Initial troponin as a Predictor of High Thrombus Burden in Patients with Acute Myocardial Infarction Undergoing Primary Percutaneous Coronary Intervention

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ABSTRACT

Background: Intracoronary thrombus management is still challenging, despite recent major pharmacological and invasive improvements, such as glycoprotein IIb/IIIa antagonists or thrombectomy, respectively, in percutaneous coronary intervention (PCI). Intracoronary thrombus burden is still a risk factor for long-term adverse cardiovascular events, stent thrombosis, no reflow, and distal embolization. Establishing the predictors of intracoronary thrombus and associated clinical and angiographic conditions, therefore, may provide improvements in its management. To address this issue, we aimed to investigate Initial troponin as a Predictor of High Thrombus Burden in Patients with Acute Myocardial Infarction Undergoing Primary Percutaneous Coronary Intervention Methods: The current study is a cross-sectional study involving 180 patients with acute myocardial infarction undergoing primary percutaneous coronary intervention, admitted to the Coronary Care Unit in Zagazig University Hospitals in the period between January 2019 and January 2020. They were classified into two groups: Group 1 (Low thrombus burden of culprit vessel). Group 2 (High thrombus burden culprit vessel). **Results:** Regarding univariate logistic regression, predictors of high thrombus burden that showed high statistically significance include initial troponin. Roc carve showed cut-off value (1110.5) pg./mL for initial troponin to predict high thrombus burden with sensitivity (89.60%) and specificity (79.40%) and AUC (0.853). Conclusion: Initial troponin, was determined as predictor of high thrombus burden in acute STEMI patients undergoing primary PCI.

Key words: Primary Percutaneous Coronary, Acute Myocardial Infarction, Initial troponin

I. Introduction:

Acute myocardial infarction (MI) is a leading cause of death all over the world and continues to be a

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significant public health problem in both developed and developing countries. Cardiogenic shock complicates 7-10% of cases of acute myocardial infarction and is associated with 70-80% mortality. Treatment of myocardial infarction has undergone profound changes since the bed rest era of the 1960s. At that time, there was debate whether coronary thrombosis was the cause or the consequence of MI. In the 1960s and 1970s, discussion focused on how long to keep patients in bed (a month was not uncommon) and whether coronary care units reduced mortality or not. Until early 1980s, no treatment had been shown to reduce mortality or morbidity in the acute phase of MI or to prevent recurrent events ⁽¹⁾.

Coronary angioplasty, known as "percutaneous trans-luminal coronary angioplasty" (PTCA), was first developed in 1977 by Andreas Gruentzig. This is then; adopted throughout the world as a treatment for coronary artery disease (CAD)⁽²⁾.

Achievement of TIMI III flow after thrombolytic therapy in myocardial infarction was reported not to exceed 50% to 60%. The first reported application of primary mechanical reperfusion for acute MI with balloon angioplasty was in 1982. Sooner; catheter-based reperfusion has become increasingly more popular and constitutes an excellent alternative to the more widely available fibrinolytic therapy with 34% relative reduction in mortality in favor of PCI (6.5% vs. 4.4%), a 47% relative reduction in non/fatal re-infarction (5.3% vs. 2.9%)⁽³⁾.

If immediately available, primary PCI should be performed in patients with STEMI who can undergo PCI of the infarct artery within 12 hours of symptom onset, with balloon inflation within 90 minutes of presentation by certain personal and laboratory prerequisites ⁽⁴⁾.

Intracoronary thrombus management is still challenging, despite recent major pharmacological and invasive improvements, such as glycoprotein IIb/IIIa antagonists or thrombectomy, respectively, in percutaneous coronary intervention (PCI). Intracoronary thrombus burden is still a risk factor for long-term adverse cardiovascular events, stent thrombosis, no reflow, and distal embolization. Therefore, treatments such as glycoprotein IIb/IIIa inhibitors, or procedures such as thrombectomy, which are reducing thrombus burden, improve both epicardial and myocardial perfusion ⁽⁵⁾.

