Original Research Article

Relationship of platelet distribution width and white blood cell count on admission with ST-elevation in myocardial infarction

Kaur N[1*], Thangamuthu K[2]

[1]Resident Medical Officer, Comrade Jagdish Chander Freedom Fighter District Hospital, Sangrur, Punjab, India
[2]Registrar, Department of Medicine, SPT Hospitals, Coimbatore, Tamil Nadu, India
[*]Corresponding author email: **navneet.dhillon646@gmail.com**

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Abstract

Background: The early risk stratification for ST-segment Elevation Myocardial Infarction (STEMI) aims to provide early access to known therapies which will improve the outcome. The mainstay of treatment in STEMI is fibrinolysis in a patient who presents to the hospital with no Percutaneous Coronary Intervention (PCI) or could not be transferred to a PCI center and who has no contraindications for thrombolysis.

Aim of the study: To find the association between platelet distribution width and white blood cell count on admission with ST-segment resolution in patients with ST-segment elevation myocardial infarction treated with streptokinase.

Materials and methods: This single centered cross-sectional study was conducted in Comrade Jagdish Chander Freedom Fighter District Hospital, Sangrur in the year 2020. 100 Patients admitted in the casualty with ST-segment elevation myocardial infarction were taken a detailed history to find out the duration of symptoms, any contraindications for thrombolysis, any previous history of coronary artery heart disease, and any previous history of bleeding tendencies.

Results: In the study group, 39% of patients presented within 3 hours of symptoms, and 61% of patients presented after 3 hours. Among 100 patients, the door to needle time was less than 15 minutes in 46% of patients and more than 15 minutes in 54%. In the study group, 49% of patients had platelet distribution width less than 12.85, and 51% of patients had platelet distribution width more than 12.85. Mean platelet distribution width: 12.35. In the study group, 50% of the patients had white blood cell count of less than 12650 per microlitre and 50% had white blood cells count of more than 12650 per microlitre.

Conclusion: The relationship between platelet distribution width and white blood cell count on admission with ST-segment resolution in patients with acute ST-elevation myocardial infarction treated with streptokinase proved to be significant in terms of higher the indices, more chances of failed thrombolysis. So these patients can be identified early and can be referred for more aggressive treatment modalities.

Key words

Acute Coronary Syndrome, Electrocardiography, Non-ST-Elevation Myocardial Infarction, ST-segment Resolution.

Introduction

Cardiovascular disease is on the rise, accounting for up to 16 million deaths globally in 2010 Ischemic heart disease (IHD) is a condition which comprises the inadequate supply of nutrients to the myocardium and occurs typically when there is a mismatch between oxygen supply and demand [1]. Ischemic heart disease can present as the following syndromes: Myocardial Infarction (MI), Angina pectoris, Chronic IHD with heart failure, and sudden death. Acute myocardial infarction (AMI), unstable angina (UA), and sudden cardiac death (SCD) are referred to as acute coronary syndromes sharing the pathology of plaque disruption or acute plaque change [2]. The early risk stratification for ST-segment Elevation Myocardial Infarction (STEMI) aims to provide early access to known therapies which will improve outcome. The mainstay of treatment in STEMI is fibrinolysis in a patient who presents to the hospital with no Percutaneous Coronary Intervention (PCI) or could not be transferred to a PCI center and who has contraindications for thrombolysis. ST-segment resolution (STR) remains a cost-effective solution to assess reperfusion after fibrinolysis in STEMI [3]. It is well established that large platelets are involved in the development of atherosclerotic plaques and Acute Coronary Syndrome (ACS). Studies have shown that patients with elevated White Blood Cell Count (WBC-C) during acute myocardial infarction are at higher risk of mortality and recurrent AMI [4].

Materials and methods

This single centered cross-sectional study was conducted in Comrade Jagdish Chander Freedom Fighter District Hospital, Sangrur in the year 2020. 100 Patients admitted in the casualty with ST-segment elevation myocardial infarction were taken a detailed history to find out the duration of symptoms, any contraindications for thrombolysis, any previous history of coronary artery heart disease, and any previous history of bleeding tendencies.

