ORIGINAL ARTICLE

Platelet Indices as a Marker of Severity in Non-diabetic Non-Hypertensive Acute Ischemic Stroke Patients

Rathindra Nath Sarkar[1*], Chandan Kumar Das[2], Urmimala Bhattacharjee[2], Moumita Banerjee[2]

Abstract

Background: Platelet activation & aggregation are critical in pathogenesis of acute ischemic stroke. Mean platelet volume (MPV) & Platelet distribution width (PDW) are markers & determinants of platelet function. Larger platelets are metabolically more active, produce more prothrombotic factors, aggregate more easily & act as index of homeostasis and its dysfunction thrombosis.

Material: We studied 70 non diabetic non hypertensive ischemic stroke patients without previous thrombotic events & not on anti platelet medications within 24 hour of onset of symptoms & compared with equal number of age and sex matched controls. Severity of stroke was calculated by Canadian neurological scale (CNS).Platelet indices were obtained from SYSMEX KX-21.

Observation: Mean age of patients was 55 ± 7.11 and of controls was 52 ± 5.37. According to CNS patients were divided in two groups; with comprehension deficit (1st group, 32 patients) & without comprehension deficit (2nd group, 38 patients).Mean value for PDW & MPV in 1st group was 18.675 ± 3.494 & 12.894 ± 1.270 respectively and in 2nd group was 18.62 ± 3.387 & 12.42 ± 0.984 respectively and was significantly higher than mean value of 15.694 ± 3.127 & 10.46 ± 1.273 of PDW & MPV respectively in controls. In both study groups PDW & MPV was found to be significantly associated with severity of motor deficit.

Conclusion: In patients of ischemic stroke platelet indices may be used for predicting severity of motor deficit. Although larger sample size and multivariate analysis is required before this can be used regularly in clinical practice.

Introduction

Acute ischemic stroke results from sudden loss of blood circulation to an area of cerebral hemisphere leading to irreversible brain injury and neurological deficits persisting for more than 24 hours or until death. It accounts for 80-87% of all strokes.[1] Several risk factors like hypertension, diabetes mellitus, dyslipidaemia, tobacco smoking are instrumental in the pathogenesis of acute ischemic stroke largely by their link to atherosclerosis.[2]

Platelets are small, discoid and non-nucleated structures derived from fragmentation of megakaryocytes. Platelets play a pivotal role in the pathogenesis of atherosclerosis. Platelets secrete a large number of substances that are important mediators of coagulation, inflammation, thrombosis and atherosclerosis. Within an individual there is a wide variation in platelet size and density. Larger platelets contain more dense granules and produce more thromboxane A2. Thus larger platelets are metabolically more active and have greater prothrombotic potential.[3,4]

Mean platelet volume (MPV) is a commonly used biomarker of platelet function and activation.[5,6] Increased MPV has been associated with greater in vitro aggregation in response to ADP and collagen.[7] Mean platelet volume is a cost-effective and routinely available test. Elevated MPV levels are associated with increased risk of myocardial infarction in patients with coronary artery disease, as well as death or recurrent vascular events after myocardial infarction.[8,9] Also higher MPV is observed in patients with diabetes[10] mellitus, hypertension,[11] hypercholesterolemia,[6] smoking and obesity.[12]

Platelet distribution width (PDW) represents variation in platelet size. Larger PDW also indicates prothrombotic status.[13] So far there is a paucity of data on the association between MPV, PDW and stroke severity or stroke outcome.[14-16] The aim of our study was to investigate the relationship between platelet indices, MPV and PDW, and severity and outcome of acute ischemic stroke.

Material and Methods

This prospective observational cohort study comprising 70 acute ischemic stroke patients was conducted at the Department of medicine, Medical College, Kolkata during the study period between January 2015 and June 2015. The only inclusion criteria was the diagnosis of Acute Ischemic Stroke based on history, physical examination and computed tomography (CT) scan that was performed at the Emergency Department within 24 hours of symptom onset. Exclusion criteria were:

a. Age <18 years
b. CT features of cerebral haemorrhage
c. Presence of hypertension, diabetes mellitus and other co morbidities like liver and kidney failure, cardiac dysfunction.
d. Recent episode of infection
e. Histories of transient ischemic attacks (TIA), stroke, autoimmune disorders and peripheral vascular disease.
f. Patient on anti-platelet medications, medications for dyslipidaemia, immunosuppressants.

