Association of TIMI Risk Score with Angiographic Severity of Coronary Artery Diseases and In-Hospital Outcome in Patient with STEMI Undergoing Primary PCI

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Abstract

Background: *The Thrombolysis In Myocardial Infarction (TIMI) risk score was developed as a bedside tool to stratify STEMI patients eligible for reperfusion by their mortality risk. The TIMI risk score has shown to provide good discrimination in predicting mortality at 30 days and even up to 365 days.*

Methods: *By purposive sampling a total of 64 consecutive patients were considered. Coronary artery disease severity was assessed by Vessels Score. The in-hospital adverse outcomes looked for were heart failure, cardiogenic shock, ventricular arrhythmia, re-infarction, stroke and death. Study subject was divided into two groups on the basis of TIMI risk score. In group I - patients with low TIMI risk score (0-4); in group II - Patients with high TIMI risk score (≥5).*

Results: *Multi vessel involvement were less in low TIMI group 1 (3.1%) but much greater ($p<0.05$) in high TIMI group 9 (28.1%). Adverse outcome was present 10(31.3%) in high TIMI group and 2(6.3%) in low TIMI group ($p=0.01$).*

Conclusion: *High TIMI risk score was associated with more adverse in hospital outcome in patients with STEMI who underwent primary PCI. This study also demonstrated that the TIMI risk score carried a significant positive correlation with the coronary artery disease severity.*

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Introduction:

Acute coronary syndrome (ACS) is a unifying term representing a common end result, acute myocardial ischemia. It encompasses acute myocardial infarction (MI) resulting in ST segment elevation MI (STEMI) or non ST-segment elevation MI (NSTEMI) and unstable angina.[1] Currently, there are three main reperfusion strategies for STEMI: fibrinolytic therapy, primary percutaneous coronary intervention (PCI), and fibrinolytic-facilitated primary PCI. Approximately 95% of patients who are treated with primary PCI obtain complete reperfusion versus 50% to 60% of patients who are treated with fibrinolytics.[2]

Several model of risk scores are developed for predicting short and mid-term outcomes in patients with ACS and to distinguish the patients at the highest risk or an adverse outcome who may benefit from aggressive therapies. The PURSUIT, TIMI, GRACE and FRISC risk score models are well validated in this regard.[3] Recently, the HEARTrisk score was developed. The Primary Angioplasty in Myocardial Infarction (PAMI) risk score is used to predict the six-month mortality. The Controlled Abciximab and Device Investigation to Lower Late Angioplasty Complications (CADILLAC) risk score is used to predict the one-year mortality.[4] The development of both risk scores (PAMI and CADILLAC) was based on individuals treated by invasive procedures. The dynamic TIMI risk model is an upgrade of the classic TIMI risk score, using in-hospital events for an easy reassessment of the risk of Patients discharged from hospital.[4]

The Thrombolysis In Myocardial Infarction (TIMI) risk score was developed as a bedside tool to stratify STEMI patients eligible for reperfusion by their mortality risk. The TIMI

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risk score has shown to provide good discrimination in predicting mortality at 30 days and even up to 365 days.[5] Decision taken quickly and correctly in emergency room to distinguish which patients with STEMI could derive a benefit from invasive strategies using TIMI score. Also, TIMI risk score can be a good predictor to determine the extension of coronary artery disease in patients with STEMI.[6] Within the STEMI population, there is a spectrum of higher and lower risk patients. Stratification of risk in STEMI has been more difficult because primary PCI has been offered and incorporated into national and international guidelines to all patients without contraindication who present with clinical and electrocardiographic criteria.[7]

Methods:

This study was an observational study conducted in the Department of cardiology, National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh from April, 2015 to March, 2016. The study protocol was approved by the institutional review board of NICVD. All patients with ST segment elevation Myocardial Infarction undergoing primary percutaneous coronary intervention in NICVD during the specified period of time were the study population. A total of 64 consecutive patients were considered. Study subjects were divided in to two groups on the basis of TIMI risk score. In group I: patients with low TIMI risk score (0-4); in group II: Patients with high TIMI risk score (≥5). Patients with prior MI, patients with prior PCI, patients with prior CABG, patient with valvular heart diseases, patients with cardiomyopathy and patients with severe comorbidity were excluded from the study. Coronary artery disease severity was assessed by Vessels Score. In-hospital outcomes assessed were: a) Heart failure, b) Cardiogenic shock, c) Ventricular arrhythmia, d) Re-infarction, e) Stroke, and f) Death.

