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Comparison of MACE between High and Low TIMI Risk

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ABSTRACT ORIGINAL RESEARCH ARTICLE

Introduction: Patients with ST-segment elevation myocardial infarction (STEMI) have increased risk for death and adverse cardiac events. Of great concern is the risk of cardiac arrest that accounts for the majority of early deaths and other major adverse cardiac events. Significant hospital resources are dedicated to these high risk patients. **Objective:** To see the correlation of MACE between High and Low TIMI Risk. **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. 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:** 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

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without MACE (16.95, SD 1.78 versus 3.00, SD 1.10; p<0.001) respectively. 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.

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INTRODUCTION

Patients with ST-segment elevation myocardial infarction (STEMI) have increased risk for death and adverse cardiac events. Of great concern is the risk of cardiac arrest that accounts for the majority of early deaths and other major adverse cardiac events. Significant hospital resources are dedicated to these high risk patients. A potentially relevant issue in the treatment of patients with STEMI is that this population is highly heterogeneous regarding their risk of adverse events. Thus, their correct stratification becomes essential to evaluate their prognosis and to take accurate therapeutic decisions. An ideal risk score must be useful, simple & fast to apply to predict prognosis at short and long range [1]. So accurate risk stratification of patients with STEMI is important to target efficiently the use of evidence-based therapies and is to identify high risk patients who may get benefit from advanced treatment. In particular, the capacity to reliably identify patient at very low risk for fatal recurrent events may offer the opportunity to select low risk patients for early discharge [2]. 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 [3]. It also helps to provide a more accurate assessment of a patient's prognosis [4]. The term acute myocardial infarction (AMI) should be used when there is evidence of myocardial injury (defined as an elevation of cardiac troponin values with at least one value above the 99th percentile upper reference limit) with necrosis in a clinical setting consistent with myocardial ischaemia [5]. Typically, this involves a rise and fall of cardiac biomarkers, along with supportive evidence in the form of symptoms, suggestive electrocardiogram (ECG) changes, or imaging evidence of a new loss of viable myocardium [6]. The overall prevalence of MI in the US is around 2.8% in adult's ages 20 years or over. The estimated incidence is 550,000 new and 200,000 recurrent MIs annually. According to American Heart Association estimates, every 42 seconds an American will have an MI. In 2013, 116,793 deaths in the US were due to MI, and of these around 57% were in males and 43% were in females. The incidence of MI has been steadily decreasing in Western countries over the past 20 years, which may be due to better control of risk factors such as hypertension, diabetes, high cholesterol, and smoking [7]. The relative incidences of STEMI and NSTEMI are decreasing and increasing, respectively [8, 9]. Probably the most comprehensive European STEMI registry is found in Sweden, where the incidence rate of STEMI was 58 per 100 000 per year in 2015. In other European countries, the incidence rate ranged from 43 to 144 per 100 000 per year. Similarly, the reported adjusted incidence rates from the USA decreased from 133 per 100 000 in 1999 to 50 per 100 000 in 2008, whereas the incidence of NSTEMI remained constant or increased slightly. There is a consistent pattern for STEMI to be relatively more common in

younger than in older people, and more common in men than in women [10]. TIMI risk score for STEMI patients as a predictor of in-hospital mortality was reported mostly in abroad. In Bangladesh a few studies have revealed increasing TIMI risk score is associated with increased risk of major adverse cardiac events. But no study yet to be done in Sylhet division regarding the correlation of TIMI risk score and major adverse cardiac events in patients with STEMI. Therefore, this study is designed to see the correlation of TIMI risk score and major adverse cardiac events in patients with STEMI.

METHODOLOGY

Study Design: This was a cross-sectional observational study.

Study period: This study was conducted during the period from 1st July 2017 to 30th June 2018.

Place of Study: This study was conducted in the Department of Cardiology, Sylhet MAG Osmani Medical College Hospital, Sylhet.

Target Population: The patients got admitted in the Coronary Care Unit of Department of Cardiology, Sylhet MAG Osmani Medical College Hospital, Sylhet with the diagnosis of ST elevation myocardial infarction (STEMI) were the target population.

Study Population: The patients got admitted in the Coronary Care Unit of Department of Cardiology, Sylhet MAG Osmani Medical College Hospital, Sylhet with the diagnosis of ST elevation myocardial infarction (STEMI) and those fulfilling the inclusion criteria were the study population.

Inclusion criteria

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

Exclusion Criteria

- 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.

