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Correlation of TIMI Score and Killip Class with MACE In Non ST Elevation Myocardial Infarction

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A B S T R A C T

OBJECTIVES: Non-ST-elevation myocardial infarction (NSTEMI) constitutes a significant proportion of acute coronary syndromes (ACS) and is a leading cause of morbidity and mortality worldwide. TIMI score and Killip class are easily obtained clinical parameters to predict MACE . The objective of this study is to assess the correlation of TIMI score and Killip class with MACE in Non ST elevation myocardial infarction

METHODS : The study included 154 patients who presented to the Department of Cardiology, NEIGRIHMS, Shillong with NSTEMI . Non-STEMI myocardial infarction is characterized by abnormal cTnI ≥ 0.04 ng/ml. A 12-lead ECG was performed at admission in all cases and then at 6, 12, 18, 24 and 48 h post-admission. Blood samples were obtained after ≥ 6 hours since the beginning of the last episode of chest pain to assess cTnT .TIMI score and Killip class was calculated on admission . Major clinical events (MCE) observed up to 30 days post-discharge and considered as composite endpoint are: cardiac death, non-fatal myocardial and recurrent angina which led to cine coronary angiography, and according to the results, the ensuing urgent revascularization treatment within 30 days of admission. Patients were divided into two groups according to the presence (group A) or absence (group B) of MACE . A ROC curve was generated to relate the TIMI score and Killip class with major cardiovascular events Sensitivity, specificity and positive predictive value was estimated for TIMI score and Killip classification for presence or absence of major cardiovascular events.

RESULTS: The mean TIMI score in patients with MACE was 3.76±0.75 and was significantly higher in patients without MACE 2.24±0.84 (p≤0.001).
In 33 of the 38 patients with MACE the TIMI SCORE was more than 2 while 51 of the 116 patients without MACE had TIMI SCORE>2. The number of patients with TIMI SCORE>2 had significantly higher rate of MACE . (p≤0.001).
28 OF THE 38 patients with MACE had KILLIP CLASS > 1 ; while 15 of 116 patients without MACE had KILLIP CLASS > 1. The number of patients with KILLIP CLASS > 1had significantly higher rate of MACE . (p=0.004).

CONCLUSION: There is a significant correlation between TIMI score and Killip Class in prognosis of patients with Non ST elevation Myocardial Infarction . TIMI score and Killip class are easily available tools to predict MACE

Keywords: TIMI Score . Killip Class , MACE . NSTEMI

INTRODUCTION:

Non-ST-elevation myocardial infarction (NSTEMI) constitutes a significant proportion of acute coronary syndromes (ACS) and is a leading cause of morbidity and mortality worldwide. Despite advancements in diagnosis and management, NSTEMI patients continue to face a substantial risk of adverse cardiovascular events, including major adverse

cardiovascular events (MACE) such as recurrent myocardial infarction, rehospitalization for heart failure, and cardiovascular death. Accurate risk stratification is paramount in NSTEMI to guide early invasive strategies, optimize medical therapy, and ultimately improve patient outcomes.

Among the various risk stratification tools available, the Thrombolysis in Myocardial Infarction (TIMI) risk score has been widely adopted due to its simplicity and effectiveness in predicting short-term mortality and ischemic events in patients with ACS. The TIMI score incorporates readily available clinical parameters, providing a rapid assessment of risk at presentation. Concurrently, the Killip classification, a clinical grading system based on physical signs of heart failure, has long been recognized as a powerful predictor of mortality in patients with acute myocardial infarction, reflecting the severity of myocardial damage and hemodynamic compromise.

While both the TIMI score and Killip classification independently provide valuable prognostic information in NSTEMI, the extent and nature of their combined predictive utility, particularly concerning MACE, warrant further investigation. This study aims to explore the correlation between the TIMI risk score and Killip classification at presentation in NSTEMI patients and to assess their combined predictive value for major adverse cardiovascular events (MACE) during hospitalization and follow-up. The findings of this research are expected to enhance current risk stratification strategies, facilitate more precise patient management, and ultimately contribute to improved clinical outcomes in NSTEMI.
This study will look for a bedside marker for early diagnosis and prognosis.

