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Correlation of TIMI Risk Score and Major Adverse Cardiac Events in Patients with ST Segment Elevated Myocardial Infarction

Md. Abdul Mukid[1*], Md. Shahabuddin[2], Farzana Tazin[3], Md. Suhail Alam[4], Partha Sarathi Roy Chowdhury[5]

[1]Assistant Professor (Cardiology), Parkview Medical College, Sylhet, Bangladesh
[2]Ex: Professor and Departmental Head (Cardiology), MAG Osmani Medical College, Sylhet & Vice-Principal and Departmental Head (Cardiology), Parkview Medical College, Sylhet, Bangladesh
[3]Senior Consultant (Cardiology), Clinical and intervention Cardiologist, National Heart Foundation Hospital, Sylhet, Bangladesh
[4]Assistant Professor, Department of Cardiology, Jalalabad Ragib Rabeya Medical College, Sylhet, Bangladesh
[5]Junior Consultant (Cardiology), 250 bed Adhunic Sadar Hospital, Hobigonj, Bangladesh

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***Corresponding author:** Md. Abdul Mukid
Assistant Professor (Cardiology), Parkview Medical College, Sylhet, Bangladesh

Abstract **Original Research Article**

***Introduction*:** Considerable variability in mortality risk exists among patients with ST-elevation myocardial infarction (STEMI), therefore the implementation of risk predictive models is required. The Thrombolysis in Myocardial Infarction (TIMI) risk score is derived from clinical trial involving patients who are eligible for fibrinolysis. TIMI risk score for ST elevation myocardial infarction (STEMI) is an important tool to assess mortality risk; however, it has not yet been well studied in our country. ***Objective*:** To see the correlation of TIMI risk score with major adverse cardiac events (MACE) in patients with STEMI**.** ***Methodology*:** This cross-sectional prospective study was conducted in the Department of Cardiology, Sylhet MAG Osmani Medical College Hospital, Sylhet during the period from July 2017 to June 2018. Fifty patients with definite diagnosis of acute STEMI, received streptokinase, aged above 18 years and both sex were included. Prior myocardial infarction, coronary revascularization procedures either CABG or angioplasty or coronary stenting; co-morbidities such as renal failure, heart failure, cardiomyopathy, valvular heart disease and congenital heart disease were excluded. On admission TIMI was recorded. In hospital MACE were also recorded. ***Results*:** The mean age of patients was 52.64 (SD 11.88) years and majority of the patients were male (84%) with male to female ratio was 5.25:1. Smoking was the most prevalent risk factor (64.0%) followed by hypertension (34.0%), diabetes mellitus (26.0%), dyslipidemia (32.0%) and family history of ischaemic heart disease (28.0%). The mean TIMI risk score for STEMI 4.50 (SD 2.38). In hospital major adverse cardiac events (MACE) occurred in 19 (38.0%) cases. TIMI risk score for STEMI was significantly higher in patients with MACE compared to without MACE (16.95, SD 1.78 versus 3.00, SD 1.10; p<0.001) respectively. ***Conclusion*:** From the study we conclude that TIMI risk score (5 or above) is a reliable tool in predicting in- hospital major adverse cardiac events in ST-segment elevation myocardial infarction.

Keywords: TIMI Risk, Cardiac Events, ST Segment Elevated, Myocardial Infarction.

INTRODUCTION

Acute coronary syndrome (ACS) refers to a spectrum of conditions compatible with acute myocardial ischemia and/ or infarction that are usually due to an abrupt reduction in coronary blood flow [1]. It encompasses acute myocardial infarction (resulting in ST-segment elevation or non-ST-segment elevation) and Unstable angina [2]. ST-segment elevation myocardial infarction (STEMI) is a clinical syndrome defined by symptoms of myocardial ischemia in association with persistent electrocardiographic (ECG) ST elevation and subsequent release of biomarkers of myocardial necrosis. Despite advances in diagnosis and management, STEMI remains a major public health problem in the industrialized world and is on the rise in developing countries. Individuals admitted with STEMI are at considerable risk of ischemic complications during the acute phase. In the United States, almost 600,000 patients are admitted to the hospital each year with a primary diagnosis of STEMI [3]. In the developing nations like Bangladesh, medical facilities are very limited and various investigations procedures are not widely available, very often costly and time consuming. In these situations The Thrombolysis in Myocardial Infarction (TIMI) risk score is likely to be

