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Association of Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) with Acute Coronary Syndrome (ACS).

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Abstract

Platelets play a key role in pathogenesis of Acute Coronary Syndrome (ACS). A careful study and identification of these risk factors is important for diagnostic and prognostic importance. Thus, the present study shows that platelet indices like Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) can act as reliable diagnostic indicators especially in patients with raised Troponin-T. MPV & PDW is a part of basic Complete Blood Count (CBC) provided by automated haematology analysis which are rarely used in clinical practice and correlation for acute coronary syndrome. High MPV has been associated to more reactive platelets and regarded as an independent risk factor for myocardial infarction.

In this study 36 patients suffering from Acute Coronary Syndrome (ACS) with elevated Troponin-T were evaluated against 15 healthy individuals (control). The results obtained showed significantly higher MPV and PDW in these cases.

The assessment of blood samples is done by Sysmex-SX 800i autoanalyzer.

The p value for MPV and PDW is < 0.001. Hence a positive correlation can be made between raised MPV and PDW with raised Troponin-T levels.

Introduction

Coronary heart disease (CHD) is most commonly caused by rupture of an atherosclerotic plaque. It is one of the leading cause of mortality and morbidity world wide especially in developing countries like India.

Atherosclerosis is a chronic inflammatory phenomenon that occurs in response of an injury to vascular endothelium. Leading to alterations in vascular permeability, exposing of adhesion molecules, lipid deposition and macrophage accumulation.

Adipocytes can synthesize cytokines such as Tumour Necrosis Factor- Alpha (TNF- alpha) and Interlukin-6 (IL-6), in this way it can promote atherogenesis. [1]

A study conducted by Pignatellie P et. al showed that TNF- alpha behaves as a triggering agent of platelet activation through stimulation of the arachidonic acid pathway. [2]

The progression of atherosclerotic lesions seems to occur with increased thrombopoiesis activation where

cytoplasmic maturation of megakaryocytes is faster than nuclear maturation, resulting in macroplatelets that produce more thromboxane-A2 and show greater reactivity in platelet aggregation curves. [2]

These observations emphasise that MPV and PDW may be considered as indicators of platelet function. Large platelets have also been associated with myocardial damage in acute coronary syndrome with an unfavourable outcome of patients suffering with myocardial infarction.[3]

A regular complete blood count sample is sufficient enough to identify these platelet indices i.e. Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) which are barely use in clinical practice and correlation.

Materials and Methods

It is a hospital based cross-sectional study. The study was conducted between May 2017 to January 2018 at Mahatma Gandhi Medical College & Hospital, Jaipur. Considering 36 patients suffering from acute coronary syndrome are considered for the study. Only those cases with troponin -I positive were considered for study. Troponin-I levels > 0.3ng/ L were taken to be positive. Venous blood samples were drawn from all the subjects after admission to the hospital but before initiation of the treatment. All the blood samples were collected in standardised EDTA tubes.

The blood samples were processed within one hour of collection using Sysmex-SX 800i autoanalyzer.

Sysmex- XS 800i uses Hydrodynamic Focusing (DC detection) method for analysis of platelet indices.

Mean platelet Volume (MPV) :- Calculated from the following equation- [4]

$$MPV\ (fl) = \frac{PCT\ (\%) \times 1000}{PLT\ (x10^3/ul)}$$

Platelet Distribution Width: With the peak height assumed to be 100%, the distribution width at the 20% frequency level is PDW.[4]

Table I- Case & Control Data

PATIENT	PDW	MPV	Trop-1 level	CONTROL	PDW	MPV
patient 1	16	12.5	3.96	Control 1	13.2	9
patient 2	19.2	14	3.39	Control 2	14.5	8.5
patient 3	19	13.8	4.4	Control 3	16.3	12
patient 4	17.6	13.5	3.5	Control 4	15	10
patient 5	15.2	10.4	10	Control 5	12.1	8.4
patient 6	17	13.2	8.37	Control 6	14	11
patient 7	17.2	13.1	3.52	Control 7	13	9.3
patient 8	18.6	13.2	7.15	Control 8	12.5	9
patient 9	20.9	14.2	10	Control 9	13.7	10
patient 10	15	10.2	8.2	Control 10	11.5	11
patient 11	16.2	9.3	3.2	Control 11	10.2	9.4
patient 12	18	13.7	5.56	Control 12	11.4	11
patient 13	18.5	13.8	10	Control 13	14.6	9.5
patient 14	17.3	13.5	10	Control 14	12.6	10
patient 15	19	13.8	8	Control 15	11.1	10.3

