VALIDATION OF TIMI AND GRACE SCORES IN ACUTE CORONARY SYNDROME (ACS) PATIENTS - A DEMOGRAPHIC STUDY IN A TERTIARY HOSPITAL OF NORTH KERALA

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ABSTRACT

BACKGROUND

Though the aetiology and pathophysiology of Acute Coronary Syndrome (ACS) is same whether the patients have ST segment elevation or not, but they form a heterogeneous group with variable short- and long-term prognoses. Early differentiation of these patients would help in better treatment and followup.

The aim of this study is to conduct a Demographic study of patients with ACS and validating them with both Thrombolysis in Myocardial Infarction (TIMI) and Global Registry of Acute Coronary Events (GRACE).

MATERIALS AND METHODS

76 patients with ACS admitted to the Department of Medicine through the casualty were included in the study. Demographic details were recorded. The final outcome of STEMI and UA/NSTEMI were compared.

RESULTS

Among 76 patients, 37 (46.68%) with STEMI and 39 (51.31%) with UA/NSTEMI were included. The comparable mean age among these two groups were 55 ± 3.76 and 57 ± 4.12 years respectively. Among the STEMI group, males were 78% and 64% in UA/NSTEMI group. Familial tendency was in 27.02% in STEMI compared to 23.07% in UA/NSTEMI. History of smoking was in 59% and 41% respectively. The UA/NSTEMI group had history of previous ischaemia in 73%, unlike 27% in STEMI group. Similarly hypertension was in 48.71% of UA/NSTEMI and in 37.83% of STEMI patients; Diabetes (29.72% and 38.46%). STEMI group patients had higher in-hospital MACE (35.13% unlike UA/NSTEMI patients with 20.51%). A higher 30-day all-cause mortality rate was 5.40% and 0% respectively and recurrent non-fatal MI of 2.70% and 0%.

CONCLUSION

The age of occurrence of ACS is a little lower in these parts of India sharing common risk factors. Among ACS patients, STEMI group had bad in-hospital outcome and total 30-day outcome.

KEYWORDS

Acute Coronary Syndromes; Demographics; Risk Factor Scores; STEMI, TIMI; GRACE; Prognosis.

HOW TO CITE THIS ARTICLE: Kannan KK, Mushthaque MP. Validation of TIMI and GRACE scores in acute coronary syndrome (ACS) patients - a demographic study in a tertiary hospital of North Kerala. J. Evolution Med. Dent. Sci. 2017;6(8):615-619, DOI: 10.14260/Jemds/2017/132

BACKGROUND

Even though the risk factors and pathophysiology are common for the patients of Acute Coronary Syndrome, either belonging to the STEMI and NSTEMI type, they form a heterogeneous group requiring early identification and treatment. The concept of risk assessment has become widespread in the last few years.^{1,2} Classifying the patient's risk factors in ACS helps one to identify high risk of death or recurrent ischaemic events, which might help us further to investigate and change the course of treatment. It also identifies low-risk patients, likely requiring early hospital discharge. It helps in better understanding of cost-benefit clinical resource utilisation like transfer to tertiary centres,

level of care, length of hospital stay and which pharmacological and interventional treatments should be used.² The prognostic scores being used are derived from clinical trials such as TIMI (Thrombolysis in Myocardial Infarction),^{3,4} PURSUIT (Platelet glycoprotein IIb - IIIa in unstable angina, receptor suppression using Integrilin Therapy trial),⁵ and GUSTO (Global Utilisation of Streptokinase and t-PA for Occluded Coronary Arteries)⁶ scores. Some studies also use registries and cohort studies such as PREDICT (the Predicting Risk of Death in Cardiac Disease Tool),⁷ CCP (Cooperative Cardiovascular Project)⁸ and GRACE (Global Registry of Acute Coronary Events)⁹ scores. STEMI and GRACE scores are calculated from initial clinical history and electrocardiographic and laboratory data collected on admission. These scores are very simple and practical at the bedside for risk assessments across a wide spectrum of patients with ACS.^{1,2} The classification helps the physicians' subjective risk selection of more aggressive therapies than would be chosen if patients were objectively classified by validated risk score models. Therefore, dedicated efforts to improve and implement risk classification may enhance the overall care process and resource utilisation.¹⁰ The present study aims at analysing the demographics of ACS patients admitted to Kannur Medical College, Anjarakandy, Kannur District, Kerala

Financial or Other, Competing Interest: None.