clinically useful to predict the short term prognosis. The TIM) risk score for ST-Elevated Myocardial Infarction (STEMI) is a simple integer score for bed side risk assessment of developing and adverse cardiac outcome (death, re-infarction or recurrent severe ischaemia) of patients with STEMI [4]. It also helps to provide a more accurate assessment of a patient's prognosis [5]. The main advantage of TIMI score are its simplicity and ease of use. The TIMI risk score is of potential interest even beyond simple prognostication of outcomes because it also appears to be predictive of increasing benefit from specific therapies as risk increases [6]. This information would be helpful for patients, their families and would also allow for more effective triaging and clinical allocation. TIMI risk score incorporates eight variables obtained from the history, physical examinations, and ECG. In brief, the TIMI risk score consists of eight dichotomic variables, with the exception of age that adds points in two distinct strata. The presence of previous infarction (or left bundle branch block), major risk factors (hypertension, diabetes, or prior angina), weight <67 kg, and reperfusion time >4 hours adds one point each. The variables Killip > 1, heart rate >100 bpm, and systolic pressure < 100 mmHg adds 2 points each. Age adds 2 points if between 65 and 74 years and 3 points if ≥75 years. The final score may vary between 0 and 14 [7]. Several studies validate the TIMI risk score for STEMI patients as a predictor of in- hospital mortality, 30 days mortality and even one year mortality in abroad [7-11]. A few data was done regarding TIMI risk score and major adverse cardiac events in ST elevation acute myocardial infarction in Bangladesh and revealed that increasing TIMI risk score is associated with increased risk of major adverse cardiac events [5, 12]. But no study was done previously in population of Sylhet division. So, this study was designed to evaluate the correlation of TIMI risk score and major adverse cardiac events in patients with ST elevated myocardial infarction.

METHODOLOGY

This cross-sectional prospective study was conducted in the Department of Cardiology, Sylhet MAG Osmani Medical College Hospital, Sylhet during the period from July 2017 to June 2018. Fifty patients with definite diagnosis of acute STEMI, received streptokinase, aged above 18 years and both sex were included. Prior myocardial infarction, coronary revascularization procedures either CABG or angioplasty or coronary stenting; co-morbidities such as renal failure, heart failure, cardiomyopathy, valvular heart disease and congenital heart disease were excluded. On admission TIMI was recorded. In hospital MACE were also recorded.

Inclusion Criteria were:

- Patients with STEMI.
- Age above 18 years.
- Those who received streptokinase.

Exclusion Criteria were:

- Prior myocardial infarction, coronary revascularization procedures either CABG or angioplasty or coronary stenting.
- Serious co-morbidities like renal failure, heart failure, cardiomyopathy, valvular heart disease, congenital heart disease and severe anaemia.

After admission a detailed history, general and physical examination were performed. Informed written consent was taken from the patients after detailed explanation of the purpose of study. A 12 lead ECG was taken on admission by placing the leads in proper position. Acute ST elevation myocardial infarction was diagnosed if a patient has acute chest pain (anginal pain) persisting more than 20 minutes at rest with ECG changes such as:

a. New ST elevation at J point in at least 2 contiguous leads of 2mm or more in men or
b. 1.5mm or more in women in leads v2-v3 and/or
c. 1mm or more in other contiguous chest leads or the limb leads in absence of LVH or LBBB [2].

Fifty patients with acute STEMI were selected purposively. Following risk scores were noted at the time of admission- (a) Age (b) The presence of previous infarction or left bundle branch block, (c) Hypertension, (d) diabetes, (e) prior angina, (f) weight (g) reperfusion time (h) Killip class, (i) heart rate and (j) systolic pressure. Total TIMI risk score was calculated. The final score was between 0 and 14 [7]. Risk categorization was based on the admission TIMI risks score from 0-14 possible points: (1) Low risk, 0 to 4; (2) Moderate risk 5 to 8; and (3) High risk 9 to 14 [13]. Baseline laboratory investigations such as Random Plasma Glucose, serum creatinine, Fasting lipid profile, serum electrolytes and Troponin-I were measured. Echocardiography was performed in all patients.

