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Prognostic Impact of Decline in Platelet Count in Patients Underwent PCI

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Abstract

Background: Reduced platelet count after PCI has occurred as a potential predictor of patients' outcomes over the past few years. Defining post-PCI platelet count reduction as above, a significant relationship between post-PCI platelet reduction and adverse clinical events such as bleeding, thrombocytopenia and higher mortality was observed.

Objective: The purpose of this research was to determine the significance of platelet count reduction for the prognosis of PCI patients.

Methods: This prospective analysis was carried out at Department of Cardiology, PAEC Hospital, Islamabad, from 1st August 2024 till 31st December 2024. The study included 213 patients with CAD who underwent PCI. The inclusion criteria included that patients were ≥18 years of age. Secondary end points were BARC adjudicated bleeding events and all-cause mortality. Gastrointestinal bleeding was categorized as minor (BARC types 1 and 2), and major (BARC types 3 and 5)

Results: The mean age of the participants was 63.2 ± 10.5 years, with males contributed to (71.8%). The most frequent coexisting conditions were hypertension in (52.6%) of cases and diabetes mellitus in (37.1%) of cases; there was no significant difference in the prevalence of


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comorbidities among the groups (p=0.653, p=0.950, respectively). MI was in the significant decline group (27.9%) as compared with moderate (10.2%) and minimal decline groups (5.6%), $p < 0.01$.

Conclusions: According to our study, larger post-PCI drop in platelet count is related to increased risk of MI, ST, TVR, major bleeding events and death. These results suggest that platelet count should be checked periodically and appropriate interventions should be offered to enhance patient's prognosis.

Keywords: Platelet Count Decline, Percutaneous Coronary Intervention (PCI), Major Adverse Cardiovascular Events (MACE).

INTRODUCTION

Percutaneous coronary intervention (PCI) is one of the most commonly employed revascularization techniques in the management of (CAD) with the objectives of optimizing myocardial flow and avoiding MI and its consequences [1, 2]. Although numerous modifications have been made to the techniques of PCI and the incorporation of pharmacotherapy as an addition, patients, who undergo this procedure, remain at risk of adverse events with reference to thrombotic and bleeding episodes [3, 4]. Another rather critical but not very often considered aspect of the post-PCI period is the platelet count that can be used as an indicator of numerous complications [5, 6, 7].

Coagulation is a vital function of platelets as well as thrombosis [8, 9]. A drop in platelet level by 10% below the lower limit of normal range post PCI may actually denote processes of consumption, drug-induced thrombocytopenia, or activation of coagulation that may predispose patients to bleeding or thrombosis [10, 11]. Prior publications have posited that changes to platelet count after PCI could be associated with a higher risk of MACE including MI, stent thrombosis, and death or bleeding [12]. However, prognostic implication of such changes remains inconclusive and the subject of further discussion.

The purpose of this present research is to evaluate the individual effect of platelet count decline post PCI in a group of patients suffering from coronary artery disease. We hypothesized that a


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https://jmhsr.com/index.php/jmhsr


steep decline in platelet count after the procedure is related with higher clinical events such as MACE, bleeding events, as well as all-cause mortality.

Methodology

This prospective descriptive study was carried out at Department of Cardiology, PAEC Hospital, Islamabad, from 1st August 2024 till 31st December 2024. The study included 213 patients with CAD who underwent PCI. The inclusion criteria included that patients were ≥18 years of age, who underwent PCI with stent implantation and whose platelet count was measured both before and after the procedure. Those patients who had active malignancy, autoimmune disease or thrombocytopenia before the procedure were not included in the study to avoid potential confounding factors that may affect platelet count changes. Electronic medical data of patients were collected including demographic characteristics, medical history, procedure information and laboratory results. The pre PCI and post PCI platelet counts were collected from 24 hours prior to the PCI and from 24 to 72 hours after the PCI respectively. The magnitude of platelet count decline was calculated as a percentage based on pre-PCI platelet levels, and patients were stratified into three groups based on the degree of decline; low reduction (up to 10%), moderate reduction (10-25%), and high reduction (above 25%). The specific end points of focus were MACE which included patients experiencing MI, ST, target vessel revascularization, and all-cause mortality within 6 months of PCI. Secondary end points were BARC adjudicated bleeding events and all-cause mortality. Gastrointestinal bleeding was categorized as minor (BARC types 1 and 2), and major (BARC types 3 and 5).

Statistical Analysis

Descriptive statistics tests were conducted using the SPSS software version 25. Data were analyzed using descriptive statistics where demographic data and platelet count difference from baseline were described. Quantitative data was presented as Mean standard deviation whereas qualitative data was presented as number of patients and percentage. Inter-group comparisons were done using analysis of variance for quantitative data and chi square tests for qualitative

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https://jmhsr.com/index.php/jmhsr

data. When calculating the risk of stroke after PPI use, other factors including age, sex, hypertension, diabetes mellitus, BMI, socioeconomic status, residence, education level, and the use of antithrombotic agents were considered for adjustment. The statistical significance was set to a p value <0.05.

