelet Volume			
	Normal (7-11 fl)	Raised (>11fl)	Normal (7-11 fl)	Raised (>11fl)		
18-39	0	2	2	0	0.00	0.99^{ns}
40-49	12	8	16	2	3.95	$<0.05^{s}$
50-59	28	23	44	9	9.45	$<0.01^{s}$
60-69	9	12	15	6	3.5	$>0.05^{ns}$
>70	3	3	4	2	0.34	$>0.05^{ns}$
Total	100		100			

Table-7 shows differences of MPV with age groups. There was no differences of values in two extreme group of ages.

Table-8: Relationship between Mean Platelet Volume and outcome of cases after 48 hours

Outcome of cases at the time of discharge	No of cases (n)	Mean platelet volume [mean (fl)± SD]	x^2	p value
Improved	55	10.13±0.97	166.32	0.0001^{s}
Not Improved	39	11.63±0.77		
Died	06	12.92±0.30		
Total	100	10.88±1.23		

Patients who died during this study period had a higher value of MPV in compare to the other groups. There was significant statistical differences among the values.

Table-9: Binary Logistic Regression analysis for determining the role of MPV in predicting stroke severity

Variables	Regression coefficient	S.E.	Odds Ratio	p value	95% C.I.	
Mean Platelet volume (MPV)	1.486	0.297	4.418	0.000	2.468	7.908
Age (in years)	0.66	0.037	1.068	0.077	0.993	1.149
H/O hypertension	0.87	0.567	1.091	0.878	0.359	3.315
H/O Diabetes	0.155	0.653	1.168	0.812	0.324	4.202
H/O Dyslipidemia	-0.329	1.565	0.719	0.833	0.033	15.449
H/O Smoking	0.428	0.724	1.533	0.555	0.371	6.332
H/O Obesity	0.081	1.642	1.084	0.961	0.043	27.064
Family H/O CAD	-0.002	0.635	0.998	0.998	0.287	3.469
Constant Coefficient	-20.609	5.214	-	0.000	-	

MPV- mean platelet volume; SE- Standard error; CI- Confidence interval, Hosmer-Lemeshow test of goodness of fit (p=0.120).

After controlling risk profiles associated with ischemic stroke in the multivariate logistic regression model (Table-9), the effect of MPV in ischemic stroke remained statistically significant (OR: 4.418, 95% CI 2.468-7.908, p= 0.000).

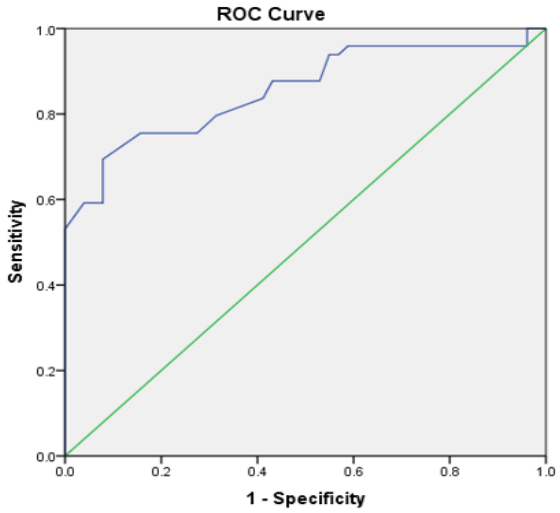

Figure-4: ROC curve

Specificity and sensitivity of Mean Platelet volume in predicting ischemic stroke severity is presented in figure-13. Area under curve is 0.85 and standard error 0.039 (95% CI: 0.779-0.932; p<0.01).

DISCUSSION

MPV values have become a point of interest in the last few decades particularly in association with thrombosis and inflammation. So, this hospital based observational case-control study was carried out with the aim to observe the level of mean platelet volume in newly diagnosed ischemic stroke and its relation to stroke severity as thrombosis is the main pathological feature in stroke. Stroke usually occurs in older age group but can affect either sex. Men at their 5th decade and female at their 6th decade are more prone for stroke [10]. It was observed that male were 57(57%)] and female were 43(43%)]. The male: female ratio was approximately 1.3:1. This indicates that sex distribution revealed male predominance among the study population. Among male 31 (54%) and among female 20(47 %) were in 50-59 years age group. Mean age of male is 56.64 years and 55.46 years in female and over all mean age is 56.14 years in case group. Where as in control group mean age of male is 57.09 years and in female 55.53 years and overall mean age is 56.42; which are quite similar in both groups. In a study of 291 consecutive stroke patients in Bangladesh revealed mean age was 57.9 years and incidence of stroke was 80 in male patients [12]. This study reveals mean age of stroke as 58.36±14.80 years and frequency of stroke in male and female patients are 68 and 32 respectively. Almost similar result regarding age and sex of the patients were observed in a study conducted in India Parvaiz et al., 2013 [12]. However, there is contravention to these observations made in similar studies from the developed world. This disparity in age may be due to higher life expectancy in the West as compared to the developing