Submission 06-01-2017, Peer Review 18-01-2017,

Acceptance 20-01-2017, Published 25-01-2017.

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DOI: 10.14260/Jemds/2017/132

comparing ST Segment Elevation Myocardial Infarction (STEMI) with Unstable Angina/Non-ST Segment Elevation Myocardial Infarction (UA/NSTEMI) patients. To validate both TIMI and GRACE scores as tools to predict both in-hospital Major Acute Cardiac Events (MACE) and 30-day all-cause mortality.

Inclusion Criteria

Patients with history of coronary artery disease including Myocardial Infarction (MI) were included. Patients were assigned to types of STEMI and NSTEMI or unstable angina according to standard definitions were only included.

Exclusion Criteria

1. Patients with non-coronary causes of chest pain, i.e. trauma, gastritis or pericarditis were excluded.
2. Patients with acute dyspnoea from non-cardiac causes.
3. Patients with significant co-morbidity like advanced liver diseases, cerebrovascular diseases, malignancy and chronic lung diseases were excluded.

Total history taking was done and demographic details recorded by using a standard proforma. The management of ACS was according to the European guidelines.¹¹ STEMI patients were re-perfused using streptokinase. Coronary angioplasty was done where the patient could afford. A standard 12-lead Electrocardiogram (ECG) record was recorded at a paper speed of 25 mm/s and amplification of 10 mm/mV. Laboratory evaluation at the baseline included random blood sugar, serum lipid profile, serum urea and creatinine, creatine kinase, troponin and haemoglobin level on admission. The risk score assessment was done by using GRACE score according to risk model: age, history of congestive heart failure, history of MI, heart rate, systolic blood pressure on presentation, ST-segment deviation, initial serum creatinine and cardiac enzymes raised above the upper limit of normal for that laboratory. To record Major Acute Cardiac Events (MACE), the patients were reviewed daily until discharge and only the most serious events like death > asystole > cardiogenic shock > pulmonary oedema > serious arrhythmia > recurrent non-fatal MI > recurrent or refractory angina. MACE is reported according to the standard definitions.^{2,12} Statistical analysis of risk scores were calculated according to TIMI and GRACE risk score models.^{3,4,9} Data were analysed using Statistical Package for Social Sciences (SPSS) version 16.0.

RESULTS

The total number of patients included in the study was 76. The patients were divided into two groups: 37 (46.68%) with STEMI and 39 (51.31%) with UA/NSTEMI were included. The age groups of both groups were similar in STEMI 55 ± 3.76 and 57 ± 4.12 in UA/NSTEMI. The highest percentage of patients was in the age group less than 65 years being > 70% for both groups and the lowest percentage of patients was in the age group 74 years being 10.81% for the STEMI group and 7.69% for the UA/NSTEMI group. The STEMI group had a significantly higher rate of male gender (78.37% versus 64.10% of UA/NSTEMI), smoking (54.05% versus 61.53%), diabetes (29.72% versus 38.46%), dyslipidaemia (39% versus 29%) and family history of CAD (16% versus 7%). The number of UA patients was 9 (24.32%) and the number of

NSTEMI patients was 12 (30.76%). Interestingly, the percentage of patients who had a previous history of ischaemia in the UA/NSTEMI group was 64.09% unlike 32.43% in STEMI group. The UA/NSTEMI group had a higher rate of hypertension (48.71% versus 37.83%), diabetes (38.46% versus 29.72%) and previous coronary angiography (17.94% versus 13.51%). Patients with UA/NSTEMI had a longer duration since the first angina pain until presentation (96 ± 152 h) compared with STEMI patients (20 ± 32 h; $p < 0.001$). On the other hand, STEMI patients had more warning rest angina pain in the preceding 24 h (5 ± 2) compared with UA/NSTEMI patients (3 ± 2 ; $p < 0.001$), (Table 1).

