The correlation between thrombolysis in myocardial infarction and angiographic scores in patients with ST-elevation myocardial infarction

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Abstract

BACKGROUND: Myocardial infarction is a common and lethal disease, especially in the first hours. Rapid and correct decision is essential to prioritize advanced therapies. This study followed the accuracy of a scoring system for this triage. The aim was to assess the correlation between thrombolysis in myocardial infarction risk scores and angiographic scores in patients with ST elevation myocardial infarctio.

METHODS: In this cross-sectional, correlation study, 240 patients with ST elevation myocardial infarction from coronary care units (CCUs) of 3 academic hospitals in Isfahan, Iran, were evaluated. Thrombolysis in myocardial infarction risk score was calculated. All subjects underwent angiography and were followed up for 2 months.

RESULTS: Mean age of patients was 60.02 ± 11.95 years old and 79 patients were female. The correlation between thrombolysis in myocardial infarction risk and angiographic scores was significant ($P < 0.001$). In addition, the correlations between ejection fraction and thrombolysis in myocardial infarction risk score ($P < 0.001$), as well as angiographic score and age ($P < 0.001$) were significant. There was no significant correlation between angiographic score and recurrent angina ($P = 0.143$), rehospitalization ($P = 0.524$), and death ($P = 0.179$). Pearson's correlation showed a significant relation between thrombolysis in myocardial infarction risk score and angiographic score ($P < 0.001$; $r = 0.556$).

CONCLUSION: This study showed that thrombolysis in myocardial infarction risk score could probably be used for evaluating the angiographic extent of coronary artery disease. If confirmed by a prospective cohort study, simple clinical use of this score at bedside would make it a method to stratify patients in high and low risk groups. Diagnostic and therapeutic strategies would accordingly be catgorized.

Keywords: Thrombolysis in Myocardial Infarction Risk Score, Angiographic Score, ST Elevation Myocardial Infarction, Ejection Fraction.

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Introduction

Coronary artery disease is caused by the blockage of coronary arteries with atheromatous plaque. It is a spectrum of acute coronary syndromes including ST elevation myocardial infarction (STEMI) which is detected by an echocardiogram.[1] Acute myocardial infarction (MI) is life threatening, weak performance of the physician can lead to patient death. Quick and correct decision in emergency department is very important to save the lives of these patients.[2] Despite the great advances, the history of the patient is still essential for diagnosis.[3] The most important decision for patients with STEMI is to restore the blood flow. The method is effective in balancing the demand and supply of blood. To select a method for restoring the blood flow (either medical or emergency angioplasty), several criteria including the time of disease onset, the risk of brain hemorrhage, the time required to transfer the patient to a center with angioplasty equipment and the risk of MI, must be considered.[4] Several diagnostic and therapeutic scoring systems have been proposed for STEMI and can be helpful in decision making.[5] The ideal scoring system should possess high predictive capacity, availability, and ease of performance at patient's bedside.[6] Thrombolysis in MI (TIMI) is one of suggested scoring systems. It is

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Table 1. The scoring system based on thrombolysis in myocardial infarction (TIMI) criteria

TIMI criteria	Score
Age equal or greater than 75 years old	3
Age between 65 and 74 years old	2
History of diabetes, angina, and hypertension	1
Systolic blood pressure > 100 mmHg	3
Heart rate > 100 pulse per minute	2
Killip class > II	2
Weight < 67 kg	1
Anterior surface ST elevation myocardial infarction	1
Onset to treatment more than 4 hours	1
Total	0-14

designed on the basis of 8 clinical indicators by which patients can be divided into two categories of low risk (scores of 0-4) and high risk (scores of more than 5) (Table 1).[7]

The gold standard to evaluate coronary artery stenosis is angiography. It can provide the best anatomical information required for selecting a therapeutic policy. The data obtained through this method is very useful to determine the severity of coronary disease and to optimize the aggressive medical therapies.[8] The most important predictive information revealed by angiography are the number of involved vessels, the extent of proximal vascular involvement, and the overall left ventricular function.[1] The Gensini scoring system is used in order to determine the severity and extent of coronary artery disease (Table 2).[9]

In this study, the relationship between TIMI score and angiographic score was investigated in patients with STEMI who referred to academic hospitals. The relationship between these two scores has not been previously studied in patients with STEMI. Most studies in this field were conducted on patients with unstable angina or non-ST elevation myocardial infarction (NSTEMI).