Sample Size: Sample was calculated by using Guilford and Frucher's formula, considering 5% level of significance, 5% precision level (marginal error) and the prevalence rate of coronary artery disease in Bangladesh of 3.4% [11]. The sample size is calculated by using under mentioned formula which comes to 50.

The formula is: $n = \frac{Z^2 pq}{d^2}$

Sampling Technique: Non-probability, convenient sampling method was applied.

Follow up: schedule was

- 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.

The TIMI score was created and validated in a sample of patients with ST-segment elevation myocardial infarction, and thus, has specific variables for this clinical condition. In brief, this score consists of eight

dichotomic variables, with the exception of age that adds points in two distinct strata (Table-I).

Table-1: TIMI Risk Score for STEMI [12]

Component of TIMI risk score	**Score**
Age between 65-74 years old	2 points
Age ≥ 75 years old	3 points
History of diabetes, hypertension or angina	1 point
Systolic blood pressure < 100 mmHg	3 points
Heart rate > 100 bpm	2 points
Killip classification II to IV	2 points
Weight < 67 Kg	1 point
ST segment elevation in anterior wall or left bundle branch block	1 point
Reperfusion time > 4 hours	1 point

The final score may vary between 0 and 14

Risk categorization based on the baseline 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 (Singh and Rajender, 2015) [13].

RESULTS

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

Table-II: 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-II.

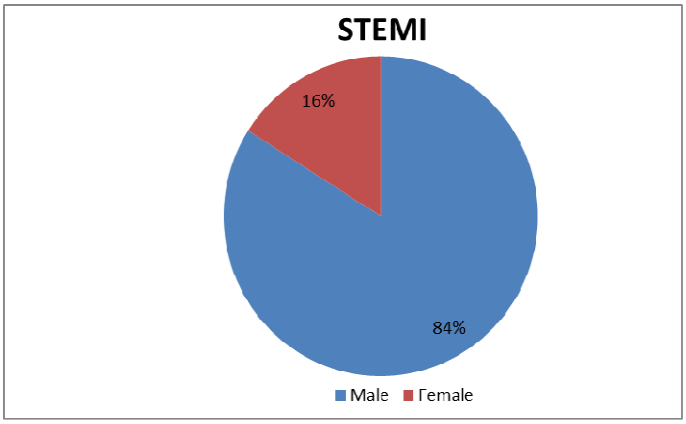

Figure-1: Sex distribution of the patients.

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.

Table-III: Distribution of the Patients According to the Thrombolysis in Myocardial Infarction (TIMI) Risk Score for STEMI

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

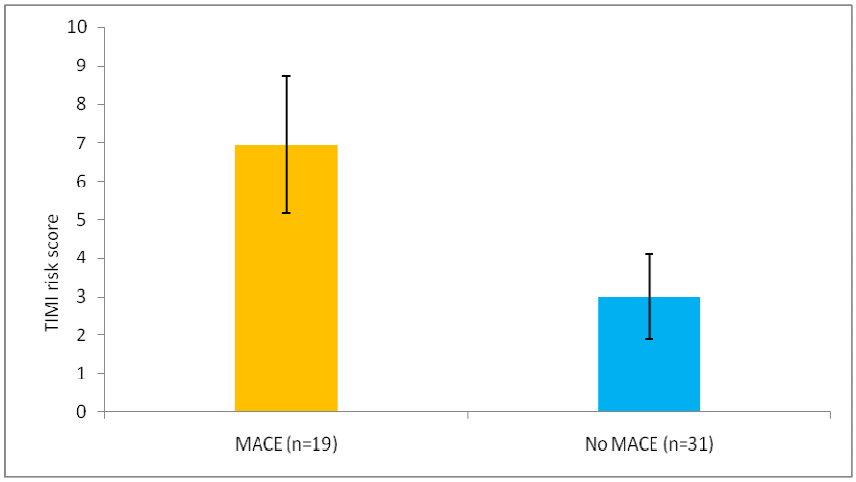

Figure-2: Distribution of Patients According to Major Adverse Cardiac Events **(MACE) and the Thrombolysis in Myocardial Infarction (TIMI) Risk Score for STEMI.**

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-5)

Table-IV: Comparison of Demographic and Risk Factors between TIMI Risk Score of High Risk (≥5) and Low Risk (≤4)

Variables	High TIMI (≥5)	Low TIMI (≤4)
Age (years)	58.62 (SD 12.95)	48.31 (SD 9.00)
Sex (male)	18 (85.7%)	24 (82.8%)
Smoker	14 (66.7%)	18 (62.1%)
Hypertension	10 (47.6%)	7 (24.1%)
Diabetes mellitus	7 (33.3%)	6 (20.7%)
Dyslipidemia	2 (9.5%)	0 (0.0%)
Family history of IHD	5 (23.8%)	11 (37.9%)