	STEMI (NO = 37)	UA/NSTEMI (NO = 39)	p- Value
Male Gender	29 (78.37%)	25 (64.10%)	0.02
Age in Years			
< 65	26 (70.27%)	28 (71.79%)	NS
≥ 65 – < 74	7 (18.91%)	9 (23.07%)	
≥ 74	4 (10.81%)	3 (7.69%)	
Smoking	20 (54.05%)	24 (61.53%)	< 0.001
Hypertension	14 (37.83%)	19 (48.71%)	< 0.001
Diabetes mellitus	11 (29.72%)	14 (38.46%)	0.006
Dyslipidaemia	9 (24.32%)	12 (30.76%)	0.005
Family history of CAD	10 (27.02%)	39 (23.07%)	< 0.001
Previous CA	5 (13.51%)	7 (17.94%)	< 0.001
First Angina until presentation	(96 ± 152 h)	(20 ± 32 h)	< 0.001
History of Ischaemia			
NO	25 (67.56%)	13 (35.33%)	< 0.001
STEMI	8 (21.62%)	7 (17.94%)	
UA/NSTEMI	4 (10.81%)	18 (46.15%)	
Number of rest angina in last 24 h	5 ± 2	3 ± 2	< 0.001
Heart Rate (bpm)			
< 60	3 (8.10%)	5 (12.82%)	NS
60 - 100	28 (75.67%)	31 (79.48%)	
> 100	6 (16.21%)	3 (7.69%)	
Systolic Blood Pressure (mmHg)			
< 120	11 (29.72%)	8 (20.51%)	NS
120 - 139	12 (32.43%)	14 (35.89%)	
≥ 140	14 (37.83%)	15 (38.46%)	
Serum creatinine > 120 mmol/L	8 (21.62%)	10 (25.64%)	NS
Cardiogenic shock on admission	6 (16.21%)	3 (7.69%)	< 0.001
ST-segment deviation on admission	37 (100%)	25 (64.10%)	< 0.001
Table 1. Showing Differences between STEMI and UA/NSTEMI Groups regarding Socio-Demographic Variables and History of Ischaemia			

(CA, Coronary Angiography; CABG, Coronary Artery Bypass Grafting; CAD, Coronary Artery Disease; STEMI, ST-Elevation Myocardial Infarction; PAD, Peripheral Arterial Disease; UA/NSTEMI, Unstable Angina/Non-ST elevation Myocardial Infarction.)

Regarding heart rate, both groups had the highest percentage of patients in the heart rate group 60 - 100 bpm (75.67% and 79.48%, respectively). The major portion of the two groups had a systolic blood pressure of 140 mmHg, which was 37.83% in the STEMI group and 38.46% in the UA/NSTEMI group. The percentage of patients with elevated creatinine was almost equal in both groups being 25.64% in patients with UA/NSTEMI versus 21.62% in STEMI patients. Cardiogenic shock upon admission was significantly higher with STEMI (6 patients, 16.21%) compared with UA/NSTEMI (three patients, 7.69%). ST segment deviation was in 100% of STEMI and 64.10% of the UA/NSTEMI patients (Table 1).

There were 29.72% of patients (11) in the STEMI group, who had diabetes mellitus or hypertension and/or angina. On the other hand, a small percentage of patients had a systolic blood pressure < 100 mmHg (13.51%) and heart rate > 100 bpm (32.51%). Patients who suffered from anterior STEMI or left bundle branch block represented the minor component of the STEMI group (24.32%). In 75.67% of the patients, there was time for starting treatment more than 4 hours (Table 2).