Materials and Methods

This cross-sectional correlational study used an easy sampling method to select subjects from among nearly 300 patients who referred to the coronary care unit (CCU) of Khorshid, Chamran, and Alzahra Hospitals (Isfahan, Iran) from October 2007 to November 2008. The inclusion criterion was the diagnosis of STEMI in patients at complete bed rest. Patients were excluded if they had a relative rest, non-specific changes in echocardiogram, or lack of coronary angiography for various reasons. Finally, according to the formula of sample size, 240 patients were studied. The information of the patients was entered into a questionnaire containing name, age, occupation, history of diabetes, hypertension, angina, and chest pain onset. Blood pressure and pulse measurements and heart and lung examinations were performed and recorded. For each patient, echocardiogram parameters were studied at various leads and entered into the questionnaires. This description was based on the TIMI score in National Registry of Myocardial Infarction (NRMI3).[7] The total score for each

Table 2. Angiography scores based on the Gensini scoring system

		Score
Artery involvement	Left main coronary	5
	Left descending anterior	20
	Left circumflex	20
	Right coronary	20
	First diagonal	10
	First obtuse marginal	10
	Descending posterior	10
	First septal	5
Stenosis percentage	1-49	1
	50-74	2
	75-99	3
	100	4

patient was calculated after completing the questionnaire (Appendix 1).

Patients underwent angiography during hospitalization or within 2 months of follow-up. The angiography film was reviewed to determine the extent of coronary artery disease using the Gensini scoring system. This scoring system gave the score from zero to four to coronary stenosis and five to twenty to the involved components. The multiplication of the two numbers specified the overall angiographic score.[9] Left ventricular ejection fraction (LVEF) of patients was recorded based on their angiography results. All subjects received their echocardiography results, too. All participants were followed for two months and treated for the secondary prevention of heart disease. The 2-month follow-up was also performed in terms of death, readmission and angina. TIMI scores associated with these events were investigated. The obtained data was entered into $SPSS_{13}$ and statistical analyses were performed. After summarizing the collected information, the Spearman's correlation coefficient was used for the relationship of TIMI score with angiographic score. The findings were confirmed with Pearson's correlation coefficient.

Results

From the 240 STEMI patients who entered the study, 161 were males and 79 were females. The youngest patient was 17 and the oldest was 83 years old. The mean age of patients was 60.02 ± 11.959 years. In the two-month follow-up, 62 patients (26%) were admitted to hospital with recurrent angina, 31 patients (13%) had readmission, and 12 patients (5%) died. LVEF ranged from 6% to 70% (mean: 44.05 ± 12.592). Mean TIMI scores of patients varied between zero and 13 (mean: 6.30 ± 2.51). Mean angiographic scores ranged between zero and 230 (mean: 120.77 ± 50.84). The investigation of findings with the Pearson's correlation coefficient showed a relationship between the TIMI score and age ($P < 0.001$), recurrent angina ($P = 0.03$), and LVEF ($P < 0.001$; $r = -0.46$). However, there was not a relationship between TIMI scores and readmission ($P = 0.63$) or death ($P = 0.96$). Angiographic scores were related with age ($P < 0.001$) and LVEF ($P < 0.001$). Nevertheless, significant relationships were not found between angiographic scores and recurrent angina ($P = 0.14$), readmission ($P = 0.52$), and death

Table 3. Comparison of the studied statistical variables using Pearson's correlation coefficient