RESEARCH METHODS

Aims and objectives:
The purpose of this study is to assess the correlation of TIMI score and Killip class with MACE in Non ST elevation myocardial infarction.

METHOLOGY: An hospital based prospective observational study was carried out in the Department of Cardiology, NEIGRIHMS, Shillong in the period between March 2018 to February 2019 .The project was approved by the Institutional scientific advisory committee as well as the Institutional Ethics committee. Consecutive recruiting was carried out after the research was duly explained and Informed consent duly signed.

Study Participants:

154 patients who presented to the Department of Cardiology, NEIGRIHMS, Shillong with NSTEMI were considered. All patients satisfying the inclusion and exclusion criteria and having given an informed consent to participate in the study were selected for the study.

Inclusion criteria:

1. Aged >18 years,
2. Admitted in hospital due to NSTE ACS, with or without acute ischemic ECG changes, classified as Braunwald´s subclass II-IIIB.

Exclusion criteria:

1. ST-segment-elevation AMI criteria.
2. Valve disease or severe cardiomyopathy.

Sampling Technique : Consecutive sampling was done ; all patients fulfilling the criteria was enrolled in the study consecutively.

Study procedure Patients with unstable angina (UA) and non-Q wave myocardial infarction were included in the study. Unstable angina is defined as typical angina chest pain without elevation of biochemical markers, and with or without ECG changes. Non-STEMI myocardial infarction is characterized by abnormal cTnI $\geq$ 0.04 ng/ml. A 12-lead ECG was performed at admission in all cases . Demographic variables at admission such as age, gender, height, weight, arterial pressure, history of myocardial infarction, hypertension, diabetes mellitus, smoking, hypercholesterolemia, family history of coronary disease, cerebrovascular disease, and previous coronary revascularization were noted. All patients were classified at admission according to the TIMI score for NSTE-ACS. Killip class was evaluated .
After basal characterization, all patients were followed-up for 30 days after discharge.

Study endpoints
Major clinical events (MCE) observed up to 30 days post-discharge and considered as composite endpoint are: cardiac death, non-fatal myocardial infarction (defined by increased biochemical markers of myocardial injury, characteristic dynamic and evolving electrocardiographic changes and typical prolonged chest pain) and recurrent angina which led to cine

coronary angiography, and according to the results, the ensuing urgent revascularization treatment within 30 days of admission. Patients were divided into two groups according to the presence (group A) or absence (group B) of MCE.

TIMI SCORE CLASSIFICATION (1,2)

The TIMI Risk Score for UA/NSTEMI

Characteristics	Points
Historical	
Age ≥65 yrs	1
≥3 Risk factors for CAD	1
Known CAD (stenosis ≥50%)	1
Aspirin use in past 7 days	1
Presentation	
Recent (≤24 h) severe angina	1
ST-segment deviation ≥0.5 mm	1
↑Cardiac markers	1
Risk Score = Total Points	(0–7)

CAD = coronary artery disease; NSTEMI = non–ST-segment elevation myocardial infarction; TIMI = Thrombolysis In Myocardial Infarction; UA = unstable angina.

KILLIP CLASS (3)

Killips classification was done in all the patients enrolled for the study

Killip Class	Characteristics	Patients (%)	Mortality (%)
I	No evidence for CHF	85	5
II	Rales, ↑ JVD, S_3	13	14
III	Pulmonary edema	1	32
IV	Cardiogenic shock	1	58

Statistical analysis:

Descriptive analysis was used to describe the socio - demographic characteristics of the study subjects. Continuous variables were expressed as mean standard deviation and percentages were used for categorical behaviours.

Statistical significance was defined as a p value less than 0.05. Data entry and analysis was done on SSPS version 22.0

A ROC curve was generated to relate the TIMI score with major cardiovascular events Sensitivity, specificity and positive predictive value was estimated for TIMI score and Killip class for presence or absence of major cardiovascular events.