Follow up schedule were**:**

- All patients were followed up hourly in 1st 24 hours and then 3 times in 24hours (8:00am, 2:00pm, 8:00pm) up to discharge of the patients.

During follow up: followings were recorded:

- Development of chest pain (post MI angina).
- Recurrent MI.
- Any arrhythmia.
- Cardiogenic shock
- In-hospital mortality.

Data Interpretation and Analysis

Data were processed and analyzed both manually and by using SPSS (Statistical Package for Social Sciences) Version 22.0. Quantitative data were

expressed as mean and standard deviation; comparison was dome using unpaired t test. Qualitative data were expressed as frequency and percentage. Analysis was done by T-test. Pearson's correlation coefficient was also determined. A probability value $p<0.05$ was considered as significant, $p<0.01$ was considered as highly significant and $p>0.05$ was considered as non-significant.

RESULTS

Fifty patients with ST elevation myocardial infarction were studied. The results were shown in below:

Table I: Distribution of the Patients by Age (n=50)

Age	Frequency	Percentage (%)
<65 years	38	76.0
≥ 65 years	12	24.0
Mean (SD)	52.64 (SD 11.88)	

The age of the patients ranged from 35 to 75 years with the mean age of 52.64 (SD 11.88) years. Distribution of the patients by age was shown in Table-I.

Table II: Distribution of Patients by Risk Factors (n=50)

Risk Factors	Frequency	Percentage (%)
Smoker	32	64.0%
Hypertension	17	34.0%
Dyslipidemia	16	32.0%
Family history of IHD	14	28.0%
Diabetes mellitus	13	26.0%

Smoking was the most prevalent risk factor (64.0%) followed by hypertension (34.0%), diabetes mellitus (26.0%), dyslipidemia (32.0%) and family history of ischaemic heart disease (28.0%) (Table-II).

Table III: Distribution of Patients According to Component of TIMI risk score for STEMI (n=50)

Component of TIMI risk score	Frequency	Percentage (%)
Age		
Below 65 Years	38	76.0
65-74 years	7	14.0
≥ 75 years	5	10.0
Pulse		
<100 b/min	39	78.0
≥100 b/min	11	22.0
Systolic blood pressure		
<100 mm of Hg	11	22.0
≥100 mm of Hg	39	78.0
DM or HTN or angina		
Yes	23	46.0
No	27	54.0
Killip class		
I	31	62.0
II-IV	19	19.0
Weight		
<67 Kg	21	42.0
≥67 Kg	29	58.0
Anterior MI or LBBB		
Yes	24	48.0
No	26	52.0
Time to treatment		
> 4 hours	43	86.0
≤ 4 hours	7	14.0

Distribution of Patients According to Component of the Thrombolysis in Myocardial Infarction (TIMI) risk score for STEMI was shown in Table-III. The age between 65-75 years was in 7

(14.0%) cases and 75 years or above was in 5 (10.0%) cases; heart rate more than 100/min was found in 11 (22%) patients; systolic blood pressure below 100 mm of Hg was in 11 (22.0%) cases; Killip class II-IV was in 19 (38.0%) cases; DM or HTN or angina was in 23 (46.0%) cases, weight less than 67 kg was in 21 (42.0%) cases; anterior MI or LBBB was in 24 (48.0%) cases; and time to treatment more than 4 hours was in 43 (86.0%) cases.