Analysis was performed with the statistical package SPSS 17. The continuous and discrete variables were expressed as mean and standard deviation (SD). Differences were analyzed with Student's t test to compare two variables. The categorical variables were expressed as frequencies and percentages and compared with chi-square or Fisher's exact test, Depending on the frequency of expected events. Differences were considered significant at a p value of less than 0.05.

Results:

A total of 64 patients with STEMI were enrolled in this study. 32 patients were taken with low TIMI risk (Group I) and 32 patients were taken with high TIMI risk (Group II). All the variables like baseline characteristics and outcome variables were compared between these two groups. The findings obtained from data analyses were documented below:

The age distribution of the patients in Table I shows that most of the study patients belonged to 46 - 55 years age in both groups, which was 9 (28.1%) in low TIMI risk group and 14 (42.8%) with high TIMI risk group. The mean age was found 48.5±10.32years with low TIMI group and 52.65±10.54 years with high TIMI group. Analysis revealed statistically not significant mean age difference (p>0.05) between two groups by unpaired t-test.

Figure 1 shows 56 (87.49%) patients of the study were male and 8 (12.49%) patients were female.

Table-I

Comparison of the study population according to age (N=64).

Age in years	Group I (n =32)		Group II (n = 32)		p value
	Number	%	Number	%	
≤35.00	4	12.5	2	6.3	
36 – 45	12	37.5	7	21.9	
46 – 55	9	28.1	14	43.8	
56 – 65	5	15.6	5	15.6	
≥66	2	6.3	4	12.5	
Mean ± SD	48.5±10.32		52.53±10.54		0.443

p value reached from unpaired t-test
Group I: patient with low TIMI
Group II: patient with high TIMI

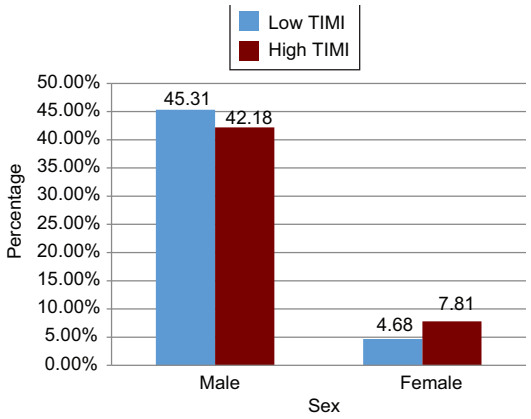

Fig.-1: *Sex distribution among the study population by bar diagram (n=64).*

Male and female ratio was 7.1. In Low TIMI group 29 (90.61%) patients were male and 3(9.4%) patients were female. In High TIMI group 27 (84.4%) patients were male and 5 (15.6%) patients were female. Hence, the sex distribution of the study patients was similar in both groups (p>0.05).

Table II compares the risk factors between the Low TIMI group and with High TIMI group. Patients with high TIMI group had highest percentage of smoking (58.4%), followed by hypertension (50%) in high TIMI group, diabetes (37.5%), Dyslipidemia (31.3%), family history of coronary artery disease (15.6%). Similarly, patients with low TIMI group, smokers were predominant (34.4%), followed by hypertension (31.3%), diabetes mellitus (25%), Dyslipidemia (12.5%) family history of coronary artery disease (6.3%). All of the risk factors mentioned in the above table were found not to be statistically significantly different between the two groups (p>0.05).

Table III shows that LAD was the most common culprit vessel in low TIMI group 13(40.6%) and high TIMI group 18(56.3%) followed by RCA was 10(31.3%) low and 3(9.4%) in high TIMI group and LCX 8(25.0%) in low TIMI group, 2(6.3%) in high TIMI. Multi-vessel involvement was 1(3.1%) in low TIMI and 9(28.1%) significantly (p<0.05).

Table IV shows that in high TIMI group was associated with 23 (71.9%) single vessel involvement, 3(9.4%) in double vessel and 6(18.8%) in triple vessel involvement. The difference across the study groups was statistically significant (p<0.05).

Table V shows the distribution of the study patients by in-hospital outcome.4(12.5%) patients developed heart failure in high TIMI group and no heart failure low TIMI group, cardiogenic shock 2(6.3%) in high TIMI group and 0(00%), ventricular arrhythmia 2(6.3%) in high TIMI group and 1(3.1%) in low TIMI group, re-infarction 1(3.1%) in high TIMI group and 1 (3.1%) in low TIMI group and death 1(3.1%) in high TIMI group and absent in low TIMI group. No stroke in both group. Heart failure and cardiogenic shock were significantly high in group II (p<0.01 and <0.05, respectively).

