A study of platelet volume indices in a patients of ischaemic cerebrovascular disease.

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ABSTRACT

Background: The objective of the study is to estimate platelet volume indices in patients of cerebral ischemic vascular disease. **Methods:** The present study was conducted on 170 subjects in Department of Medicine, NIMS Medical College and Hospital, Jaipur, Rajasthan over eighteen months. The study was conducted on 60 patients admitted in the wards and ICU under the Department of Medicine and 110 controls who were the normal and healthy during the study period. In this study the values of platelet indices – MPV, PDW and platelet count were observed in patients of cerebral ischemia. It was found that large platelets contribute to the prethrombotic state in ischemic syndromes and they may play a specific role in infarction. Because larger platelets are haemostatically more active and hence, their presence is probably a risk factor for developing thrombosis. Statistical analysis was done using Chi – square test, unpaired 't' test and ANOVA test. A p value <0.05 was considered statistically significant. **Results:** In this study it was found that in cerebrovascular disease patients, MPV was 10.30±0.83 fL, PDW was 14.50±0.55 fL, platelet count was 260×10^9 ± 29×10^9 /L while in control, MPV was 8.14± 0.72 fL, PDW was 10.71±0.48 fL, platelet count was 285×10^9 ± 50 $\times10^9$/L. MPV and PDW were higher and platelet count lower in cerebrovascular disease group and a highly significant difference (p<0.001) was found on comparing with controls. **Conclusion:** In this study, it was found that MPV and PDW were raised in cerebrovascular disease suggestive of statistically highly significant when compared to normal control group.

Keywords: Cerebrovascular disease, platelet distribution width (PDW), Mean platelet volume (MPV), Platelet count.

INTRODUCTION

Vascular diseases are leading cause of morbidity and mortality in India and worldwide of which cerebrovascular disease are common ones.[1,2]

Platelets not only act as mediators of thrombus formation, but also as inducers of inflammation. They may also themselves respond to inflammatory mediators produced by leucocytes and endothelial cells. These platelet-mediated inflammatory pathways contribute to atherogenesis in both the early and late stage of the process. The bidirectional interaction between platelets and other cells may also be involved in the nonresolving inflammation characterizing atherosclerosis'

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Platelet morphology has a significant role to play in thrombosis. Platelet size varies between 1.5-3 micrometer.[3]MPV (Mean platelet volume) showing platelet size reflects platelet function and activity. Its value is around 7.4-10.4fL.[4]Juvenile platelets are large in size. Platelets which are large in size i.e. ones which have higher MPV contribute to thrombosis to a greater extent as compared to small platelets hence is a marker of hypercoagulability.[5]

The MPV is higher when there is destruction of platelets.[6] This may be seen as in immune thrombocytopenic purpura (ITP)[7], myeloproliferative diseases[8] and Bernard-Soulier Syndrome.[9] It may also be related to pre-eclampsia,[10] and recovery from transient bone marrow hypoplasia. MPV is also increased in Essential thrombocythemia. [11]

High MPV associates with a variety of established risk factors, cardio and cerebrovascular disorders, and low-grade inflammatory conditions prone to arterial and venous thrombosis.[5]

PDW (Platelet distribution width) provides information about the range of platelet size in a blood sample. It is a more specific marker of platelet activation than MPV since it does not increase during simple platelet swelling.[12]It is decreased in thrombocytopenia and Von Willibrand disease and is increased in myeloproliferative disorders[13]as Essential thrombocythaemia, sickle cell disease.[14]

In Bernard-Soulier syndrome, up to 10% of normal platelets are giant, whereas more than 20% of platelets are giant in conditions like Immune thrombocytopenic purpura, lympho- and myeloproliferative disorders, thrombotic thrombocytopenic purpura, Disseminated intravascular coagulopathy.[15]

Large platelets contain more dense granules, are metabolically and enzymatically more active than small platelets and produce more thromboxane A2.[16,17] They release more serotonin and β-

thromboglobulin,[17,18]hence having higher thrombotic potential. An increased MPV decreases the inhibitory effectiveness of prostacyclin on both platelet aggregation and release reaction.[19]
Thus, platelet volume indices are an important, simple, effortless, and cost effective tool that should be used and explored extensively, especially in countries such as India, for predicting the possibility of impending acute events.

MATERIALS AND METHODS

The present study was conducted on 170 subjects in Department of Medicine, NIMS Medical College and Hospital, Jaipur, Rajasthan over eighteen months. 60 patients were of cerebrovascular disease and 110 controls were taken. In this study the values of platelet indices – MPV, PDW and platelet count were observed in patients of coronary and cerebral ischemia.
Inclusion criteria include adults above the age of 18 years, patients admitted with ischemic stroke and transient ischemic attack and age and sex matched healthy controls from the normal population. Exclusion criteria include patients with primary platelet disease, patients with any bleeding disorder, patients with any clotting disorder, patients taking antiplatelet therapy, patients on statins and doxazosin.
All subjects were evaluated by taking detail history along with various investigations like Hb, TLC, DLC, Platelet count, Peripheral blood film, Platelet volume indices- Mean platelet volume, Platelet distribution width; Urine examination complete, Blood Urea, Serum Creatinine, Random blood sugar, Serum electrolyte, Lipid profile, ECG, Chest X ray, CT head–plain and contrast as required, Cerebral CT angiography as required, MRI brain as required, Cerebral MRI angiography as required were done. All 110 matched normal healthy controls also underwent the same procedure of history, examination and investigation.Blood samples were obtained before giving any antiplatelet or anticoagulant therapy. Blood was collected in di-potassium EDTA tubes by a clean puncture avoiding bubbles and froth. Sample was examined by running into autoanalyser (Benesphera three part Hematology Analyser H31) within two hours of venepuncture.Normal value of platelet count is 1,50,000 to 4,50,000/µL[26]; PDW is 9 to 14 fL and MPV is 7.4 to 10.4 fL.[3]
Statistical Methods: - Statistical tests like Chi-square test, unpaired't' test and ANOVA test were applied . A p value <0.05 was considered statistically significant. Data obtained was analysed statistically by SPSS software.