world. There is also less no of young patients, only 7 (7%) of study population were below 40 years of age. There was 23% young stroke in a Indian study Parvaiz, et al., 2013 [12]. This disparity in occurrence of young strokes may be accounted for by sample bias including methodology used in the present study. In our study 52% cases belong rural area. But in the study conducted by a group of researcher in India found that 73% of cases were from rural areas [12]. This difference is probably due to delay in bring the rural patients to our hospital, as we take those patients who presented to us within 24 hours of symptom onset. Risk factors analysis among the study population were done. As Mean Platelet volume (MPV) increases in different systemic conditions and situations such as hypertension, diabetes mellitus, obesity, dyslipidemia, smoking, history of CAD. We found a relationship between MPV and DM history, smoking and history of CAD. However, DM is one of the systemic diseases, which showed a strong relationship with MPV. In these patients, MPV increase might contribute to the diabetes-associated vascular damage. In our study, 23% patients had DM previously. Consistent with the literature, MPV values in diabetic patients were significantly higher than the non-diabetic patients. Variation in MPV between case and control group may be attributed to the occurrence of large sized platelets with comparatively low platelet count. Mean platelet volume and platelet count in control group were lower and higher respectively, in comparison to the case group. Again, this observation is in conformity with bulk of the published data [13]. In our study analysis of symptoms reveal that hemiplegia or hemiperesis (79%), speech involvement (62%), cranial nerve involvement (36%) and cerebellar involvement (09%) correlate with the findings of Walter, et al., [14]. In a study of Aydin et al., found 74 of patients with GCS>13 and 11 with GCS< 7. In our study 78 patients were with GCS score 8-15 and 22 were with score< 8. This study has similar relationship with the above parameters. At present non-contrast CT scan is the standard of care in the evaluation of acute stroke, although CT changes associated with ischemia are often absent or quite subtle [15]. In this study patients were categorized into stroke subtypes on the basis of clinical history, examination and CT findings. Cerebral infarction was categorized anatomically into 3 groups cortical, cortical and subcortical; and subcortical, and our study reveals both cortical and subcortical 56%; subcortical 34% and cortical only 10% cases which is similar to several studies [16, 17]. In this study, we found that the values of MPV were higher in the group of patients with worse stroke outcome (mRS 3 or more), the mean (±SD) was 10.15±0.739 fl in mRS=2 group and in mRS 3 or more group it was 11.63±1.04 (z=7.7, p<0.001). So there is a definite relation between the elevation of MPV value and the severity of stroke, and that MPV could possibly be used as a tool to predict more aggressive form of the disease. This was consistent with what was stated by Ghahremanfard et al., [18] in their study that measuring MPV within the first 24 hours of brain stroke appearance was strongly related to the severity of disease, and could effectively discriminate a severer situation from a milder degree of the disorder. Increased MPV was associated with a poorer outcome in patients suffering an acute ischemic cerebrovascular event. In another study done by Arikanoglu et al., [19] they found higher MPV values in the acute ischemic stroke patients in comparison to the control group. More over 06 patients died in our study with in first 48 hours of their admission had a MPV of 12.92±0.30 (x^2=166.32, p<0.0001). In their study did not find statistically significant difference between patients and controls regarding MPV values. This finding may indicate differences in environment, dietary habits or other co-morbidities that should play a role in MPV values, but most of the studies determined that MPV levels were higher in stroke patients [20]. The current study assessed the role of MPV for predicting severity of acute ischemic brain stroke from its mild status. We showed that measuring MPV within the first 24 hours of brain stroke appearance was strongly related to the severity of disease, and could effectively discriminate a severer situation from a milder degree of the disorder (area under the curve was: 0.85; 95% CI: 0.779-0.932, p<0.001). Patients within the higher MPV range had more than 4-fold risk (OR= 4.418) of suffering a severe stroke compared with patients within the lower range of MPV. The association of high MPV with severe stroke remained significant after adjustment for confounding factors. Similarly, Pikija et al., and Ghahremanfard, et al., [18, 21] also indicated that higher MPV was independently associated with larger infarct size, and higher risk of early and mid-term death after stroke. Furthermore, in a study by Mayda-Domac MPV was observed as independent risk factor for ischemic stroke and correlated with poorer outcome. In fact, according to these results, an increase in MPV is a feature of both the acute and non-acute phases of cerebral ischemia.

Limitation of the Study:

1. The study population was selected from Medicine department of a single tertiary level center in Dhaka city. So that the results of the study may not reflect the exact picture of the country.
2. The present study was conducted within a very short period of time.
3. Small sample size was also a limitation of the present study.
4. Another limitation was that patients were followed up only once after 48 hours enrolment in the study.
5. Many patients of stroke present after 24 hours of symptom onset, so they couldn't be enrolled in the study.
6. Injudicious use of ACEi and ARB at periphery limited patient enrollment in the study.

CONCLUSION

First newly diagnosed ischemic stroke patients have a higher Mean Platelet Volume (MPV) in relation to age and sex matched control subjects and secondly higher MPV volume in newly diagnosed ischemic stroke patients have more severe disease and might have poor outcome.

Measurement of MPV is easy to establish and do not require any further cost and its interpretation is also very simple. Though our study had several limitations, it has been seen that MPV is a strong and independent risk factor for ischemic stroke and can predict more severe form. Thus, considering MPV in ischemic stroke patients may provide an additional tool for our clinician to predict prognosis.

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