CHA2DS2-VASc score is easily applied in daily practice to predict thromboembolic risk in atrial fibrillation patients. Furthermore, it predicts major adverse cardiac events after PPCI, and it is associated with increased 1 y mortality rate in patients with Acute Coronary Syndrome (ACS) ⁽⁶⁾.

The aim of the study was to assess Initial troponin as a Predictor of High Thrombus Burden in Patients with Acute Myocardial Infarction Undergoing Primary Percutaneous Coronary Intervention.

II. Patients and methods

The current study is a cross-sectional study involving 180 patients with acute myocardial infarction undergoing primary percutaneous coronary intervention, admitted to the Coronary Care Unit in Zagazig University Hospitals in the period between January 2019 and January 2020.

They were classified into two groups:

• Group 1 (Low thrombus burden of culprit vessel): This group consisted of 74 consecutive participants who had thrombus grade less than 4, with age of 56.53 ± 5.435 years and were 39 males and 35 females.

• Group 2 (High thrombus burden of culprit vessel), which included 106 cases. Patients who had thrombus grade more than or equal 4 with age of 57.32 ± 6.6 years and were 57 male patients and 49 females.

Inclusion Criteria:

All patients diagnosed as STEMI and Presented within the first 12 hours from the onset of chest pain.

Ethical Considerations

Subjects of the study received full explanation of the study, and a written consent was obtained from each subject. The study was approved by the medical research and ethics committee.

All patients were subjected to:

- 1) Complete history taking:
- 2) General and local examination:
- 3) Electrocardiographic Examination:
- 4) **CBC:**
- 5) Kidney Function Test including serum uric acid:
- 6) Cardiac Enzymes:

Initial troponin

Table (1): Grades of thrombus burden:

Grade	Description					
Zero	No angiographic characteristics of thrombus are present.					
One	Possible thrombus is present, with such angiography characteristics: -reduced contrast density, haziness, irregular lesion contour, -or a smooth convex meniscus at the site of total occlusion suggestive but not diagnostic of thrombus; in thrombus.	Small thrombus				
Тwo	Definite thrombus, with greatest linear dimensions<1\2 vessel diameter.	burden				
Three	Definite thrombus, with greatest linear dimensions>1\2 vessel diameter but <2vessel diameters.	t				
Four	Definite thrombus, with greatest linear dimensions> 2vessel diameters.	Large thrombus				

		burden
Five	Total occlusion (unable to assess thrombus burden due to total vessel occlusion).	

After restoring antegrade flow through guide wire or small balloon dilatation in patients with TIMI thrombus grade 5; coronary angiogram enabled re-stratification of the underlying residual thrombus (final TIMI thrombus grade)⁽⁷⁾.

• All patients received dual antiplatelet (aspirin and clopidogrel) as pre-medications before PPCI.

• Use of aspiration (thrombectomy) devices was left to the discretion of the interventional cardiologist.

• After PPCI, all patients were moved to CCU and received the standard post-STEMI medications as per guidelines.

Statistical analysis: Statistical analysis for the collected data was performed using statistical package for the social sciences (SPSS) version 23. Normally distributed numerical data was described as mean \pm standard deviation (SD), non-normally distributed numerical data was described as median and range, while categorical data was described as number and percentage. The differences between patients with low thrombus burden regarding categorical data was assessed using Chi-square (X2) test. Differences between subjects with low thrombus burden and high thrombus burden regarding numerical variables were assessed using the Mann Whitney U test, then odds ratio for the statistically significant independent variables were assessed using binary logistic regression analysis. A receiver operating characteristic (ROC) curve was then performed to assess a cut-off value for initial troponin, pain to balloon time and RDW to predict high thrombus burden with the best available sensitivity and specificity. Area under the curve was assessed, criteria to qualify for AUC were as follows: 0.9-1 = excellent, 0.8-0.9 = good, 0.7-0.8 = fair, 0.6-0.7 = poor, and 0.5-0.6 = fail.

III. Result:

There was statistically nonsignificant difference between both groups regarding age, sex, DM, HTN and dyslipidemia.

There was statistically highly significant difference between the two studied groups as regard Initial troponin.

Regarding univariate logistic regression, predictors of high thrombus burden that showed high statistically significance include initial troponin.