Table VI shows the total adverse outcome was present 10(31.3%) in high TIMI group and 2(6.3%) in low TIMI group which was statistically significant (p=0.01).

Table-II

Comparison of the study population according to cardiovascular risk factor before PPCI (N=64).

Risk Factors	Group I (n = 32)		Group II (n = 32)		p value
	Number	%	Number	%	
Smoking	11	34.4%	19	58.4%	0.06
Hypertension	10	31.3%	16	50%	0.127
Diabetes mellitus	8	25%	12	37.5%	0.281
Dyslipidemia	4	12.5%	10	31.3%	0.070
Family history of premature CAD	2	6.3%	5	15.6%	0.230

Data were analyzed using Chi Square test and Fisher's exact test
Group I: patient with low TIMI
Group II: patient with high TIMI

Table-III

Comparison of the study population according to involvement of vessel (N=64).

Involvement of vessel	Group I (n = 32)		Group II (n = 32)		p-value
	Number	%	Number	%	
Left anterior descending	13	40.6%	18	56.3%	0.071
Right coronary artery	10	31.3%	3	9.4%	0.061 0.057 0.046
Left circumflex	8	25.0%	2	6.3%	
Multi-vessel	1	3.1%	9	28.1%	

Data were analyzed using Chi Square test and Fisher's exact test
Group I: patient with low TIMI
Group II: patient with High TIMI

Table-IV

Coronary arteries involvement according to angiographic findings (N=64).

Number of vessel	Group I (n = 32)		Group II (n = 32)		p value
	Number	%	Number	%	
Single	31	96.9%	23	71.9%	
Double	1	3.1%	3	9.4%	0.017
Triple	0	00%	6	18.8%	

Data were analyzed using Chi Square test and Fisher's exact test
Group I: patient with low TIMI
Group II: patient with high TIMI

Table-V

Comparison of population by in-hospital outcome after PPCI (n=60).

In-hospital outcome	Group I (n = 32)		Group II (n = 32)		p-value
	Number	%	Number	%	
Heart failure	0	00%	4	12.5%	0.007
Cardiogenic shock	0	00%	2	6.3%	0.048
Ventricular arrhythmia	1	3.1%	2	6.3%	0.097
Re-infarction	1	3.1%	1	3.1%	0.781
Stroke	0	00%	0	00	0.865
Death	0	00	1	3.1%	0.793

Table VI

Comparison of population by adverse outcome after PPCI (n=64).

Adverse in-hospital outcome	Group I (n = 32)		Group II (n = 32)		p value
	Number	%	Number	%	
Present	2	6.3%	10	31.3%	0.01
Absent	30	93.8%	22	68.8%	

Data were analyzed using Chi Square test and Fisher's exact test
Group I: patient with low TIMI
Group II: patient with high TIMI

Discussion:

Male patient was predominant in the whole study population. Over all male and female ratios was 7.1. In another study in Bangladesh male 70(95%) and female 3(5%).[8] Female are less prone to developed IHD in premenopausal age due to protective role of estrogen, moreover smoking as a risk factor of IHD is less common in our country among female, which may explain male predominance of IHD. Female also have less access to medical facilities.

This study found that the most common risk factor was smoking in both groups of patients. Differences of all of the risk factors between the two groups were found to be statistically insignificant (p>0.05). One of study in Bangladesh found that smoking (45%) was the highest risk factor.[8]

Angiographic characteristics of patients undergoing primary PCI was shown that LAD was the most common culprit vessel in both groups. Multi vessel involvement was less in low TIMI group 1. Jamaluddin, et al. showed that LAD (57%), RCA (38.3%) and LCX (6.8%). There were was significant statistically difference (p=0.002).[8]

TIMI group 1 had more commonly single vessel disease and group 2 had more double and triple vessel disease. This value was statistically significant (p=0.017). In a study it was shown that 93 (14.6%) patients had single vessel disease, 119 (18.68%) patients had double vessel disease, 259 (40.66%) had triple vessel disease.[9]