		TIMI score	Angiographic score	Age	LVEF	Recurrent angina	Readmission	Death
TIMI score	Pearson's correlation coefficient	1	0.746	0.333	-0.463	0.143	-0.032	0.003
	P-value		< 0.001	< 0.001	< 0.001	0.03	0.63	0.96
Angiographic score	Pearson's correlation coefficient	0.746	1	0.272	-0.420	0.095	-0.041	-0.087
	P-value	< 0.001		< 0.001	< 0.001	0.14	0.52	0.18
Age	Pearson's correlation coefficient	0.333	0.272	1	0.039	0.019	0.217	0.182
	P-value	< 0.001	< 0.001		0.55	0.77	0.001	0.005
LVEF	Pearson's correlation coefficient	-0.463	-0.420	0.039	1	-0.035	0.010	0.017
	P-value	< 0.001	< 0.001	0.55		0.59	0.88	0.79
Recurrent angina	Pearson's correlation coefficient	0.143	0.095	0.019	-0.035	1	-0.175	0.039
	P-value	0.03	0.14	0.77	0.59		0.01	0.54
Readmission	Pearson's correlation coefficient	-0.032	-0.041	0.217	0.010	-0.175	1	0.135
	P-value	0.63	0.52	0.001	0.88	0.01		0.04
Death	Pearson's correlation coefficient	0.003	-0.087	0.182	0.017	0.039	0.135	1
	P-value	0.96	0.18	0.005	0.79	0.54	0.04	

TIMI: Thrombolysis in myocardial infarction; LVEF: Left ventricular ejection fraction

(P = 0.18). Finally, a significant relationship was detected between TIMI and angiographic scores (P < 0.001; r = 0.56) (Table 3).

Discussion

This cross-sectional study investigated the relationship between TIMI and angiographic scores in patients with STEMI. Factors such as age, gender, LVEF, and associated events were followed up for 2 months. The existence of a significant relationship between TIMI and angiographic scores showed that this scoring system could be a criterion for estimating the extent of coronary angiographic involvement. However, for its generalization, a prospective cohort study would be essential.

Similar to our study, Garcia et al. reported a relationship between TIMI and angiographic scores in patients with unstable angina.[10] In addition, the statistically significant relationship between TIMI scores and age in our study was also obtained by Bonow et al. who indicated age as an important criterion in coronary disease mortality.[11] In a cohort study by Chase et al. on patients with unstable angina who referred to the emergency room due to chest pain, TIMI scores and the incidence of consequences were evaluated for one month. The most important consequences were the occurrence of death and acute MI which had significant correlations with TIMI scores.[12] However, in our study TIMI scores and death were not significantly related which might have been caused by the insufficient number of studied subjects. Thune et al. made an initial classification of STEMI patients based on TIMI scores. They finally found the rates of death, reinfarction, and disabling stroke to be lower in patients who were under high risk and received invasive therapy.[13] Although in our study, TIMI score was significantly related with angiographic score, it was not associated with death. Singh et al. performed a cohort study to evaluate the role of TIMI scores in determining the risk of death and complication. Their results suggested the possibility using LVEF to predict the risk in patients after MI.[14] This finding was consistent with our study.

Conclusion

Our study showed a statistically significant relationship between TIMI and angiographic scores. TIMI scores were also associated with patient age, LVEF, and recurrent angina. On the other hand, there was a relationship between the age of patients and angiographic scores. However, in order to generalize the results, conducting a prospective cohort study is needed. Absence of a significant relationship between TIMI scores and readmission and death, and also between angiography scores and angina, readmission, and death showed that the necessity of further investigations in this regard.

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Conflict of Interests

Authors have no conflict of interests.

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Appendix 1. The questionnaire used in the study

Date
Name
Age
Gender
Occupation
Address
Telephone number

CCU location
Khorshid Hospital
Chamran Hospital
Alzahra Hospital

Chest pain start time until referring to the emergency department
Less than 4 hours
More than 4 hours

Disease history
Diabetes
Hypertension
Angina

Examinations
Weight
Blood pressure
Heart rate

Killip class
I
II
III
IV

Echocardiogram
ST elevation in anterior leads V2-V6
Non-ST elevation in anterior leads V2-V6

Total score
Thrombolysis in myocardial infarction score
Angiographic score

Risk determination
Low risk
High risk