patient 16	18.7	13.3	5	total	195.7	148.4
patient 17	16.9	13	10	SD	1.662127	1.029193
patient 18	15.2	10.3	7.9	Mean	13.04667	9.893333
patient 19	21.3	14.3	3.81			
patient 20	15	10.6	10			
patient 21	16.7	13.3	7.32			
patient 22	18.5	13.5	10			
patient 23	17.3	13.2	6.4			
patient 24	18	13.6	10			
patient 25	16.7	12	3.22			
patient 26	17.5	13.7	4.73			
patient 27	15	12.5	1.83			
patient 28	19	14	5.48			
patient 29	16.8	12.5	10			
patient 30	16	13.4	2.68			
patient 31	19	14	5.23			
patient 32	18	13.5	8.1			
patient 33	16.6	13.2	10			
patient 34	20	13.2	3.19			
patient 35	17	13	10			
patient 36	17.5	13.6	10			
Total	631.4	465.9				
Mean	17.53889	12.94167				
Sd	1.591276	1.245191				

Results

A total of 51 subjects were enrolled in the study. The study group consists of 36 patients suffering from acute coronary syndrome. All patients were troponin-I positive i.e trop-I value more than 0.3ng/L. Their platelet indices like Mean platelet volume (MPV) and platelet distribution width (PDW) were evaluated against 15 healthy individuals.

Troponin-I positive patients showed a higher MPV 12.94 ± 1.24 against 9.89 ± 1.02 for the control group. PDW also showed high variation between the study and control groups. PDW of study group of 36 patients with Trop-I levels was noted as 17.53 ± 1.59 against 13.04 ± 1.65 for control population.

Thus both Mean Platelet volume (MPV) and Platelet Distribution Width (PDW) both are found to be higher in patients suffering from acute coronary syndrome (ACS). The p- value for MPV < 0.001 and PDW < 0.001. So we reject null hypothesis and the result is statistically significant. Proving strong correlation between raised MPV and PDW with ACS.

Table-II Observation and Results- Case Group

	MEAN	SD
MPV	12.94	1.24
PDW	17.53	1.59

Table-III Observation and results – Control Group

	MEAN	SD
MPV	9.89	1.02
PDW	13.04	1.65

Discussion

Large platelets are characterised by high MPV. It is known that larger platelets are more reactive due to higher concentration of active substances in microgranules like thromboxane A2 and B2, platelet factor-4, P-selectin, platelet derived growth factor [5]

Activation process of platelets results in signalling pathways that induce platelets to change their shape (metamorphosis) and size.[6]

Thus become more active in secreting TX-A2 and ADP into the circulation. Larger platelets are more adhesive and tend to aggregate more than smaller ones.[7] It also expresses adhesive receptors like glycoprotein II b / III a. All these factors collectively contribute to formation of arterial thrombus.

Platelet indices like MPV and PDW are automatically generated by any automated analyser. Hence the values of MPV and PDW are raised when concentration of reactive platelets is raised. The current study showed higher MPV and PDW in study population as compared to the healthy population.

Data derived from our study is well supported by studies conducted by El- Dosouky and Shehata [8], Wang X, Xu XL et. al. [9], Randheer Pal et al. [5], Kumar V et al. [10] All these studies showed strong statistical significance ($p < 0.001$), thus proving strong correlation between MPV and acute coronary syndrome. All these studies had considered Troponin positive individuals in their study.

Silva Cristina Costa et al. [3], Musluhittin Emre Erkus [11] et. al., Jan Budzianowski, et al.[12], Kruthika et. al.[13], Kumar V et. al. [10] Abdullah S Assiri et. al. [14] have successfully concluded that MPV and PDW are significantly raised in patients with acute coronary syndrome.

Study conducted by Wang X, Xu XL et.al.[9]calculated sensitivity as 68.81% and specificity as 97.98%. While study conducted by El- Dosouky and Shehata conclude sensitivity as 84% and specificity as 65%.[8]

Conclusion

Patients suffering from acute coronary syndrome had higher platelet indices i.e. Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) at the time of hospital admission compared to those of the control groups.

Since the readings of MPV and PDW are generated along with the regular CBC can act as an effective adjuvant in diagnosis of ACS. This can be of great use especially in peripherial health care centres (PHC). Accurate and timely diagnosis may also help in reduced mortality rates occurring due to ACS

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