Distribution of the clinical factors used in TIMI score calculation.

TIMI for STEMI (No = 37)	No (%)
Age in years	
< 65	26 (70.27%)
≥ 65 - < 74	5 (13.51%)
≥ 74	6 (7%)
Diabetes, hypertension or angina	11 (29.72%)
Systolic blood pressure (< 100 mmHg)	5 (13.51%)
Heart rate (> 100 b/min)	13 (32.51%)
Anterior ST elevation or LBBB	9 (24.32%)
Angina start Time to treatment (> 4 h)	28 (75.67%)
TIMI for UA/NSTEMI (NO = 39)	
Diagnosis (UA or NSTEMI)	
UA	29 (74.35%)
NSTEMI	11 (28.20%)
Age (≥ 65 years)	15 (33.33%)
> 3 Risk factors for CAD	33 (84.61%)
Aspirin use in the past 7 days	30 (76.92%)
> 1 episode rest Angina in < 24 h	29 (71.79%)
ST-segment deviation	32 (82.05%)
Table 2. Showing the Distribution of TIMI Score Factors among Patients with STEMI and UA/STEMI	

(CAD, Coronary Artery Disease; LBBB, Left Bundle Branch Block; NSTEMI, Non ST-Elevation Myocardial Infarction; STEMI, ST-Elevation Myocardial Infarction; TIMI, Thrombolysis In Myocardial Infarction; UA, Unstable Angina.) In the patients with UA/NSTEMI, approximately 74.35% were diagnosed with unstable angina, 33.33% with an age 65 years, 82.05% with an ST segment changes more than 3 risk factors in 84.61%. Most patients (71.79%) were found to have had severe anginal episodes. Aspirin was used in the last seven days by 70.3% of the patients and 80.6% were found to have > 3 risk factors of coronary artery disease (Table 2).

In-hospital MACE was significantly higher among the STEMI patients (51.35%) compared with the UA/NSTEMI (20.51%). There was a significantly higher mortality,

asystole, cardiogenic shock, serious arrhythmia, recurrent non-fatal MI with STEMI.

	STEMI (n = 37)	UA/NSTEMI (n = 39)	P value
MACE	19 (51.35%)	8 (20.51%)	0.001
In-hospital death	2 (5.40%)	0	< 0.001
Asystole	4 (10.81%)	1 (2.56%)	0.013
Cardiogenic shock	6 (16.21%)	2 (5.12%)	0.001
Serious arrhythmias	3 (8.10%)	2 (12.82%)	NA
Recurrent non-fatal MI	2 (5.40%)	0	0.01
Recurrent angina	2 (5.40%)	3 (7.69%)	0.31
Table 3. Showing Incidence of In-Hospital MACE among STEMI and UA/NSTEMI Groups Surviving the Admission Event			

(MACE, Major Acute Cardiac Events; NSTEMI, Non ST-Elevation Myocardial Infarction; STEMI, ST-Elevation Myocardial Infarction; UA, Unstable Angina).

The overall 30-day follow-up results of patients surviving the in-hospital course displayed a significantly higher incidence of mortality in the STEMI group (2/37 - 5.40%) compared with the UA/NSTEMI group (0/39, 0%; $p < 0.001$). Recurrent non-fatal MI was also significantly higher in the STEMI group (2/37, 2.70%) compared with the UA/NSTEMI group (0/39, 0%; $p < 0.01$).