In our study the most common complication was heart failure in high TIMI group followed by ventricular arrhythmia and cardiogenic shock. Reinfarction rate was 3.1% in both groups. Only one death (3.1%) was in high TIMI group, no stroke in any of the groups. Heart failure was found statistical significant difference (p=0.039) between the groups that was more in high TIMI group. One of the studies in abroad showed that Heart failure (15.3%), cardiogenic shock (10.9%) left ventricular arrhythmia (14.8%) in high TIMI group and in low TIMI group which were 4.1%, 1.5%, 5.9% and 2.1% respectively group.[10]

Total hospital adverse outcome 12 (18.8%) of patients. Adverse outcome was present 10 (31.3%) in high TIMI group and 2 (6.3%) in low TIMI group. So, the study revealed that in-hospital outcome was statistically significant (p=0.01). One study of Bangladesh showed 28.9% patients developed complications during the acute MI phase.[11]

Conclusion:

In conclusion, this study found that high TIMI risk score was associated with more adverse in hospital outcome than patient of low TIMI risk score in patient with STEMI who underwent primary PCI. This study also demonstrated that the TIMI risk score carried a significant positive correlation with the coronary artery disease severity in patients with STEMI.

Study limitations

This study had some limitation which might affect the result i.e., this was a non-randomized study, number of study population was small, it was a single centered study, medium and long term outcomes of these patients were not included.

Conflict of Interest - None.

References:

1. Kim MC, Kini AS, Fuster V. Definitions of acute coronary syndrome. In: Fuster V, Walsh RA, Harrington RA. Eds. Hurst's The Heart. 13th ed. New York: The McGraw-Hill Companies, Inc. 2011: 1287–1295.
2. Hass EE, Yang EH, Gersh BJ, O'Rourke RA. ST-Segment Elevation Myocardial Infarction. In: Fuster V, Walsh RA, Harrington RA. Eds. Hurst's The Heart. 13th ed. New York: The McGraw-Hill Companies, Inc. 2011. 1354–1385
3. Backus BE, Six AJ, Kelder JH, Gibler WB, Moll FL, Doevendans PA. Risk scores for patients with chest pain: evaluation in the emergency department. *Curr Cardiol Rev*2011;7:2–8.
4. Littnerova S, Kala P, Jarkovsky J, Kubkova L, Prymusova K, Kubena P, et al. GRACE Score among Six Risk Scoring Systems (CADILLAC, PAMI, TIMI, Dynamic TIMI, Zwolle) Demonstrated the Best Predictive Value for Prediction of Long-Term Mortality in Patients with ST-Elevation Myocardial Infarction. *PLoS ONE*. 2015;10:e0123215.
5. Selvarajah S, Fong AYY, Selvaraj G, Haniff J, Uiterwaal CSPM, Bots ML. An Asian validation of the TIMI risk score for ST-segment elevation myocardial infarction. *PLoS ONE*. 2012;7:e40249.
6. Golabchi A, Sadeghi M, Sanei H, Akhbari MR, Seiedhosseini SM, Khosravi P, et al. Can Timi Risk Score Predict Angiographic Involvement in Patients with St-Elevation Myocardial Infarction? *ARYA Atheroscler* 2010;6:69–73.
7. Brogan RA, Malkin CJ, Batin PD, Simms AD, McLenachan JM, Gale CP. Risk stratification for ST segment elevation myocardial infarction in the era of primary percutaneous coronary intervention. *World J Cardiol* 2014;6:865–873.
8. Jamaluddin M, Khalil I, Karmakar KK, Kabir H, Litu RI, Rashid B, et al. Outcomes of primary percutaneous coronary intervention (PCI) in NICVD, Dhaka, Bangladesh- our initial experiences. *University Heart Journal* 2015;9:83–87.
9. Akanda MAK, Ali S, Islam AEMM, Rahman MM, Parveen A, Kabir MK, et al. Demographic Profile, Clinical Presentation & Angiographic Findings in 637 Patients with Coronary Heart Disease. *Faridpur Med. Coll J*. 2011;6:82–85.
10. González-Pacheco H, Arias-Mendoza A, Álvarez-Sangabrie A, Juárez-Herrera Ú, Damas F, Eid-Lidt G, et al. The TIMI risk score for STEMI predicts in-hospital mortality and adverse events in patients without cardiogenic shock undergoing primary angioplasty. *Arch Cardiol Mex* 2012;82:7–13.
11. Malik FTN, Kalimuddin M, Ahmed N, Badiuzzzaman M, Ahmed MN, Dutta A, et al. AMI in very young (aged d"35years) Bangladeshi patients. Risk factors & coronary angiographic profile. *Clinical Trials and Regulatory Science in Cardiology* 2016;13:1–5.