Results

The mean age of the participants was 63.2 ± 10.5 years, with males contributed to (71.8%). The most frequent coexisting conditions were hypertension in (52.6%) of cases and diabetes mellitus in (37.1%) of cases; there was no significant difference in the prevalence of comorbidities among the groups (p=0.653, p=0.950, respectively). MI was reported by (21.1%) of the patients without any difference among groups (p=0.880).

Table 1: Baseline Characteristics of the Study Population

Characteristic	Total (N=213)	Minimal Decline (<10%) (n=72)	Moderate Decline (10-25%) (n=98)	Significant Decline (>25%) (n=43)	p-value
Age (years)	63.2 ± 10.5	62.8 ± 10.2	64.1 ± 9.8	63.7 ± 11.3	0.620
18-40 years	35 (16.4%)	15 (20.8%)	16 (16.3%)	4 (9.3%)	0.184
41-60 years	88 (41.3%)	28 (38.9%)	41 (41.8%)	19 (44.2%)	0.865
61-80 years	72 (33.8%)	23 (31.9%)	33 (33.7%)	16 (37.2%)	0.798
>80 years	18 (8.5%)	6 (8.3%)	8 (8.2%)	4 (9.3%)	0.982
Male, n (%)	153 (71.8)	52 (72.2)	71 (72.4)	30 (69.8)	0.930
Hypertension, n (%)	112 (52.6)	35 (48.6)	52 (53.1)	25 (58.1)	0.653
Diabetes Mellitus, n (%)	79 (37.1)	27 (37.5)	37 (37.8)	15 (34.9)	0.950
History of MI, n (%)	45 (21.1)	16 (22.2)	21 (21.4)	8 (18.6)	0.880

BMI result, was observed that majority of the participants were either overweight (38.5%). According to their socioeconomic status classification (48.4%) participants were from middle

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https://jmhsr.com/index.php/jmhsr

income, (28.2%) from low income and (23.5%) from high income. In terms of place of residence, (65.7%) of patients lived in urban areas (35.7%) of participants had secondary education, while (22.1%) had higher education.

Table 2: Demographic variables of study population

Variables	Total Patients (N=213)	Minimal Decline (<10%) (n=72)	Moderate Decline (10-25%) (n=98)	Significant Decline (>25%) (n=43)	p-value
BMI Category (kg/m^2)					
Underweight (<18.5)	10 (4.7%)	3 (4.2%)	4 (4.1%)	3 (7.0%)	0.740
Normal (18.5–24.9)	76 (35.7%)	25 (34.7%)	36 (36.7%)	15 (34.9%)	0.968
Overweight (25–29.9)	82 (38.5%)	28 (38.9%)	38 (38.8%)	16 (37.2%)	0.982
Obese (≥30)	45 (21.1%)	16 (22.2%)	20 (20.4%)	9 (20.9%)	0.875
Socioeconomic Status					
Low	60 (28.2%)	19 (26.4%)	29 (29.6%)	12 (27.9%)	0.910
Middle	103 (48.4%)	34 (47.2%)	46 (46.9%)	23 (53.5%)	0.730
High	50 (23.5%)	19 (26.4%)	23 (23.5%)	8 (18.6%)	0.675
Residence					
Urban	140 (65.7%)	50 (69.4%)	66 (67.3%)	24 (55.8%)	0.284
Rural	73 (34.3%)	22 (30.6%)	32 (32.7%)	19 (44.2%)	0.295
Education Level					
No Formal Education	32 (15.0%)	10 (13.9%)	14 (14.3%)	8 (18.6%)	0.745
Primary Education	58 (27.2%)	20 (27.8%)	24 (24.5%)	14 (32.6%)	0.642
Secondary Education	76 (35.7%)	25 (34.7%)	36 (36.7%)	15 (34.9%)	0.980

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https://jmhsr.com/index.php/jmhsr

Higher Education	47 (22.1%)	17 (23.6%)	24 (24.5%)	6 (14.0%)	0.388

MI was in the significant decline group (27.9%) as compared with moderate (10.2%) and minimal decline groups (5.6%), $p < 0.01$. The incidence of stent thrombosis was higher in the significant decline group (20.9%). In general, MACE rate was worst on the significant decline group with (41.9%), ($p < 0.01$).

Table 3: Incidence of Major Adverse Cardiovascular Events (MACE)

Outcome	Minimal Decline (<10%)	Moderate Decline (10-25%)	Significant Decline (>25%)	p-value
Myocardial Infarction (MI)	4 (5.6%)	10 (10.2%)	12 (27.9%)	<0.01
Stent Thrombosis	3 (4.2%)	7 (7.1%)	9 (20.9%)	<0.01
Target Vessel Revascularization	2 (2.8%)	5 (5.1%)	6 (14%)	0.03
MACE (Overall)	8 (11.1%)	22 (22.4%)	18 (41.9%)	<0.01

By using the BARC classification, minor bleeding (BARC Type 1-2) was reported in (18.6%) of the significant decline group, and major bleeding events (BARC Type 3-5) were significantly higher in the significant decline group (16.3%). Any bleeding complication was documented in (34.9%) of the significant decline group, thus showing a positive correlation between platelet decline and bleeding risk ($p<0.01$).

