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Original Article

A PROSPECTIVE OBSERVATIONAL STUDY ON RISK ASSESSMENT OF STEMI PATIENTS AT A TERTIARY CARE HOSPITAL

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ABSTRACT

Objectives: To estimate risk of mortality and morbidity of STEMI patients at admission and discharge time. One objective includes comparing the lipid profile in STEMI patients and healthy subjects to establish the relation between the risk factor.

Methods: A prospective observational study was conducted from January 2013 to September 2013. We included 80 patients in the study group and 50 healthy subjects in the control group to assess the risk in STEMI patients using the dynamic TIMI risk score. Serum lipid levels were measured in these patients by (CC3300) cholesterol analyzer.

Results: The study group consists of 80 patients and 50 controls. Our results show the significant correlation of hospital events with a dynamic TIMI risk score. In addition to that we observed that highly significant HDL,LDL levels at p-value <0.0001 and Triglycerides were less significant with p-value <0.038. Dynamic TIMI risk score estimate 1-year mortality at discharge time.

Conclusion: The Dynamic TIMI risk score applied to STEMI patients, identifies a group of patients at high risk and this should be a continuous process, as over the time patients condition can change.

Keywords: Timi, Dtimi, Risk Assessment, Stratification, Non-Stmi, Stmi, Risk Factors.

INTRODUCTION

Myocardial infarction (acute MI) refers to the death of heart muscle (cardiac myonecrosis) due to inadequate blood flow (perfusion) from the coronary arteries. Impaired perfusion to the myocardium results in a critical reduction of nutrient supply (primarily oxygen) to the myocardium, a condition known as ischemia [1]. Some major epidemiological survey performed in Indian population best three incidence studies used different diagnostic criteria; however, the incidence of myocardial infarction (MI) in urban India in the 14 years to 1991 remained similar at about 6/1000 in males and 2/1000 in females. Prevalence range was higher in urban than rural areas in men (35–90/1000 *v* 17–45/1000) and women (28–93/1000 *v* 13–43/1000)[2] There was no clear rise in age specific rates in men over a 27 year period, whereas a rise was seen in women. In conclusion, using a relatively objective measure of CHD (Cardiovascular heart disease) it was found that CHD is more common in urban than rural areas of India, but there was little evidence of a rise in CHD over time, especially in men.

The assessment of risk and population who are at risk can be calculated by scoring the patients using the risk factors present in them. One such scoring system in clinical practice has been TIMI (Thrombolysis In Myocardial Infarction) RISK SCORE [4], the GRACE (The Global Registry of Acute Coronary Events) risk score [5,6] and to a lesser extent, the PURSUIT risk score [7]

Effective risk stratification is integral to management of Acute Coronary Syndromes (ACS). Even among patients with STEMI, for whom initial therapeutic options are well defined, patient risk characteristics impact short and long term medical decision making. Considerable variability in short term mortality risks existing among the patients with STEMI who receive the fibrinolytic therapy. [8,9]

Timi risk score

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. For each patient, the score is calculated as the arithmetic sum of points for each risk feature present (range, 0-14) the risk score was derived based on mortality through 30 days after the presentation but showed stable prognostic performance cross multiple time points, including time to discharge. It is a robust clinical for mortality risk prediction in fibrinolysis- eligible patients with STEMI.

Table 1: Timi risk score assessment

High risk features	Points
AGE ≥75 Yr	3
Diabetes, hypertension or	2
Angina	1
Systolic BP <100 mm Hg	3
Heart rate >100/min	2
Killip class II-IV	2
Weight <65kg	1
Anterior wall MI or LBBB	1
Time to therapy >4 hrs	1

Table 2: Risk categorization based on the baseline timi risks score from 0-14 possible points [24].

