

QUANTIFICATION OF THROMBUS BURDEN AND IDENTIFICATION OF ITS DETERMINANTS IN PATIENTS OF ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION UNDERGOING PRIMARY PERCUTANEOUS INTERVENTION

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Abstract: Primary PCI is the gold standard treatment of STEMI. Thrombus Burden in coronary vessels is the main challenge for a good procedure prognosis. We aimed to analyze thrombus burden and to identify its determinants. **Objective:** To evaluate the extent of thrombus burden in coronary vessels and identify associated determinants in patients treated with primary PCI. **Methods:** A single center cross-sectional survey that included 470 patients was conducted at the Punjab Institute of Cardiology, Lahore from June 2023 to December 2023. We recorded demographics and risk factors in history. The angiographic findings about thrombus burden and TIMI flow were recorded before and after the procedure. All the collected data was analyzed using SPSS 23.00. **Results:** The mean age of the participants was 51.97±10.84 years. 410 (87.2%) were male patients and 60(12.8%) females were included in this study. 283 (60.2%) patients in our study had a high thrombus burden, whereas 187 (39.8%) patients had a low thrombus burden. There was a significant difference in TIMI flow before and after the procedure (p-value = 0.004). Four patients had no flow. All of them had high thrombus burden but were not found to be associated significantly (p-value>0.05). **Conclusion:** Most of the patients with STEMI had a high thrombus burden. Risk factors of IHD were not associated with high thrombus burden. 410 (87.2%) were male patients and 60(12.8%) females were included in this study.

Keywords: Percutaneous Coronary Intervention, Thrombus Burden, STEMI, TIMI Flow

Introduction

Acute coronary Syndrome (ACS), most commonly presenting as chest pain in the emergency department, is a group of conditions that involves myocardial infarction (ST-segment elevation (STEMI) and ST Segment depression (NSTEMI)) and unstable angina. (1) STEMI is one of the most challenging and lethal forms of ACS, with an average mortality of 16.8% in Pakistan after the presentation in the hospital. Mortality due to STEMI is on the verge of increasing in Pakistan (2, 3).

The best management of STEMI is Primary percutaneous intervention (PCI), irrespective of the presence of other pharmacological and surgical strategies adopted in a new era of advancing cardiology (4, 5). The improvement in interventional cardiology and the introduction of effective pharmacological therapy have improved the outcome of PCI (6). Intracoronary Thrombus remains a more significant challenge to deal with during the procedure. It leads to deadly complications of stent thrombosis, no-reflow, and distal embolization (7, 8).

There is a lack of literature concerning the thrombus burden and its causes. There is a need to explore the actual burden of thrombus, and more is needed to explore its pathophysiology. The underlying mechanism and its associated causative factors need to be explored. However, literature has shortened the causative agents related to complications of PCI secondary to high thrombus burden (9, 10). We aimed to analyze the thrombus burden due to STEMI in the Primary PCI setting and find the determinants of clot burden.

Methodology

We conducted a cross-sectional survey at the Punjab Institute of Cardiology from June 2023 to December 2023 after getting permission from the institution's ethical review board. We included 470 patients after having informed consent. The inclusion criteria were that the duration of pain should be less than 12 hours, and the patient has documented STEMI evident by 1mm in limb leads (2mm in chest leads) in two contiguous leads or a new onset left bundle branch block. Both genders were included in the study. All those patients with a history of anemia, recent blood transfusion, coagulation disorder, cancer, chemotherapy, and bedridden patients were excluded from the study. A detailed history was taken from the patients. Demographic variables like age, gender, and door-to-balloon time were noted. The presence of risk factors like diabetes, hypertension, dyslipidemia, smoking, and family history of Ischemic heart disease (IHD) was recorded on a pre-formed Performa. The prior myocardial infarction (MI) and PCI history were also sorted. Primary PCI was performed by a consultant cardiologist every time, having more than five years of experience in the field. The angiographic findings related to pre and post-procedural thrombolysis in myocardial Infarction (TIMI) flow grade were recorded. TIMI flow grades were from 0 to 3. Zero TIMI flow was regarded as no flow (11). TIMI Thrombus Burden was classified into five grades based on criteria. 4 and 5 grades were considered as high thrombus burden, and the rest of the grades as low thrombus burden (8, 11).

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All the collected data was analyzed using SPSS 23.0. Numerical Variables were described as percentages and frequencies. Quantitative variables were explained as mean and standard deviation. Stratified variables were compared using chi-square with thrombus burden. A p-value of less than 0.05 was considered significant.

Results

We included 470 patients in this study. The mean age of the participants was 51.97±10.84 years, with a mean door-to-balloon time of 93.86 minutes. 410 (87.2%) were male patients and 60(12.8%) females were included in this study. While considering comorbidities, we evaluated patients for diabetes and hypertension, smoking, dyslipidemia, family history of ischemic heart disease, and prior history of PCI based on past clinical history. The relative distribution of all these variables is presented in Table 1.