Table 4: Bleeding Complications (BARC Classification)

BARC Type	Minimal Decline (<10%)	Moderate Decline (10-25%)	Significant Decline (>25%)	p-value
Minor (BARC Type 1-2)	5 (6.9%)	10 (10.2%)	8 (18.6%)	0.048

Journal of Medical & Health Sciences Review
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https://jmhsr.com/index.php/jmhsr

Major (BARC Type 3-5)	3 (4.2%)	8 (8.2%)	7 (16.3%)	<0.05
Any Bleeding Complication	8 (11.1%)	18 (18.4%)	15 (34.9%)	<0.01

Mortality within six months was (6.1%) in moderate group and (5.6%) in minimal decline groups, (p=0.045). Cardiovascular mortality as a proportion of deaths in the significant decline group was (11.6%), (p = 0.03). But risk difference did not show significant variation among the groups on non-cardiovascular mortality, (p=0.88).

Table 5: All-Cause Mortality within 6 Months

Mortality	**Minimal Decline (<10%)**	**Moderate Decline (10-25%)**	**Significant Decline (>25%)**	**p-value**
Mortality, n (%)	4 (5.6%)	6 (6.1%)	6 (14%)	0.045
Cardiovascular Mortality	2 (2.8%)	4 (4.1%)	5 (11.6%)	0.03
Non-Cardiovascular Mortality	2 (2.8%)	2 (2%)	1 (2.3%)	0.88

Discussion

Our study showed the positive correlation between the cardiovascular events and the decrease of platelet count. The occurrence of (MI) in the significant decline group (27.9%) falls within previously documented rates of 25–30% of MI in thrombocytopenia patients after PCI (Wang et al., 2020) [13]. Likewise, the present research disclosed that 20.9% of the enrolled patients were diagnosed with stent thrombosis, which is comparable to those previous investigations reporting that stent thrombosis ranged from 18 to 22% in patients with platelet loss (Kim et al., 2018) [14]. These observations have implications for the clinical practice of platelet monitoring as a marker of thrombotic episodes in progress.


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https://jmhsr.com/index.php/jmhsr


We also found significant correlation between the platelet drop and target vessel revascularization 14% which is in parity with revascularization rate of 12-15% in patients with platelet depletion (Singh et al., 2021) [15]. These conclusions support the role of platelet count in determining further management of patients after PCI to reduce subsequent ischemic events.

As per the BARC criteria, the bleeding complication was found to be more frequent in patients with significant decline in platelet count. Minor bleeding events were observed in 18.6% of patients in this group, and major bleeding events were noted in 16.3% of the patients in this group. These values are in accordance with other study, in which BARC Type 1-2 bleeding was from 15 to 20%, and BARC Type 3-5 in 14–17% of cases with platelet decline (Kozek-Langenecker et al., 2017) [16].

These findings highlight the need to strike the appropriate risk of thrombosis without making the bleeding rate higher than the control group. Prior studies have shown that DAPT increases both thrombotic events' prevention and bleeding risks in patients with declining platelet counts (Mehta et al., 2019)[17]. These observations are in line with our results underlining the potential of tailored antiplatelet therapy for the high risk patients.

All-cause mortality within six months was significantly higher in significant decline group (14%) from that of minimal (5.6%) and moderate decline (6.1%) groups. The cardiovascular mortality rate (11.6%) in this group matches the findings in Zhang et al. (2021), demonstrating cardiovascular mortality variability in the range of 10-12% in patients who developed thrombocytopenia after PCI [18]. Nevertheless, our non-cardiovascular mortality rates were low for all the groups (2.3%); this corroborates the findings of other similar studies that explained that platelet decline influences cardiovascular outcomes to a greater extent than non-cardiovascular mortality (Wang et al., 2022) [19].

The results obtained for urban and rural residence are also in line with previous work that herein, the residence was not identified as an independent predictor of cardiovascular events or platelet count (Mehta et al., 2021) [20]. This implies that clinical variables including co existing medical condition and platelet count may be more important than socio demographic factors for patient outcomes.

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https://jmhsr.com/index.php/jmhsr

Conclusion

According to our study, larger post-PCI drop in platelet count is related to increased risk of MI, ST, TVR, major bleeding events and death. These results suggest that platelet count should be checked periodically and appropriate interventions should be offered to enhance patient's prognosis. The comparisons with the earlier studies point out the similarities of our observations with that of other studies and further strengthen the role of platelet management for patients after PCI. If patients with potential significant platelet decline are identified early enough, potential interventions may help reduce the consequences of cardiovascular illnesses among those patients.

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Journal of Medical & Health Sciences Review
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