The control group comprised of 40

[1]Professor, [2]Postgraduate Trainee, Department of Medicine, Medical College, Kolkata, West Bengal; *Corresponding Author
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healthy age and sex matched subject from our own hospital which included doctors, nurses and other staffs who did not have any past history of stroke/ TIA or other vascular risk factors.

All patients were subjected to detailed physical and neurological examination at the time of presentation. Severity of the stroke in the form of impaired neurological status was calculated for all patients using the Canadian Neurological Scale (CNS). The patients were divided into two broad groups, with comprehension deficit (1st group) and without comprehension deficit (2nd group), based on CNS.

During the first day of admission blood samples for the measurement of platelet indices were collected in ethylenediaminetetraacetic acid (EDTA) tubes and sent to the hospital laboratory. The blood samples were analysed by the SYSMEX KX-21 automated haematological analyser which is based upon the Coulter principle.

Table 1: Demographic characteristics of cases and controls

	Patients with acute ischemic stroke (n=70)	Controls (n=40)
Mean Age	55±7.11	52±5.37
Male	52 (74.3%)	30 (75%)
Female	18 (25.7%)	10 (25%)
With comprehension deficit (1st group)	32 (45.7%)	_
Without comprehension deficit (2nd group)	38 (54.3%)	

All the data collected were tabulated in the Microsoft Office Excel Worksheet and all the statistical evaluation were done using the Microsoft Office Excel tools.

Results

Out of 70 study subjects, fifty-two were male and 18 were female. Mean age of patients was 55±7.11 and of controls was 52±5.37. Based on Canadian Neurological Scale (CNS), thirty-two patients had comprehension deficit (1st group) with a mean CNS score of 1.87±0.25. While 38 patients had no comprehension deficit (2nd group), mean CNS score 8.89±0.39. Table 1. shows the demographic characteristics of cases and controls.

The mean values for PDW in 1st group, 2nd group and controls were 18.675±3.494, 18.62±3.387 and 15.694±3.127 respectively. Whereas the mean values for MPV in 1st group, 2nd group and controls were 12.894±1.270, 12.42±0.984 and 10.46±1.273 respectively. Thus the mean values of PDW and MPV in acute ischemic stroke patients were significantly higher compared to the control subjects (Figure 1).

Correlation coefficient between the values of motor deficit scores (based on CNS) and platelet indices of stroke patients were calculated. The severity of motor deficits was significantly correlated with the values of PDW (r=-0.556, p<0.01) and MPV (r=-0.46, p<0.05). Thus patients with lower CNS scores for motor deficits (indicating more severe deficits) had higher mean platelet volumes and platelet distribution widths. Figures 2 and 3 shows the scatter dot diagram between the values of motor deficits and MPV and PDW respectively.

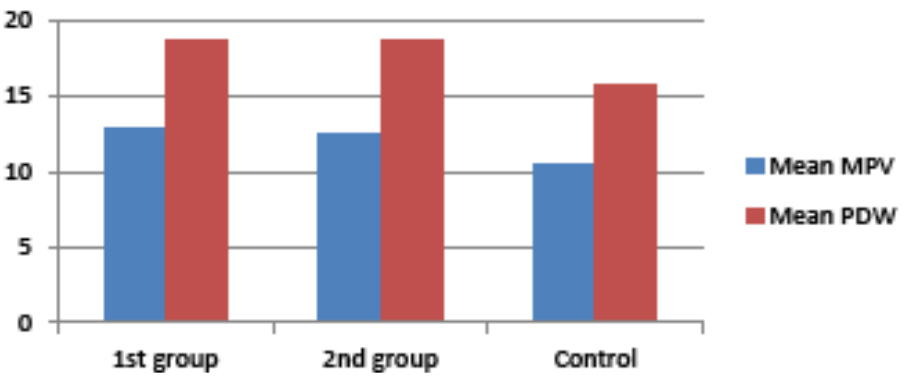

Fig. 1: Bar chart showing the mean values of MPV and PDW in different stroke groups and controls