Inclusion criteria:

- Patients admitted with ST-segment elevation myocardial who were treated by streptokinase,
- Presenting within 6 hours of chest pain.
- Without any contraindication for thrombolysis.
- Age group from 20 to 100 years.

Exclusion criteria:

- Previous history of coronary artery heart disease,
- Known case of bleeding diathesis.
- Abnormal platelet counts.
- White blood cell counts more than 25000 cells /microliter.
- Patients admitted in the casualty with ST-segment elevation myocardial infarction were taken a detailed history to find out the duration of symptoms, any contraindications for thrombolysis, any previous history of coronary artery heart disease, and any previous history of bleeding tendencies.

Those patients who meet the inclusion criteria were taken up into the study. Patients who

present within six hours of myocardial infarction but with contraindications to thrombolysis were not included in the study. A detailed clinical examination of all the systems was done. A blood sample was drawn from the patients and sent for a complete hemogram to find out the platelet distribution width and white blood cell count. The hemogram was done with an automated analyzer. Patients with gross abnormalities in the platelet counts and white blood cell counts were not included in the study. The eligible patients were then thrombolyzed with streptokinase. A follow-up electrocardiogram was taken to assess the percentage of ST-segment resolution in comparison with the first electrocardiogram taken in the casualty before thrombolysis. Patients with more than 50% of ST-segment resolution were taken as successful thrombolysis. The patients were followed up during their hospital stay until they get discharged. They were also followed up to 30 days of the event to assess their short term mortality.

Results

In this study, the age of patients ranged from 30 years to 91 years with the majority of the patients in the fifth and sixth decades and the mean age was 52.95. Among the 100 patients in the study, 74 patients were male and 26 were female. P Value: 0.195. The p-value in comparing age and platelet distribution width showed that there was no significant association between the two (**Table – 1**).

Table – 1: Age and platelet distribution width.

Age (Years)	PDW less than 12.85	PDW more than 12.85
21-30	2	0
31-40	7	8
41-50	12	17
51-60	15	18
61-70	9	4
71-80	1	4
81-90	2	0
91-100	1	0

Table – 2: Diabetes mellitus and platelet distribution width.

Diabetes mellitus	PDW less than 12.85	PDW more than 12.85
Present	31	42
Absent	18	9

Table – 3: Systemic hypertension and platelet distribution width.

Systemic hypertension	PDW less than 12.85	PDW more than 12.85
Present	36	38
Absent	13	13

Table – 4: Dyslipidemia and platelet distribution width.

Dyslipidemia	PDW less than 12.85	PDW more than 12.85
Present	38	47
Absent	11	4

Table - 5: Platelet distribution width and area of myocardial infarction.

Area of myocardial infarction	PDW less than 12.85	PDW more than 12.85
Anterior	19	19
Inferior	12	4
Anterolateral	4	1
High lateral	4	3
Inferno lateral	3	6
Antero septal	7	7
Inferior and RV	0	1

Table – 6: Duration of myocardial infarction and platelet distribution width.

Duration of Myocardial Infarction	PDW less than 12.85	PDW more than 12.85
Less than 3 hours	32	7
More than 3 hours	17	44

The above p-value showed that there was no association between diabetes mellitus and platelet distribution width in the study (P Value: 0.032) as per **Table – 2**.

Table – 7: Door to needle time and platelet distribution width.

Door to needle Time	PDW less than 12.85	PDW more than 12.85
Less than 15 minutes	35	11
More than 15 minutes	14	40

Table – 8: Platelet distribution width and ST-segment resolution.

ST - segment resolution	PDW less than 12.85	PDW more than 12.85
More than 50 %	39	10
Less than 50 %	6	45

Table – 9: Platelet distribution width and mortality.

Mortality	PDW less than 12.85	PDW more than 12.85
Alive at 30 days	47	44
Not alive at 30 days	2	7

The above p-value shows that there was no association between systemic hypertension and platelet distribution width (P value: 0.906) as per **Table – 3**.

The above p-value showed that there was no significant association between dyslipidemia and platelet distribution width (P value: 0.041) as per **Table – 4**.

The above p-value showed that there was no significant association between the area of myocardial infarction and platelet distribution width (P value: 0.669) as per **Table – 5**.