Table IV: Distribution of the Patients According to the Thrombolysis in Myocardial Infarction (TIMI) Risk Score for STEMI (n=50)

TIMI risk score	Frequency	Percentage
1 to 4	29	68.0
5-14	21	32.0
Mean (SD)	4.50 (SD 2.38)	

Table V: Distribution of Patients According to Complications (n=50)

Complications	Frequency	Percentage
Post MI Angina	12	24.0
Left ventricular failure	12	24.0
Cardiogenic shock	7	14.0
Arrhythmias		
Venricular tachycardia	8	16.0
Venricular fibrillation	5	10.0
Atrial fibrillation	1	2.0
Re-infarction	2	4.0
Mechanical complication	0	0.0
Mortality	13	26.0

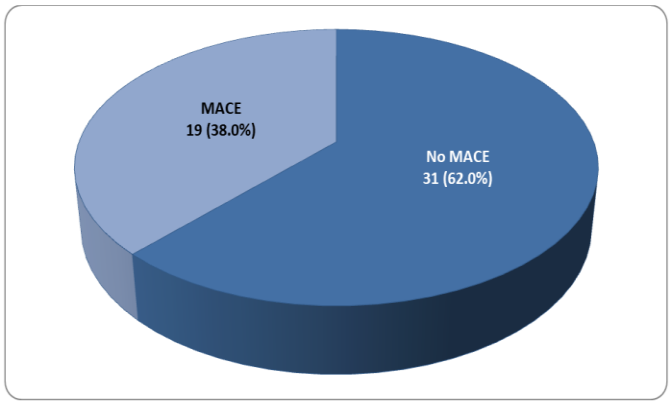

Figure 1: Distribution of Patients According to Major Adverse Cardiac Events (MACE).

Figure-1 revealed that major adverse cardiac events (MACE) occurred in 19 (38.0%) cases.

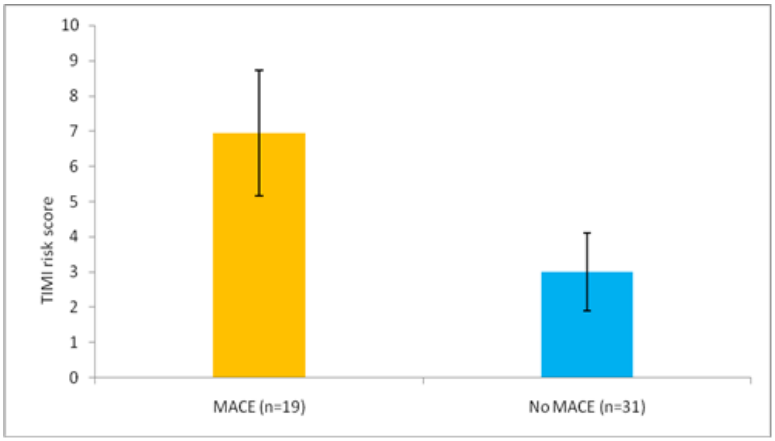

Figure 2: Distribution of Patients According to Major Adverse Cardiac Events (MACE) and the Thrombolysis in Myocardial Infarction (TIMI) Risk Score for STEMI.

Unpaired t test was appled to analysed the data.

The Thrombolysis in Myocardial Infarction (TIMI) risk score in STEMI was 6.95 (SD 1.78) in patients with major adverse cardiac events (MACE) and was 3.00 (SD 1.10) in patients with no major adverse cardiac events (No MACE). TIMI risk score for STEMI was significantly higher in patients with major adverse cardiac events (MACE) compared to patients with no major adverse cardiac events (No MACE) ($t=9.736$; $p<0.001$) (Figure-2).