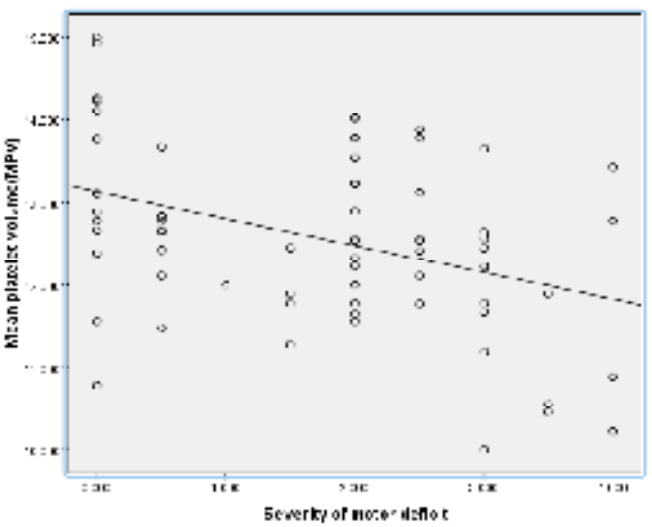

Fig. 2: Scatter dot diagram between the values of MPV and motor deficit scores (based on CNS)

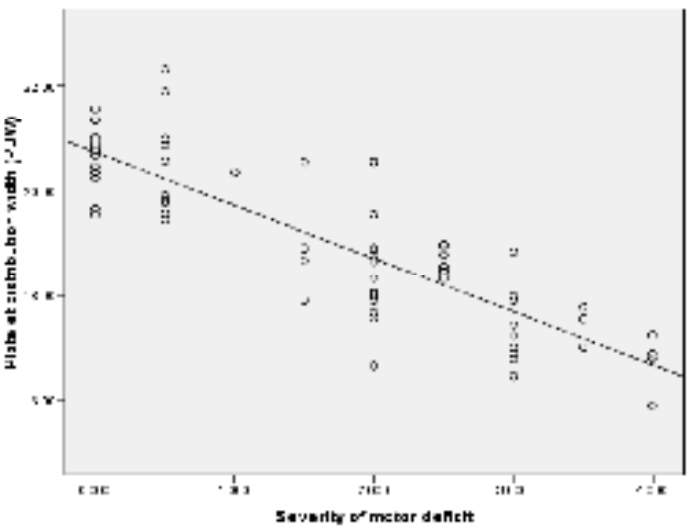

Fig. 3: Scatter dot diagram between the values of PDW and motor deficit scores (based on CNS)

Discussion

The Canadian Neurological Scale (CNS) is a simple and validated tool for assessing stroke severity. The scale amalgamates the following components: comprehension, level of consciousness, speech and motor function of arms, legs and face. Lower CNS scores indicate greater stroke severity. Generally CNS score ≥8 is mild, score 5-7 is moderate and 1-4 is severe stroke.[17,18]

Our study revealed that platelet indices such as MPV and PDW are significantly raised in acute ischemic stroke patients compared to controls. Also increased values of MPV and PDW are significantly associated with greater functional impairment as indicated by motor deficits. All these implicate the role of platelet activation as an important underlying principle in the pathogenesis of stroke.

MPV and PDW are simple indices which are readily available and easily measured. During activation platelets undergo a change of shape from discoid to spherical. There is pseudopodia formation as well. Automated haematological analysers based on impedance technology can easily measure the platelet volume by deformation of electric field, which depends on platelet vertical diameter. [13]

The association between platelet indices and acute thrombotic events have been investigated by researchers all over the world. The association of MPV with the risk of stroke was assessed in the Perindopril Protection Against Recurrent Stroke Study (PROGRESS) which revealed that MPV was positively associated with the risk of stroke, with an 11% increased relative risk (95% CI, 3% to 19%) of stroke per femtoliter greater MPV.[19] Another study by Slavka et al.[20] showed that subjects with higher MPV (>11.01 fl) had 1.5 times higher vascular mortality risk than patients with low MPV (<8.7fl). Arevalo- Lorido et al.[21] in their study concluded that higher values of platelet indices are associated with overall mortality and morbidity including cardiovascular mortality. However a study conducted by Cho et al.[22] failed to show statistically significant difference between patients and controls in terms of MPV values.

Both type II diabetes mellitus and hypertension are important risk factors of acute ischemic stroke. Several studies have demonstrated that type II diabetes mellitus and hypertension are associated with endothelial dysfunction leading to platelet activation and altered platelet-endothelial interaction. The uniqueness of our study lies in the fact that it deals with non-diabetic and non-hypertensive stroke patients. Thus it clearly upholds the view that increased platelet activity is itself an independent risk factor of acute ischemic stroke.

Conclusion

Our study supports the view that increased values of platelet indices, MPV and PDW is associated with increased platelet activity and can be considered as independent risk factor in stroke patients who are non-diabetic and non-hypertensive.

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