IN-HOSPITAL OUTCOME OF ACUTE MYOCARDIAL INFARCTION IN CORRELATION WITH 'THROMBOLYSIS IN MYOCARDIAL INFARCTION' RISK SCORE

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Background: Effective risk stratification is integral to management of acute coronary syndromes (ACS). The Thrombolysis in Myocardial Infarction (TIMI) risk score for ST-segment elevation myocardial infarction (STEMI) is a simple integer score based on 8 high-risk parameters that can be used at the bedside for risk stratification of patients at presentation with STEMI. **Objectives:** To evaluate the prognostic significance of TIMI risk score in a local population group of acute STEMI. **Material and Methods:** The study included 160 cases of STEMI eligible for thrombolysis. TIMI risk score was calculated for each case at the time of presentation and were then followed during their hospital stay for the occurrence of electrical and mechanical complications as well as mortality. The patients were divided into three risk groups, namely 'low-risk', 'moderate-risk' and 'high-risk' based on their TIMI scores (0–4 low-risk, 5–8 moderate-risk, 9–14 high risk). The frequencies of complications and deaths were compared among the three risk groups. **Results:** Post MI arrhythmias were noted in 2.2%, 16% and 50%; cardiogenic shock in 6.7%, 16% and 60%; pulmonary edema in 6.7%, 20% and 80%; mechanical complications of MI in 0%, 8% and 30%; death in 4.4%, 8%, and 60% of patients belonging to low-risk, moderate-risk and high-risk groups respectively. Frequency of complications and death correlated well with TIMI risk score (p=0.001). **Conclusion:** TIMI risk score correlates well with the frequency of electrical or mechanical complications and death after STEMI.

Keywords: ST elevation MI, Acute Myocardial infarction, Ischemic heart disease

INTRODUCTION

Cardiovascular disease (CVD) is estimated to be the leading cause of death worldwide and is responsible for one-third of all deaths.[1] Substantial advances in the treatment of Acute Myocardial Infarction (AMI) have occurred over the past several years as a result of important observations in basic myocardial research and through the vital evaluative mechanism of randomised clinical trials.[2,3] Practitioners now have a variety of treatment strategies available, especially for patients with STEMI, to restore obstructed coronary blood flow and interrupt the evolving myocardial event.[4] Despite therapeutic advances, large scale randomised clinical trials reported 6% to 9% early mortality rates (30 to 35 days), even for patients receiving thrombolytic therapy within 6 hours of symptom onset.[5,6] Often, choices among alternative therapies or decisions regarding the allocation of clinical resources are based on an assessment of patient risk. Careful attention to pivotal factors that increase the risk of early mortality may further elaborate the role of early invasive therapeutics that would further lower the fatality rate of STEMI.

Effective risk stratification is integral to management of Acute Coronary Syndromes (ACS).[7] Even among patients with STEMI, for whom initial therapeutic options are well defined, patient risk characteristics impact short and long term medical decision making.[8-10] Early risk assessment guides triage to alternative levels of hospital care, decisions regarding therapeutic interventions, and application of clinical resources.[11] Considerable variability in short-term mortality risk exists among patients with STEMI who receive fibrinolytic therapy.[8,12] Algorithms that aid clinicians in assessing prognosis may therefore be useful in guiding management and in providing valuable information for patients and their families.

To be practical clinically, a risk stratification tool should be simple and easily applied at the bedside and should make use of clinical data that are routinely available at hospital presentation. However, to perform accurately, the tool should use data that offer independent prognostic information and must take into account the complex profile of patients with multiple risk factors.[13] A risk model satisfying these objectives could also be useful in adjusting for baseline risk in epidemiological studies, such as those examining variation in practice patterns, provider types, or specific therapies.[14–16] Though many studies have attempted to define the prognosis of patients with MI and/or provide risk algorithms, they were performed before the widespread use of thrombolytic agents.[17,18]

The Thrombolysis in Myocardial Infarction (TIMI) risk score for STEMI is a simple integer score based on 8 high-risk parameters that can be used at the bedside for risk stratification of patients at presentation with STEMI.[19] For each patient, the

score is calculated as the arithmetic sum of the points for each risk feature present (range, 0–14). The TIMI risk score was developed by Morrow *et al*, using multivariable methods among patients from the Intravenous tPA for Treatment of Infarcting Myocardium Early II (InTIME II) trial, a phase 3 trial of lanoteplase vs alteplase reperfusion therapy.[13] The risk score was derived based on mortality through 30 days after presentation but showed stable prognostic performance across multiple time points, including time to discharge.[13] It is a robust clinical tool for mortality risk prediction in fibrinolysis-eligible patients with STEMI. Although it is documented to perform well among patients receiving fibrinolytics in clinical trials, the TIMI risk score has not been validated in a local population.