*Chi-Square (χ^2) test and †Fisher's Exact test were applied to analyse the data. (Annex- 4)

Table-V: Comparison of MACE between High and Low TIMI Risk

MACE	High TIMI (≥5)	Low TIMI (≤4)
Post MI Angina	11 (52.4%)	1 (3.4%)
Arrhythmias	12 (57.1%)	1 (3.4%)

Re-infarction	1(4.8%)	1 (3.4%)
Cardiogenic shock	6(28.6%)	1 (3.4%)
Left ventricular failure	12 (57.1%)	7 (24.1%)
Death	12 (57.1%)	1 (3.4%)

*Chi-Square (χ^2) test and †Fisher's Exact test were applied to analyse the data. (Annex- 4)

Post MI Angina [11 (52.4%) versus 1 (3.4%); χ^2=15.989]; Arrhythmias [12 (57.1%) versus 1 (3.4%); χ^2=18.252; Cardiogenic shock [6(28.6%) versus 1 (3.4%)]; Left ventricular failure [12 (57.1%) versus 7 (24.1%); χ^2=5.632]; Death [12 (57.1%) versus 1 (3.4%); χ^2=18.252] were significantly higher in patients with TIMI risk score ≥5 compared to TIMI risk score ≤4.

But Re-infarction [1(4.8%) versus 1 (3.4%)] did not differ significantly between patients of TIMI risk score ≥5 and TIMI risk score ≤4 (Table-V).

DISCUSSION

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., [14] that the mean age of their patients was 51.89 ± 12.01 years. Alam, Ullah, Ulabbi, et al., [15] 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., [4] 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. 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., [4] that 81% patients with STEMI were male and 19.0% were female. This result also correlated with Chen, Huang and Lin,[16] that 88.9% patients with STEMI were male and 11.1% were female. Correia, Garcia and Kalil, et al., 17] reported that 72.0% patients with STEMI were male and 28.0% were female. Male preponderance was reported in several other studies [18]. Numerous previous series have reported a male preponderance in patients presenting with STEMI. 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., [17] reported that TIMI score for STEMI was 3.7 ± 2.3. Chen, Huang and Lin, [16] reported that the median value of the TIMI risk score was 5 in the patients with STEM. Betancourt-Plaza and Martos-Benítez, [19] 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, Arias-Mendoza, Álvarez-Sangabriel, et al.,[20] 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., [14] 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 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.,[17] which found that the optimal cutoff-points of TIMI of > 4 with sensitivity 88% and a specificity of 72%. This study revealed that post MI Angina [11 (52.4%) versus 1 (3.4%); RR=30.8 (95% CI=3.5-269.9); p<0.001]; Arrhythmias [12 (57.1%) versus 1 (3.4%); RR=37.3 (95% CI=4.2-328.2); p<0.001]; Cardiogenic shock [6(28.6%) versus 1 (3.4%); RR=11.2 (95%

CI=1.2-101.9); p=0.033]; Left ventricular failure [12 (57.1%) versus 7 (24.1%); RR=4.2 (95% CI=1.2-14.1); p=0.018]; Death [12 (57.1%) versus 1 (3.4%); RR=37.3 (95% CI=4.2-328.2); p<0.001] were significantly higher in patients with high-risk group (TIMI risk score ≥5) compared to low-risk group (TIMI risk score ≤4). But Re-infarction [1(4.8%) versus 1 (3.4%); RR=1.4 (0.083-23.7); p=0.738] did not differ significantly between patients of high-risk group (TIMI risk score ≥5) and low-risk group (TIMI risk score ≤4). In this regards González-Pacheco, Arias-Mendoza, Álvarez-Sangabriel, et al., [20] observed that mortality was eight-fold higher in the high-risk group than in the low-risk group (14.8% vs. 2.1%; OR 8.2, 95% CI 3.66–18.54, p=0.0001). Other adverse events also occurred more frequently in the high-risk group: heart failure (15.3% vs. 4.1%, p=0.0001), development of cardiogenic shock (10.9% vs. 1.5%, p=0.0001), ventricular arrhythmias (14.8% vs. 5.9%, p<0001), and development of the no-reflow phenomenon (22.4% vs. 13.6%, p=0.01). The incidence of reinfarction and stroke was low and there were no significant differences between both groups.

CONCLUSION

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. 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.

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