Risk	Points
Low	0 to 4
Moderate risk	5 to 8
High risk	9 to 14

The 'Thrombolysis In Myocardial Infarction', or TIMI Study Group is an Academic Research Organization (ARO) affiliated with Brigham and Women's Hospital and Harvard Medical School. The group has its headquarters in Boston, Massachusetts, and a satellite location in Quincy.

The TIMI Study Group was founded by Eugene Braunwald, MD in 1984. Among the group's most important contributions to medicine is the TIMI Risk Score, which assesses the risk of death and ischemic

events in patients experiencing angina or a non-ST elevation myocardial infarction.

TIMI indicates thrombolysis in myocardial infarction, STEMI, ST-elevation myocardial infarction; DM, diabetes mellitus; HTN, hypertension; STE (ST-elevation), LBBB, (left bundle branch block); time to treatment; recurrent MI, recurrent myocardial infarction; CHF (Congestive heart failure).

The TIMI risk score has been validated in populations with ACS from randomized trials and observational studies for the prediction of in-hospital death or the composite outcome of death or MI at 28 days [10].

Dynamic timi

The dynamic TIMI risk score is a process of estimating the long term risk of morbidity and mortality after STEMI is based on two level assessments.

Table 3: Risk scoring by dynamic timi assessment

Variable risk factor		**0 To 14 Possible points**
Baseline timi risk score for stemi		
AGE in yrs	65 - 74	2
	≥75	3
DM/HTN/Angina		1
Systolic blood pressure <100 MM HG		3
Heart rate >100		2
Killip class II TO IV		2
Weight <67 KG		1
Anterior ste or lbbb		1
Time to treat >4 hours		1
Added index hospital events for dynamic score		
recurrent mi		1
stroke		5
major bleed		1
CHF/shock		3
arrhythmia		2
renal failure		3
dynamic timi risk score		**0 to 29 possible points***

1. At hospital admission, patients can be stratified by demographics, physical examination, presenting science, as well as initial laboratory and angiographic data.

2. The second level of assessment involves identification of long-term risk based on the development of post event complications like, recurrent MI, Stroke, Major bleeds, CHF (congestive heart failure) /shock, Arrhythmia, Renal failure shown in "Table 3".

Whereas the baseline TIMI risk score for STEMI has 0-14 possible point, the dynamic TIMI risk score has 0-29 possible points, with 0-15 points assigned based on in-hospital events. This clinical risk score, derived from a multi variable analysis, can be calculated at the bedside and is dynamic updating of the TIMI risk score for STEMI at the time of discharge.

Killip classification

The Killip classification is a system used in individuals with an acute myocardial infarction (heart attack), in order to risk stratify them. Individuals with a low Killip class are less likely to die within the first 30 days after their myocardial infarction than individuals with a high Killip class.

Patients were ranked by Killip class in the following way:

- Killip class I includes individuals with no clinical signs of heart failure.
- Killip class II includes individuals with crackles in the lungs, an S_3, and elevated jugular venous pressure.
- Killip class III describes individuals with frank acute pulmonary edema.
- Killip class IV describes individuals in cardiogenic shock or hypotension (measured as systolic blood pressure lower than 90 mmHg), and evidence of peripheral vasoconstriction (oliguria, cyanosis or sweating).

Majorly in hospitals the risk stratification is done using TIMI but not by DTIMI so this research will lead to a finding that will stratify the patients further belonging to high risk and whose care should be prime because of the coronary events happening.

Aim and objective

Risk assessment is important for the fine calculation of the prognosis of individual patients, which is an important issue not only for communicating with the patients and the relatives but also for the therapeutic decision making. Considerable variability exists among the patients with STEMI so, effective risk stratification in management of acute coronary syndrome is needed. Although there are multiple methods of risk stratification for STEMI, this study presents a prospectively validated method for reclassification of patients based on in-hospital events i. e. Dynamic STEMI risk score. A dynamic risk score provides an initial risk stratification and reassessment at discharge [3]. Patient risk characteristics impact short and long-term medical decision making.