More than 80% of the global burden of CVD occurs in low-income and middle-income countries, however, knowledge of the importance of risk factors is primarily derived from developed countries.[20] The risk factor profile as well as the contribution of different high-risk features of STEMI may vary in the local population groups from that used in international randomised trials. Our study aimed at evaluating the prognostic significance of TIMI risk score in a local population group that included 160 consecutive patients suffering from STEMI eligible for thrombolytic therapy.

MATERIAL AND METHODS

This case series study was conducted at Cardiology department, Jinnah Hospital, Lahore from June to August 2009. We included 160 patients of either gender irrespective of age, presenting to the department of accidents and emergency with acute STEMI who were eligible for thrombolytic therapy. An informed consent was obtained from each patient before inclusion in the study. The study parameters including TIMI risk score points were recorded on a pre-designed proforma for each case and the TIMI score was calculated by adding up the individual points (Table-1). The patients were divided into three risk groups, namely 'low-risk', 'moderate-risk' and 'high-risk' based on their TIMI scores (0–4 low-risk, 5–8 moderate-risk, 9–14 high risk) (Table-2). All patients received routine anti-ischemic therapy and were thrombolised subsequently, followed by routine post MI management. The patients were followed during their hospital stay for occurrence of arrhythmias, cardiogenic shock, mechanical complications, pulmonary oedema and death. Post-infarction arrhythmias included atrial fibrillation, sustained and non-sustained ventricular tachycardia, ventricular fibrillation, sinus node dysfunction and atrioventricular (AV) nodal blocks. Cardiogenic shock was defined as a state of persistent hypotension (systolic blood pressure <90 mmHg) accompanied by one or more signs of hypoperfusion including altered sensorium, cold extremities, oliguria (urine output <30 mL/hr). All patients underwent echocardiography to look for mechanical complications (mitral regurgitation, ventricular septal defects and left ventricular pump failure).

Data was analysed using SPSS-12. Categorical variables were expressed as numbers and percentages, while continuous variables were expressed as Mean±SD. Frequencies of arrhythmias, shock, mechanical complications and pulmonary oedema were compared among low-risk, intermediate-risk and high-risk groups by chi-square test. Frequencies of death were also compared among the risk groups similarly.

RESULTS

The study included 120 males (75%) and 40 (25%) females. Eighty-six (53.8%) patients were hypertensive, 66 (41.3%) were smokers, 58 (36.3%) had diabetes mellitus, 38 (23.8%) patients had family history of ischemic heart disease and 40 (25%) patients had dyslipidemia (Table-3).

One hundred and two (63.8%) patients had anterior wall, 50 (31.3%) had inferior wall, 6 (3.8%) had posterior wall and 2 (1.3%) had lateral wall myocardial infarction. Out of 160 patients, 90 (56.3%) were included in the low-risk group, 50 (31.3%) in moderate-risk group, and 20 (12.5%) in high-risk group. Post MI arrhythmias were noted in 2 (2.2%) patients from low-risk group, 8 (16%) patients from moderate-risk and 10 (50%) patients from high-risk group. Cardiogenic shock was noted in 6 (6.7%) patients from low-risk group, 8 (16%) patients from moderate-risk and 12 (60%) patients from high-risk group. Pulmonary oedema occurred in 6 (6.7%) patients from low-risk group, 10 (20%) patients from moderate-risk and 16 (80%) patients from high-risk group. Mechanical complications of MI were noted in none of the patients from low-risk group, 4 (8%) patients from moderate-risk and 6 (30%) patients from high-risk group. Death occurred in 4 (4.4%) patients from low-risk group, 8 (16%) from moderate-risk and 12 (60%) from high-risk group (Table-4).

By applying 'chi-square test', the frequency of post MI arrhythmias significantly correlated with TIMI risk groups (p=0.001). Similarly, the frequency of post MI cardiogenic shock significantly correlated with TIMI risk groups (p=0.001). The frequency of post MI pulmonary oedema and mechanical complications also significantly correlated with TIMI risk groups (p=0.001). Frequency of post MI deaths also showed significant correlation with the risk groups (p=0.001) (Table-4).