Regarding multivariate logistic regression predictors of high thrombus burden that showed statistically significance include pain to initial troponin.

Roc carve showed cut-off value (1110.5) pg./mL for initial troponin to predict high thrombus burden with sensitivity (89.60%) and specificity (79.40%) and AUC (0.853).

		Group (Total =180)			
		low thrombus burden	high thrombus burden	X2 value	Р
		n=76	n=106		
Age, years		56.53±5.435	57.32±6.686	.845	.399
	Male, n (%)	39(52.7%)	57(53.8%)	0.02	0.887
Sex	Female, n (%)	35(46.2%)	49(46.2%)	0.02	0.007
Smoking, n (%)		34(45.9%)	39(36.8%)	1.1515	0.218
Dyslipidemia, n (%	b)	37(50%)	52(41.1%)	0.016	0.901
HTN, n (%)		48(64.9%)	57(53.8%)	2.206	0.138
DM, n (%)		41(55.4%)	47(44.3%)	2.136	0.144
Killip class (>II), n (%)		32(43.2%)	67(63.2%)	7.018	0.008
Family history of premature coronary artery disease, n (%)		26(35.1%)	56(52.8%)	5.501	0.019

Table 2. Baseline Clinical and Laboratory Characteristics According to Thrombus Burden:

*DM= diabetes mellitus, HTN= hypertension

Table 3. Initial troponin According to Thrombus Burden:

Group (Total =180)			
low thrombus burden	high thrombus burden	T test	Р
n=76	n=106		

$1353.78 \pm 511.394 \qquad 9.808 < 0.00$

Table 4. Multivariate Logistic Regression Analysis to Detect the Independent Predictors of High TIMI Thrombus Burden:

	Univariate logistic regression					Multivariate logistic regression				
	В	p value	OR	95% CI for OR		В	p value	OR	95% CI for OR	
				lower	upper				Lower	upper
Initial troponin	0.002	<0.001	1.002	1.002	1.003	0.003	0.006	1.003	1.001	1.006

OR: odds ratio

CI:confidence interval

Table 5. The validity of initial troponin, with area under the ROC curve (AUC) as predictor for

predictor of High	Area under	ea Std. ler Std. Ve Error P-value 95% Confidence Interval cut- lower upper bound bound	cut-off	Sonsitivity	Specificity			
thrombus burden	curve H (AUC)		lower bound	upper bound	Cut-on	Sensitivity	Specificity	
Initial troponin	0.823	0.034	<.0001	0.756	0.89	1110.5	89.60%	79.40%

IV. Discussion

In our study, there were statistically nonsignificant differences between both groups regarding DM, HTN and dyslipedimia.

This result was in agreement with **Tanboga et al.**, ⁽⁸⁾who investigated the determinants of angiographic thrombus burden in patients with ST-segment elevation myocardial infarction (STEMI) who underwent primary percutaneous coronary intervention (pPCI). Study population consisted of 662 patients with STEMI (mean age 54.5 + 11.9 years and 87.3% males).

Multivariate logistic regression analysis was performed in order to determine independent predictors of

high-thrombus burden (initial troponinwas determined as independent predictor in our analysis).

This was in agreement with Seyis et al., ⁽⁹⁾.

In our study, the area under the ROC curve of the initial troponin was 0.823 to predict TIMI thrombus burden. The best cut-off value of the initial troponin to predict high TIMI thrombus burden was 1110.5 pg (89.6% sensitivity and 79.4% specificity).

This was in agreement with **Tanboga et al.**, ⁽⁸⁾.

Study Limitations

1. This is a single center observational study with limited applicability to the rest of the country.

2. Another major limitation of our study is small sample size.

3. Although angiographically visible thrombus is a predictor of intraprocedural complications in ACS, angiographic assessment of thrombus amount is less sensitive and less specific than intravascular ultrasound or optical coherence tomography.

4. Inter and intra-observer variability could have biased our results.

5. Long term medications as antiplatelet and statins were not included in our statistical analysis and this could have biased our results.

V. Conclusion

Initial troponin, was determined as predictors of high thrombus burden in acute STEMI patients undergoing primary PCI.

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