RESULTS

Table 1: Comparison of groups with respect to Platelet Indices

Platelet Indices	Group	N	Mean	Std. Deviation	'p' Value*
MPV(in fL)	CVD	60	10.30	0.83	<0.001
	Control	110	8.14	0.72	
PDW(in fL)	CVD	60	14.50	0.55	<0.001
	Control	110	10.71	0.48	
Platelet Count ($\times10^9$/L)	CVD	60	260	29	<0.001
	Control	110	285	50	

*Unpaired 't' test

It was found that MPV and PDW were higher and platelet count lower with a highly significant difference (p<0.001) in cerebrovascular disease group as compared to controls [Table 1, Figure 1& 2].

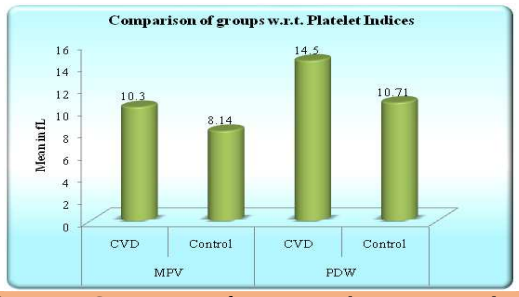

Figure 1: Comparison of groups with respect to Platelet Indices

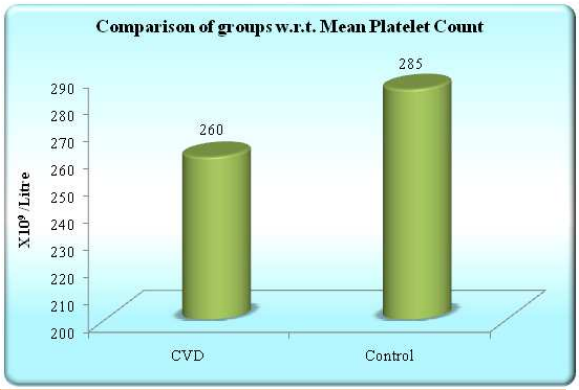

Figure2: Comparison of groups with respect to Mean Platelet Count

DISCUSSION

Platelet morphology has an important role to play in thrombosis of cerebral artery. One view is that generalized platelet activation occurs before a thrombotic event. The increase in platelet consumption at the site of the atherosclerotic plaque causes larger platelets to be released from the bone marrow.[20] This leads to larger mean platelet volume and lower platelet count in cerebral ischemia. But there are studies indicating that platelet size is determined at the level of the progenitor cell. Megakaryocyte ploidy is influenced by interleukin 3 and interleukin 6, which leads to the production of larger platelets that are more reactive.[21-22]

In the present study with cerebrovascular disease patients, MPV was 10.30±0.83 fL, PDW was 14.50±0.55 fL, platelet count was $260\times10^9\pm29\times10^9$/L while in controlMPV was 8.14± 0.72 fL, PDW was 10.71±0.48 fL, platelet count was $285\times10^9 \pm 50 \times10^9$ /L. MPV and PDW were higher and platelet count lower in cerebrovascular disease group and a highly significant difference ($p<0.001$) was found on comparing with controls.

The findings of this study were in line with the study conducted by O'Malley et al (1995)[23], Mayda-Domaç , Misirli, Yilmaz (2010)[24] and Bath et al (2004)[25].

Therefore, in this study it was found that MPV and PDW were raised with a highly significant difference and decrease in platelet count was moderately significant in most of the groups.

Data of this present study suggest that large platelets contribute to the prethrombotic state in ischemic syndromes and they may play a specific role in infarction. Because larger platelets are haemo-statically more active and hence, their presence is probably a risk factor for developing thrombosis. Patients with larger platelets can easily be identified during routine haematological analysis.

This way this study was a small step towards the study of platelet volume indices in patients of cerebral thrombosis, which may help the health providers in predicting an impending ischemic event.

In this study, it was seen that platelet morphology played an important role in thrombosis and this fact may have therapeutic implication in future.

Hence, this fact of platelet morphology playing a significant role in thrombosis should be taken into consideration and further trials shall be required to see the effect of drugs, which may affect the platelet morphology so that we can have a new line of preventive treatment for thrombotic events.

CONCLUSION

In this study, it was found that large platelets contribute to the prethrombotic state in ischemic syndromes and they may play a specific role in infarction. Because larger platelets are haemo-statically more active and hence, their presence is probably a risk factor for developing thrombosis.

Patients with larger platelets can easily be identified during routine haematological analysis. Hence, these indices serve as an important and cost effective tool in predicting an impending ischemic event.

It was observed in this study that platelet morphology played an important role in thrombosis and this fact could be used therapeutically in the future. Presently therapeutic implications regarding platelets are restricted to their numbers only whereas, it may be important to modify their morphology. Trials are going on to study the effect of various drugs on platelet morphology.

Hence, this fact of platelet morphology playing a significant role in thrombosis should be taken into consideration and further trials shall be required to explore the role of drugs, which may affect the platelet morphology so that we can have a new line of preventive treatment for thrombotic events.

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