DISCUSSION

An ideal risk score must be useful, simple and fast to apply to predict prognosis at short and long range. The TIMI risk score for STEMI is a clinical stratification calculated with data obtained at hospital presentation that can easily classify patients into low and high risk. It was developed using data from patients treated with thrombolytic therapy in a randomized trial and predicts mortality at 30 days [14]. In this study the age of the patients ranged from 35 to 75 years with the mean age of 52.64 (SD 11.88) years. This result correlated with the study of Masood, Naqvi, Jafar, et al [15] that the mean age of their patients was 51.89 ± 12.01 years. Alam, Ullah, Ulabbi, et al [16] found that the mean age of the patients with acute myocardial infarction was 53.6 ± 10.3 years. This study also revealed that 76.0% patients of STEMI were in the age group of below 65 years and 24.0% patients were in the age group of 65 or above years. This result correlated with the study of Ehsan, Mahmood, Siddique, et al [5] that 72.8% patients of STEMI were in the age group of below 65 years and 27.2% patients were in the age group of 65 or above years. Silveira, Jaeger, Hatschbach, et al [10] reported 64.2% of patients with STEMI were aged under 65 years old and 35.6% of patients with STEMI were aged at or above 65 years. In the present study 84.0% patients with STEMI were male and 16.0% were female with a ratio of male to female was 5.25:1. This result was almost similar to the study of Ehsan, Mahmood, Siddique, *et al* [5] that 81% patients with STEMI were male and 19.0% were female. This result also correlated with Chen, Huang and Lin et al [17] that 88.9% patients with STEMI were male and 11.1% were female. Correia, Garcia and Kalil, *et al* [9] reported that 72.0% patients with STEMI were male and 28.0% were female. Male preponderance was reported in several other studies [10]. Numerous previous series have reported a male preponderance in patients presenting with STEMI. Women are known to have advanced age, increased co-morbidity and increased short term mortality than men with STEMI. They are also more likely to have symptoms labeled as "atypical". They are liable to receive less aggressive therapy and be subject to delays, even if socio-cultural and financial factors are not considered ([18,19]. Female representation ranges from 18.2-35% in the literature, which is similar to our experience [20-22]. This study showed that smoking was the most prevalent risk factor (64.0%) followed by hypertension (34.0%), diabetes mellitus (26.0%), dyslipidemia (32.0%) and family history of ischaemic heart disease (28.0%). Alam, Ullah, Ulabbi, et al [16] found smoking was most prevalent and more than half of the patients had history of smoking (56.8%) followed by hypertension (46.9%), diabetes mellitus (35.8%), family history of CAD (18.5%) and dyslipidemia (14.8%) in acute inferior myocardial infarction. Hossain, Siddique, Rahman, et al [23] reported smoking (56.7%), hypertension (53.3%), diabetes mellitus (43.3%), dyslipidemia (23.3%) and family history of CAD (13.3%) among their series of acute inferior myocardial infarction. In regards to coronary risk factors referred at admission Silveira, Jaeger, Hatschbach, et al [10] reported that 24.2% had diabetes mellitus type 2; 65.8% had arterial hypertension; 36.2% had dyslipidemia; 51.8% were smokers; and 27.8% had the family history of coronary disease at the time of presentation. In this regards Chen, Huang and Lin [17] found current smoker was in 43.8%, hypertension in 64.2%, diabetes mellitus in 36.0%, hypercholesterolemia in 17.8%. Ehsan, Mahmood, Siddique, et al [5] reported that 15.6% had diabetes mellitus; 36.1% had arterial hypertension; 46.3% had dyslipidemia; 46.9% were current smokers; and 14.3% had the family history of coronary disease at the time of presentation. Betancourt-Plaza and Martos-Benítez [11] found 30.1% had a previous history of diabetes and 50.3% a history of hypertension among the patients with hypertension. In this study 14.0% cases were the between 65-75 years and 10.0% cases were aged 75 years or above. This result correlated with the study of González-Pacheco et al [14] which reported 19.6% cases were the between 65-75 years and 8.9% cases were aged 75 years or above. This study revealed that 22.0% of cases had the heart rate more than 100/min and 22.0% cases had systolic blood pressure below 100 mm of Hg. This result was consistent with the study of González-Pacheco et al [14] which reported 15.4% of cases had the heart rate more than 100/min and 12.2% cases had systolic blood pressure below 100 mm of Hg. In the present study 38.0% cases had Killip class II-IV. This result was supported by Chen, Huang and Lin [17] which reported 43.3% cases had Killip class II-IV. In this regards Ehsan, Mahmood, Siddique, et al [5] found 19.7% cases had Killip class II-IV and González-Pacheco et al [14] found 19.7% cases had Killip class II-III but no class IV. This study revealed that diabetes or hypertension or prior angina was in 46.0% cases. In this regards Ehsan, Mahmood, Siddique, et al [5] found diabetes in 15.6%, hypertension in 36.1% and prior angina was in 8.2% cases. González-Pacheco et al., (2012) [14] found diabetes in 30.1%, hypertension in 50.3% and prior angina was in 19.8% cases. The Thrombolysis in Myocardial Infarction (TIMI) risk score for STEMI of the patients ranged from 1 to 11 with the mean TIMI risk score of 4.50 (SD 2.38) years. Correia, Garcia and Kalil, et al [9] reported that TIMI score for STEMI was 3.7 ± 2.3. Chen, Huang and Lin [17] reported that the median value of the TIMI risk score was 5 in the