The aim of the study was to assess the risk of STEMI patients using dynamic TIMI risk score in a tertiary care hospital. The two objectives of the study mainly would be

1. To assess one year mortality and morbidity risk after STEMI, based on two level assessment

i) At hospital admission using the TIMI risk score.

ii) At the time of discharge based on post event complications using the DYNAMIC TIMI risk score.

2. To compare the lipid profile in STEMI patients and healthy volunteers to prove that lipid profile can be a very important risk factor for detecting the prevalence of cerebrovascular accident (CVA) patients.

MATERIALS AND METHODS

Study location

The study was conducted at the MAHATMA GANDHI MEMORIAL HOSPITAL a tertiary care 1200 bed hospital in Warangal which is assumed to be the biggest hospital in the northern Telangana region of Andhra Pradesh State. Around 1100 patients per day are being treated for various diseases/disorders in various disciplines.

Study period

The study was carried out from JANUARY 2013 to SEPTEMBER 2013. The observational study was designed to collect the patient data prospectively from the records of STEMI patients.

Methods

After getting ethics committee approval from human ethics committee Kakatiya Medical college, Warangal. Data and sample collection was started in which a data collection form was exclusively designed for the purpose. The patient records were analyzed for the following factors: Age, Sex, current diagnosis, lipid profile, risk factors, and laboratory investigations.

Source of data

Patient interview was conducted and socio-demographic data were collected and information regarding therapy and condition was collected from case sheets of patients and lab reports.

Inclusion criteria

STEMI patients were enrolled within 12 hours after the onset of symptoms.

Exclusion criteria

Patients were excluded if they had any one of the below

- Increased risk of bleeding
- Anemia
- Thrombocytopenia
- History of intracranial pathology

Analysis of the data

All the data were assembled into MS-Access 2010 database and Charts were drawn using Microsoft excel 2010.

Statistical analysis

SPSS v20.0 was used to analyze the data, using P≤ 0.05 as the level of significance

RESULTS

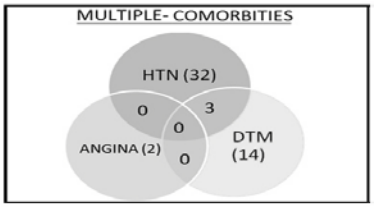

Fig. 1: Distribution of Co-morbidities in subjects of all 80 patients 32(40%) of patients were found to be Hypertensive 14(17.5%) were Diabetic and multiple risk factors were found in 3 patients with hypertension and diabetes.

Table 4: Gender ratio among the patients

S. No.	Gender	Count (80)	Mean age
1	Male	65(81%)	52.75±11.83
2	Female	15 (19%)	57.12±12.77

In the present study most of the STEMI patients were males 65 (81%) compared to females were 15 (19%). The mean age of study subjects was 53 ± 12 years. The mean age of male subjects was52.7±11.8 and female subjects was found to be 57±12.77.

Table 5: Social habits of sample population

Social habits		Count (%)
Alcohol	Current	38 (47.5)
	None	37 (46.25)
	Past	05 (6.25)
Smoking	Current	24 (30)
	None	43 (53.75)
	Past	13 (16.25)
Alcoholic+ Smoking	Current	22 (34.37)

Out of the total study population, 38 (47.5%) were current alcoholic and 5 (6.25%) of patients had a history of in the past. Meanwhile 24 (30%) were current smokers and 13(16.25%) used to smoke in past.22 (34.37%) patients were found to be current alcohol and smoking.

Table 6: Occupation distribution

Occupation	Count of occupation (%)
Agriculture	32(40)
Buisiness	16(20)
Employee	16(20)
Housewife	16(20)
Grand Total	**80**

40% of the STEMI patients belonged to agriculture occupation and 20% each belonged to business sector, employee and housewife.