Table-1: TIMI risk score

High-Risk Features	Points
Age ≥75 yrs	3
Age 64 to 75 yrs	2
Diabetes, Hypertension or Angina	1
Systolic Blood Pressure <100 mmHg	3
Heart Rate >100/min	2
Killip Class II–IV	2
Weight Less Than 65 Kg	1
Anterior wall MI or Left BBB	1
Time to Therapy >4 hrs	1
Total score calculated as arithmetic sum of individual points. (Maximum=14)	

Table-2: TIMI risk groups

	Score	No. of Patients
Low risk	0 to 4	90 (56.3%)
Moderate risk	5 to 8	50 (31.3%)
High risk	9 to 14	20 (12.5%)

Table-3: Baseline characteristics of the patients

GE (Yr)	51.89±12.01
Males	120 (75%)
Females	40 (25%)
Hypertension	86 (53.8%)
Smoking	66 (41.3%)
Diabetes mellitus	58 (36.3%)
Dyslipidemia	40 (25%)
Family history of IHD	38 (23.8%)

Table-4: Frequency of post MI complications and mortality according to TIMI risk groups

	Low Risk No. (%)	Moderate Risk No. (%)	High Risk No. (%)	*p*
Arrhythmias	2 (2.2%)	8 (16%)	10 (50%)	0.001
Shock	6 (6.7%)	8 (16%)	12 (60%)	0.001
Pulmonary oedema	6 (6.7%)	10 (20%)	16 (80%)	0.001
Mechanical Complications	0 (0.0%)	4 (8%)	6 (30%)	0.001
Death	4 (4.4%)	8 (16%)	12 (60%)	0.001

DISCUSSION

Other well validated scoring systems for risk stratification of STEMI patients acquire data during hospitalisation to predict long term outcomes.[16] Several of these models were developed before the widespread use of thrombolysis.[21–23] Of those derived in the era of reperfusion, several were formed by using general measures of severity of illness, such as the Acute Physiology and Chronic Health Evaluation II scoring system,[24] whereas others were based on expert opinion and prior investigation.[25] The risk estimation models by some others for mortality in STEMI were highly accurate in their predictive performance but their calculation required complex computing.[26]

In contrast, the TIMI risk score can be used as an effective bedside tool for early risk stratification, based on clinical information available at time of hospital arrival, without the need for a computer.[11] Morrow *et al* found the predictive capacity of this risk score stable over multiple time points, in men and women, and in smokers and nonsmokers in the InTIME II trial population in whom it was developed.[13] Furthermore, all of the variables included in this model were independent predictors of 30-day mortality.[13] The risk score, however, showed poor discriminative ability among nearly 50,000 elderly (older than 65 years) patients on the Cooperative Cardiovascular Project (CCP) database.[27] Subsequently, the TIMI risk index was tested as a predictor of in-hospital mortality in more than 150,000 patients with STEMI from the National Registry of Myocardial Infarction (NRMI)-3 and -4 databases.[28] The discriminative power of the score was good and the results were broadly corcordant with those expected.[28] The risk index performed good as a predictor of 30-day mortality when applied to the Enhanced Feedback for Effective Cardiac Treatment (EFFECT) study cohort of 11,510 AMI patients from Canada, despite higher 30-day mortality than among the InTIME II trial participants (10.2% versus 6.0%).[29] The discriminatory capacity was however somewhat lower for patients older than 65 years of age like that in the CCP study.[29]

Our study aimed at evaluating the predictive accuracy of TIMI risk score for in-hospital morbidity and mortality in thrombolysis-eligible STEMI patients. The mean age of this study population was 51.89±12.01 years, with 14 (8.75%) patients older than 65 years including both with and without the history of diabetes, hypertension and smoking. The score performed well in predicting mortality, as well as morbidity in terms of post MI arrhythmias, cardiogenic shock, pulmonary oedema and mechanical complications.

CONCLUSION

TIMI risk score correlates well with the frequency of electrical or mechanical complications and death after STEMI.

STUDY LIMITATIONS

Despite the statistically significant results of this study, larger cohorts are required in local settings to assess the applicability of TIMI score. Other important early prognostic indicators, such as cardiac biomarkers and ST-segment resolution, were not included in this analysis. The interaction of the TIMI risk score with these prognostic measures may be an area of interest for future investigation.

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