Table 1: Frequency distribution of associated variables

Variables	Risk Stratification	
	Yes	No
Diabetes Mellitus	159(33.8%)	311(66.2%)
Dyslipidemia	16(3.4%)	454(96.6%)
Smoking	236(50.2%)	234(49.8%)
Hypertension	227(48.3%)	243(51.7%)
Family History of IHD	186(39.6%)	284(60.4%)
Prior PCI	16(3.4%)	454(96.6%)
Prior MI	11(2.3%)	459(97.7%)

Among the complications, no death was reported in our study. 4 (0.9%) patients had no flow. 283 (60.2%) patients in our study had a high thrombus burden, whereas 187 (39.8%) patients had a low thrombus burden. Only 8 (1.7) patients were found to have no thrombus. Grade 1, 2, and 3 thrombus were present in 30(6.4%), 50(10.6%), and 90(21.1%) patients, respectively. High thrombus of grade 4 was seen in 99 (20.6%) and of grade 5 in 186 (39.6%) patients. The TIMI flow between the two groups before and after the procedure was compared and is shown in Table 2. A significant p-value (<0.05) shows the success of the procedure in achieving improved flow to the vessels.

Table 2: Comparison of TIMI flow before and after the procedure

TIMI Flow Grades	Pre-procedure TIMI flow	Post Procedure TIMI flow	P value
0	296 (62.9%)	4 (0.9%)	0.004
I	76(16.2%)	10(2.1%)	
II	67(14.3%)	50(10.6%)	
III	31 (6.6%)	406 (86.4%)	

All the stratified variables were analyzed and compared with thrombus burden to identify any determinant associated with thrombus burden.

Table 3: Association of Risk Factors with Thrombus Burden

Variables	Thrombus Burden		P-value
	B	High	
Gender	Male 410	166 244	0.481
	Female 60	21 39	
Diabetes	Yes 159	60 127	0.551
	No 311	127 184	
Dyslipidemia	Yes 16	4 12	0.301
	No 454	183 271	
Smoking	Yes 236	97 139	0.573
	No 234	90 144	
Hypertension	Yes 227	90 137	1.00
	No 243	97 146	
Family History of IHD	Yes 186	78 108	0.44
	No 284	108 175	
Prior PCI	Yes 16	4 12	0.301
	No 454	183 271	
Prior MI	Yes 11	5 6	0.760
	No 459	182 277	
There was no Flow during the procedure	Yes 4	0 4	0.155
	No 466	187 279	

Discussion

The thrombus burden of the coronary vessel is responsible for its occlusion. This is the main challenging and restricting factor in PCI's success, leading to many complications (12, 13). The thrombus restricts flow to the epicardium, compromising its flow and leading to deadly complications. However, recent therapies with specific antiplatelets have somewhat decreased the thrombus burden (14). We analyzed 470 STEMI patients to determine the thrombus burden and its determinants. 60.2% of patients had a high thrombus burden, signifying that STEMI has a high burden. It has been verified by many other studies (15, 16, 17). In our study, four patients had no flow during the procedure. All these patients had high clot burden of grade 5. However, a statistically significant relation (p-value> 0.05) was not found due to stratification of grades further to low and high thrombus burden. This significance of having high clot burden and no flow together has been documented by Rajesh *et al.* (18). They studied 747 patients and had a high thrombus burden in 68% of the patients, comparable to our study. No flow was associated with a high thrombus burden. Although the incidence of no flow was higher in this study, contrary to our results (33% vs 0.9%), This drastic variation

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can be explained by differences in the selected study sample, setting, and expertise (19).

We stratified all the variables and found an association with thrombus burden. We found that High thrombus was not associated with diabetes, hypertension, dyslipidemia, smoking, family history of IHD, or history of prior MI and PCI. All these variables were not found to predict thrombus burden grade since the p-value for all these variables was more significant than 0.05. This is in relation to recent literature (16, 18).

Pre- and post-procedure TIMI flow was analyzed and compared with each other. We found a strong association between the groups, with a p-value of 0.004. This signified the success and efficacy of PCI in achieving flow to coronary vessels, making it a gold standard. Most of the literature has also recommended this (4, 5, 17, and 18).

There are a few limitations to the study. It was a single-centre study targeting a specific population with a limited sample size. Moreover, the thrombus burden was assessed with the naked eye, which has limited value compared to some other techniques (20).

Conclusion

In the STEMI setting, most patients had high thrombus burdens, which are essential determinants of lack of flow. However, no risk factor was found associated with high thrombus burden.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-NMU-938/22)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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Conception of Study, Final approval of manuscript.

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Coordination of collaborative efforts.

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Conception of Study, Development of Research Methodology Design, Study Design, manuscript Review, and final approval of manuscript.

Coordination of collaborative efforts.

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