Table 7:Baseline characteristics of patients

Risk factor		Count (%)
Age (years)	**≥75**	01(1.25)
	65-74	24(30)
Weight <67		68 (85)
HTN		32 (40)
DTM		14 (17.5)
Angina		02 (2.5)
HTN+DTM		03(3.75)
DTM+Angina		00
HTN+DTM+Angina		00
SBP< 100 mmHg		13(16.25)
HR >100 bpm		9(11.25)
KILLIPS CLASS	KILLIP II	35 (43.75)
	KILLIPS III	3 (3.75)
	KILLIPS IV	9 (11.25)
TYPE OF AMI	AWMI/ LBBB	31 (38.75)
	IWMI	49 (61.25)
Time to treat >4 Hrs		36(45)

(AWMI: anterior wall myocardial infarction HTN: hypertension, DTM: Diabetes militias, SBP: systolic blood pressure, HR: heart rate) of the total patients 1 (1.25%) worse with age 75 years and 24 (30%) belonged to 65-74 age group. 68 (85%) Patients has weight of < 67kg. With respect to cardiac function 35 (43.75 %) of the patients come under KILLIP CALSS II, 3 (3.75%) of patients came under KILLIP CLASSIII and 9 (11.25%) of patients came under KILLIP CALSS IV.

Among all patients 13(16.25%) were with systolic blood pressure <100 mm Hg and with HR >100 BPM(beats per minute) were 9(11.25%). The location of the infraction pointed to a more frequent involvement of the IWMI in 49 (61.25%), AWMI in 31 (38.75%) and there was the bundle block seen in 3 patients. It took more than 4 hrs time to treat the patient in 36(45%) patients.

Table 8: Vitals at admission and discharge

Variable	Admission	Discharge	P value
Heart Rate	90.19±2.409	75.88±0.7436	<0.0001***
Systolic Blood Pressure (mm Hg)	128.6±3.9	114.4±1.35	<0.0001***
Diastolic Blood Pressure (mm Hg)	81±2.157	72.25±0.524	<0.0001***

Heart rate, systolic and diastolic Blood Pressure was found highly significant when compared at admission and discharge time with a P=0.0001.

Table 9: Timi risk score of subjects

Timi risk	Count (%)
0-4 = Low	50(62)
5-8 = Moderate	22(29)
9-14=High	08(9)

The distribution of patients, according to TIMI risk score were as follows: 50 (62%) were at low risk, 22 (28%) were at moderate risk and 8 (10%) were found to be at high risk.

Table 10: Dynamic timi risk of subjects

Dynamic timi risk	Count (%)
< 5 %=Low	39 (48.75)
5-15% =Moderate	25(31.25)
> 15 %=High	16 (20)

Dynamic TIMI risk score assessment according to which 39 (48.75%) were included in the low-risk group, 25 (31.25%) in the moderate risk group, and 16 (20%) in high risk groups.

Table 11: Hospital events occured during the treatment period

Hospital events	Count (%)
Reccurent mi	10 (32.25)
CHF/Shock	01 (0.03)
Arrythmia	13 (41.93)
Major bleed	07 (22.5%)
Stroke	00
Renal failure	00

By applying chi-square test the frequency of post–MI (STEMI) arrhythmias, were significantly correlated with Dynamic TIMI risk groups (P=0.0003), likewise the frequency of recurrent-MI significantly correlated with Dynamic TIMI risk groups (P=0.01). The frequency of post-MI major bleed significantly correlated with Dynamic TIMI risk groups(P=0.0118). But, there was no significant correlation found between the Dynamic risk group and CHF/shock (P=0.057).