DISCUSSION

Among the 76 patients admitted with ACS in the present study, 46.68% were for STEMI and 51.31% for NSTEMI. The distribution is not so similar to the GRACE registry data, which shows 32% STEMI and 27% for NSTEMI.¹³ The French registry of ACS (ONACI) shows 31% STEMI and 29% NSTEMI.¹⁴ Male patients constituted more than half of the present studied sample (78%). This was similar to most of the recent studies supporting that male gender increases the risk of developing ACS.^{9,10,13,14} The mean age of patients in the present study was approximately 55 ± 3.76 and 57 ± 4.12 in STEMI and UA/STEMI groups respectively, while when compared with the Western data the mean age was approximately 66 years.^{9,10,13,14} However, there were no baseline clinical features including incidence of diabetes mellitus, hypertension, dyslipidaemia, angina, systolic blood pressure and aspirin use in the previous week and initial serum creatinine between the sample of our study and those found in other recent studies.^{9,10,13,14} ST-segment deviation at presentation was reported in 82.05% of UA/NSTEMI patients. The reported rates of ST deviation at presentation varied much in the different reports being 55.9%¹¹ 45% - 47%,¹⁵ 32% - 43%,¹² 33.7%¹⁶ and 26%¹⁰; 75.67% of the STEMI patients reached the hospital after more than 4 h from the pain onset in the present study. The Cardiogenic shock admission was reported to be 1.2%⁹ to 1.5%¹⁶ in all ACS patients compared with our study (16.21% in STEMI and 5.12% in UA/NSTEMI). This difference may also be due to delayed arrival at the Hospital. In the present study, STEMI was associated with a higher incidence of in-hospital MACE, in-hospital mortality, recurrent non-fatal MI, cardiogenic shock and serious arrhythmia compared with UA/NSTEMI patients. At the 30-day follow-up, the STEMI group still had a higher incidence of all-cause mortality and recurrent non-fatal MI. These findings are consistent with those of the

GRACE study¹⁷ and ONACI registry, which reported higher in-hospital complications and higher mortality in the first 24 h in STEMI patients.¹⁶ The present study showed 5.40% mortality in-hospital mortality among STEMI patients and no in-hospital mortality in UA/NSTEMI patients. A similar study across Europe in 2000 reported an in-hospital mortality of 5.9% among patients with acute MI, 4.3% in patients with MI evolving from UA and 1.6% in patients with UA¹⁸ Morrow et al⁴ found an in-hospital mortality of 12.6% in STEMI patients. Bradshaw et al¹² found that the crude in-hospital mortality among the whole ACS spectrum was 11.0% overall, being 8.9%, 11.1% and 11.5% at small, community and teaching hospitals respectively. In this study, it was found that patients with STEMI had a higher all-cause mortality rate (5.40%) and recurrent non-fatal MI (51.35%) at 30 days compared with UA/NSTEMI patients (0% and 20.51%, respectively). In a large validation study by Morrow et al,⁴ TIMI score recruiting 84,029 patients with STEMI reported a 30-day mortality of 5.7%. In another small single-centre retrospective study of 460 consecutive patients reported a 30-day all-cause mortality rate of 2.8% and a recurrent non-fatal MI rate of 5.2%.¹¹ STEMI was associated with a higher risk of short-term mortality compared with UA and NSTEMI in the ONACI registry.¹⁴ Sangu et al reported that STEMI was an independent predictor of re-hospitalisation within 30 days after an ACS.¹⁵ In addition, data from the United Kingdom indicated that the presence of MI was associated with a higher 30-day mortality rate being 4.5%, 10.4% and 12.9% in the UA, NSTEMI and STEMI groups, respectively.¹⁹ Originally, the GRACE risk score was designed to predict all-cause mortality and the TIMI risk score was designed to predict the composite endpoint of death and myocardial re-infarction. In the present study, both scores were valid in the patients and successfully predicted in-hospital MACE, 30-day all-cause mortality and 30-day recurrent non-fatal MI with a good discriminative ability in both STEMI and UA/NSTEMI patients.

CONCLUSION

The age of occurrence of ACS was relatively younger in this part of Kerala, who share common known risk factors of Coronary Artery Disease. Patients grouped in STEMI represented approximately half of ACS patients and are associated with worse in-hospital as well as 30-day outcomes. Both TIMI and GRACE risk scores are valid for use for ACS patients in this Hospital with a better discriminative ability for the GRACE score, especially in UA/STEMI patients.

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