The above p-value showed that there was a significant association between the duration of myocardial infarction and platelet distribution width. More the duration of myocardial infarction, the higher the platelet distribution width (P value: <0.001) as per **Table – 6**.

The above p-value indicated that there was a significant association between the door to needle time and platelet distribution width. More the door to needle time, the higher the platelet distribution width (P value: <0.001) as per **Table – 7**.

The above p-value showed that there was a significant association between platelet distribution width and ST-segment resolution. The more the platelet distribution width lesser the success of thrombolysis (ST-segment resolution) (P value: <0.001) as per **Table – 8**.

The above p-value showed that there was no significant association between platelet distribution width and mortality at 30 days (P value: 0.092) as per **Table – 9**.

Discussion

Coronary artery heart disease is the major cause of mortality and morbidity and is on the rise. There are several clinical and laboratory parameters being studied to prognosticate patients with the acute coronary syndrome [5]. Platelet indices like Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) are well-studied markers to prognosticate patients. It was hypothesized that in acute coronary heart disease, there is increased platelet swelling and pseudopodia formation which causes an increase in the Mean Platelet Volume and Platelet Distribution Width [6]. Among the two indices, Platelet Distribution Width is found to be a more specific marker for the activation of platelets. White blood cells are a marker of inflammation and it is also well studied in patients with an acute coronary syndrome which causes a rise in the inflammatory markers [7]. White blood cell count, a marker of the inflammatory response and platelet distribution width, a marker of reactivity of platelets have been studied to have unfavorable outcomes in patients with ST-elevation myocardial infarction. Here in our study, we aim to analyze and evaluate the significance of Platelet Distribution Width and White Blood Cell count on admission about ST-segment resolution in patients with ST-segment elevation myocardial infarction who are

treated with streptokinase [8]. Fauci AS, et al. did a study to analyze the relationship of mean platelet volume, platelet distribution width and white blood cells on admission in patients with ST-elevation myocardial infarction with ST-segment resolution when they are thrombolysed with streptokinase. And they derived cut-off values for mean platelet volume, platelet distribution width, and white blood cell count for ST-segment resolution with the best sensitivity and specificity [9]. In a recent study done by G.K. Hansson et al. it was found that platelet distribution width and white blood cells were increased in patients with STEMI and they served as independent predictors for acute STEMI. They also found that mean platelet volume and platelet distribution width were independent predictors of failure of thrombolysis. Also, patients with acute STEMI had these indices on the higher side when compared with patients who had a stable coronary artery disease [10]. J.A. Schaar T, et al. studied that mean platelet volume is found to be an independent marker of impaired reperfusion angiographically and six-month mortality in patients with ST-segment elevation myocardial infarction who are treated with primary percutaneous coronary intervention but there was less data which analyzed the platelet distribution width and in-hospital adverse cardiovascular events [11]. He also proved that admission means platelet.volume and platelet distribution width correlates independently with the no-reflow phenomenon and in-hospital major cardiovascular event. Kasper, Fauci et al. studied that mortality due to a vascular cause increases when the mean platelet volume is more than 11.01 fL [12]. Lowe GD, et al. studied that white blood cell count is found to be elevated in acute coronary syndromes and is related to recurrent events [13]. In our study, there was no association between age, sex, smoking, systemic hypertension, dyslipidemia, area of myocardial infarction, 30-day mortality, and platelet distribution width. There was a significant association between duration of myocardial infarction, door to needle time, ST-segment resolution, hospital stay, and platelet distribution width [14]. There was no significant association between age, sex, smoking, systemic hypertension, dyslipidemia, area of myocardial infarction, 30-day mortality with ST-segment resolution. There was a significant association between duration of myocardial infarction, door to needle time hospital stay with ST-segment resolution. There was also a significant association between white blood cell count and ST-segment resolution [15].

Conclusion

Platelet distribution width, a marker of platelet reactivity and white blood cell count, a marker of inflammatory state are inexpensive and simple markers and can be used as a prognostic tool for the success of thrombolysis and the risk stratification of patients presenting with acute ST-segment myocardial infarction. We can speculate that acute STEMI patients having MPV-PDW and WBC-C values above their's cut off patients should be considered for stronger antiplatelet and helps the anti-inflammation treatment to be able to attain a favorable ST resolution and better clinical outcome.

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