Table 12: Gender wise lipid profile of study subjects vs controls (TC: Total, Cholesterol, LDL: Low Density Lipoprotein, HDL: High Density Lipoprotein, VLDL: Very Low Density Lipoprotein, TG: Try Glycerides)

Gender	Case male	Control male	Case female	Control female
TC	182.3±38.3	175.6±7.03	189.5±48.7	174.4±6.72
LDL	161.5±30.29	126.6±13.65	165.1±27.8	126.6±11.76
HDL	35.3±8.06	64.76±6.4	43.8±11.52	63.29±9.514
VLDL	31.8±6.84	34.66±6.69	34.20±8.82	28.80±34.34
TG	186.8±74.82	167.62±7.17	196.6±126	166.34±I71

Table 13: Lipid profile comparison of study subjects and controls

Variable	Controls (n=50)	Cases (n=80)	P value
Age (yrs)	48.35 ± 0.81	53.5±1.34	<0.005
Total Cholesterol(mg/dl)	174.7 ± 0.90	183.3 ± 4.52	<0.140
TG(mg/dl)	167.7±0.90	192±9.30	<0.038*
HDL(mg/dl)	64.02±1.106	37.16±1.04	<0.0001***
LDL(mg/dl)	127.1±1.86	162±3.3	<0.0001***
VLDL(mg/dl)	32.25 ± 0.81	33.74 ± 0.75	<0.2129
TC/HDL(mg/dl)	2.774 ± 0.05432	5.271 ± 0.2162	<0.0001***
LDL/HDL(mg/dl)	2.014 ± 0.05532	4.659 ± 0.1681	<0.0001***

Preprandial lipid profiles of case and control subjects showed highly significant HDL and LDL levels at P<0.0001 and triglycerides were low significant at P<0.038, whereas total cholesterol, and VLDL were not significant. There was a significant increase found in total TC/HDL ratio and LDL/HDL ratio at P<0.0001.

DISCUSSION

A total of 80 STEMI patients were included in our study of who prominent were males 81.25% than females 18.75% and the mean age was 53.5±1.34.

The age of the STEMI patients carries a risk score according to which we categorized it in two groups as ≥75 1.25% and 65-74 were 30%. As weight was also a risk factor carrying a 1 point in TIMI <67 kg were 68 (85%).

When their social habits were assessed, it was found that 47.5% are current alcoholics and 30% are current smokers. Both smoking and alcohol category patients are 34.3%. Their risk was higher when assessed using TIMI and Dynamic TIMI [11].

40% of the patients belonged to agriculture occupation followed by employee and business category. In this study an independent variable hypertensive patients are more than double 40% than diabetic patients 17.5%, and 3.75% had both diabetes and hypertension. 2.5% of the patients had angina in the study population as in contrast to [12].

A systolic blood pressure of less than 100 mm Hg on admission was present in 16.25% and heart rate of greater than 100 bpm on admission was present in 11.25%.

The current study evaluated the incidence of on admission Killip classification in patients presenting with STEMI was in contrast to [13]. Distribution of patients with Killip class II-IV was found to be 58.75%.

According to the study of "Romanian Journal of cardiology, 2011" STEMI was associated more frequently than NSTEMI with Killip class.

Early diagnosis is the key to early treatment of STEMI. Diagnosis of STEMI patients is based on any of the following.

1. Electrocardiography (ECG)changes or new LBBB.

2. Raised biomarkers, in contrast to [14].

Refuting the literature [15] in this study the most affected wall in AMI was the inferior wall, instead of the anterior wall. However, in the group classified as high risk, the anterior wall affected in 25.9% of the cases.

Time To Treat

A key system indicator for delivery of reperfusion therapy is "time to treatment". This includes:

- Time from symptom onset to first medical contact
- Time from first medical contact to fibrinolysis
- Time from first medical contact to primary percutaneous coronary intervention (PCI)
- Time from arrival at PCI referring centre to primary PCI.

Table 14: **Timi risk scoring system**

Risk score	mortality AT 30 Days (%)
0	0.8
1	1.6
2	2.2
3	4.4
4	7.3
5	12.4
6	16.1
7	23.4
8	26.8
>8	35.9

The above mentioned guideline recommendations are according to "A System of Care for STEMI" by the National Heart Foundation of Australia [16].

Only 55% of the patients were treated within the 4 hours of onset chest pain [17].