patients with STEM. Betancourt-Plaza and Martos-Benítez [11] found the average TIMI score was 5.04 (SD 2.7 points). This study also showed that 36.0% of patients had TIMI risk score 5 or above and 64.0% had up to 5. González-Pacheco et al [14] found that patients were classified as low risk with a TIMI score of 04 (68%) and high risk with a TIMI score ≥5 (32%). Masood, Naqvi, Jafar, et al [15] found that patients with TIMI score of up to 4 in 68% cases and with a TIMI score ≥5 in 32% of cases. This study revealed that post MI angina was present in 24.0% cases, arrhythmias in 26.0% cases, reinfarction in 4%, left vertricular failure in 24.0%, cardiogenic shock in 14.0% and death in 26.0% cases. None had developed mechanical complication. González-Pacheco et al [14] found death in 6.1% of cases, reinfarction in 1.4% of cases, heart failure in 7.7% of cases, ventricular arrhythmias in 8.7% and cardiogenic shock in 4.5% of cases. Chen, Huang and Lin [17] reported mortality was in 6.7% of cases with STEMI. Ehsan, Mahmood, Siddique, et al [5] reported death was in 11.6% of cases with STEMI. Correia, Garcia and Kalil, et al [9] found death was in 11% of patients with STEMI. Silveira, Jaeger, Hatschbach, et al [10] found in-hospital mortality in 8.6%, cardiogenic shock in 10.3%, reinfarction in 3%, and stroke in 1.1% of cases with STEMI. This study revealed that 38.0% cases had major adverse cardiac events (MACE). In this regards Ehsan, Mahmood, Siddique, et al [5] reported MACE in 11.6% of cases with STEMI. The Thrombolysis in Myocardial Infarction (TIMI) risk score for STEMI was 6.95 (SD 1.78) in patients with major adverse cardiac events (MACE) and was 3.00 (SD 1.10) in patients with no major adverse cardiac events (No MACE). TIMI risk score for STEMI was significantly higher in patients with major adverse cardiac events (MACE) compared to patients with no major adverse cardiac events (No MACE) ($p<0.001$). Betancourt-Plaza and Martos-Benítez [11] found mean TIMI score in those with dead was 7.8 points [SD 3.4 points] and with living was 4.7 points [SD 2.4 points]; $p = 0.001$). TIMI risk score was significantly higher in patients with dead compared to living. This study showed that the best TIMI risk score at cut-off point of ≥5 in predicting in- hospital MACE in STEMI with the sensitivity of 94.7%, specificity of 90.3%, positive predictive value of 85.7%, negative predictive value of 96.6% and accuracy of 92.0%. This result correlated with the study of Correia, Garcia and Kalil, et al [9] which found that the optimal cutoff-points of TIMI of > 4 with sensitivity 88% and a specificity of 72%.

CONCLUSION

The mean age of patients was 52.64 (SD 11.88) years and majority of the patients were male (84%) with male to female ratio was 5.25:1. Smoking was the most prevalent risk factor (64.0%) followed by hypertension (34.0%), diabetes mellitus (26.0%), dyslipidemia (32.0%) and family history of ischaemic heart disease (28.0%). The mean TIMI risk score for STEMI was 4.50 (SD 2.38). In hospital major adverse cardiac events (MACE) occurred in 19 (38.0%) cases. TIMI risk score for STEMI was significantly higher in patients with MACE compared to patients without MACE (16.95, SD 1.78 versus 3.00, SD 1.10; $p<0.001$) respectively.

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