Regarding the hemodynamic status-pulse, systolic BP and Diastolic BP during admission and at discharge varied markedly [18].

An independent risk factor, Heart Rate at admission and discharge time was statistically significant (p<0.0001).

[19] Illustrated that TIMI risk score for STEMI is a clinical stratification calculated with data obtained at hospital presentation that can easily classify patients into low, moderate and high risk. It was developed using data from patients treated with thrombolytic therapy and predicts mortality at 30 days.

The TIMI risk score is used for risk assessment of patients into one of three groups: low score (0 to 4; 62% risk); moderate (5 to 8; 29% risk); and high (9 to 14; 9% risk).

Dynamic models are applicable not only to fibrinolytic-treated STEMI patients, but also to those undergoing primary PCI.

The dynamic TIMI risk score for STEMI is a prospectively validated to allow a continuous assessment of risk. The dynamic TIMI risk score is fully compatible with the original, allowing a risk assessment on both admission and discharge. The dynamic risk stratification described here provides the benefit of a highly accurate estimation of 1-year mortality, which can easily be calculated by either physicians or physician extenders [20].

Table 15: **Dynamic timi risk scoring for stemi**

Risk score	Mortality for 1 year (%)
0/1	1.3
2	2.3
3	3.6
4	5.5
5	7.8
6/7	13.5
≥8	24.8

According to the dynamic TIMI risk score the patients are distributed into three groups 39 (48.75%) in LOW RISK, 25 (31.25%) in MODERATE RISK, 16 (20%) HIGH RISK.

There was a difference observed in the stratification of patients when TIMI AND DYNAMIC TIMI was assessed. Among the low risk group, according to TIMI risk score, 3 were found to be at moderate risk and 8 at high risk when assessed using DTIMI scoring.

In-hospital events in patients were seen in this proportion i. e., RECURRENT MI 10 (32.25%), CHF/SHOCK1 (0.03%), ARRYTHMIA13 (41.93%), MAJOR BLEED7 (22.5%), STROKE 0, RENAL FAILURE 0.

The pre Prandial lipid profile was estimated in patients and control subjects and compared, in which LDL, TC/HDL, LDL/HDL increased in case subjects with highly significant at P<0.001, there was a significant decrease in levels of HDL at <0.0001 whereas low significant increase in the TG level at <0.038. But TC and VLDL levels were not significant at P<0.05 and p<0.2 respectively.

CONCLUSION

The Dynamic TIMI risk score applied to STEMI patients identifies a group of patients at high risk and this should be a continuous process, as over the time patient's condition can change.

In our study where the patients were stratified using both TIMI and Dynamic TIMI, of which some were found to be in a higher risk group when assessed by Dynamic TIMI but in TIMI scoring they were in a lesser risk group.

Our study suggests that

1. High risk group patients needed interventions, in patient care such as more frequent monitoring of vitals.

2. A physician should be informed about the high risk situation for better patient care.

3. Counseling the patient regarding medication and lifestyle modification at discharge and during a regular health checkup.

4. Conducting a Home Medication Review will improve medication adherence and henceforth minimize the risk of the patient.

This risk assessment tool is likely to be clinically useful in the management of patients eligible for fibrinolytic therapy and may also serve as a valuable aid in clinical research.

Limitations and future scope

1. Despite the statistically significant results in the study, larger cohorts are required in local settings to assess the applicability of TIMI score

2. Important early prognostic indicators, such as cardiac biomarkers and ST-segment resolution, were not included in this analysis. Variations in appropriate use of aspirin B blockers, ACE inhibitors, lipid lowering agents could lead to substantial differences in mortality rate.

3. The absolute mortality predictions in this model may underestimate the mortality rates seen in practice.

4. The interaction of the Dynamic TIMI risk score with these prognostic measures may be an area of interests for future investigations.

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CONFLICT OF INTERESTS

Declared None

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