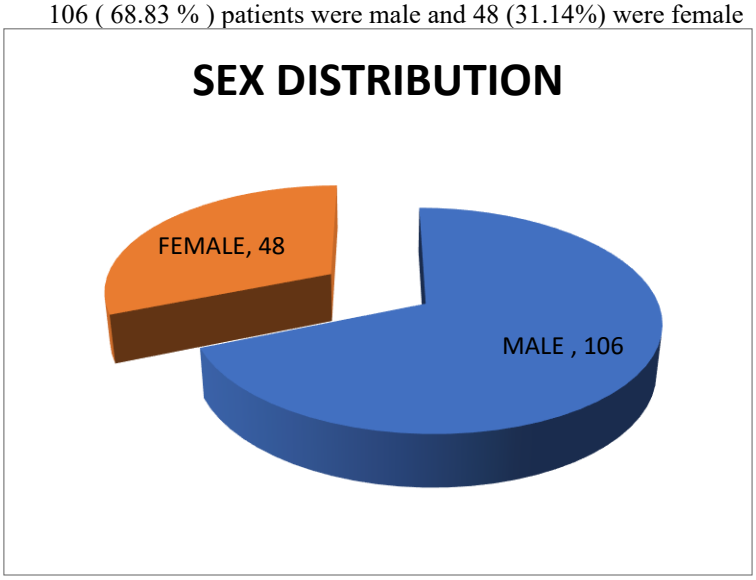
RESULTS

A total number of 154 patients presenting with NSTEMI and admitted in the Department of Cardiology , NEIGRIHMS during the 1 year study period were evaluated in this study.

Age and Sex Distribution of cases:-

The mean age of the patients enrolled in the study was 53.90 ±8.24 yrs. Most of the patients were in 5th , 6th and 7th decade of life.

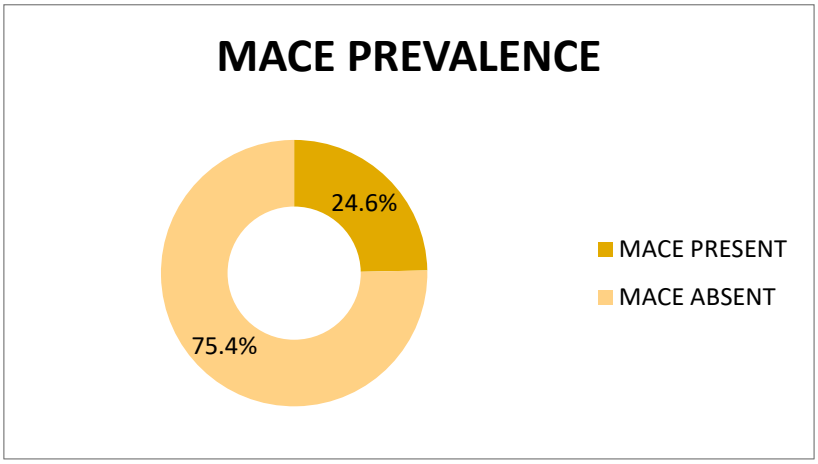
106 (68.83 %) patients were male and 48 (31.14%) were female



ENDPOINT

30-day MACE occurred in 38/154 patients (24.6%). Out of these patients, 4/154 (4.6%) patients died within 30 days ; 12/154 (7.79 %) patients had suffered recurrent non fatal MI within 30 days; 22/154 (14.2%) patients suffered Unstable Angina requiring repeat revascularization within 30 days.

Rest of the patients did not suffer MACE.



CLINICAL CHARACTERISTICS OF STUDY POPULATION ACCORDING TO OCCURRENCE OF MACE

	MACE PRESENT	MACE ABSENT	P VALUE
No. of Patients	**38**	**116**	
Age (Mean)	**61.71 ± 9.31**	**51.34 ±6.02**	**P ≤ 0.01**
Male gender	**22**	**84**	**0.106**
SMOKING	**18**	**61**	**0.708**
DM	**20**	**38**	**0.0345**
HYPERTENSION	**24**	**60**	**0.261**
H/O CAD	**6**	**12**	**0.388**
DYSLIPIDEMIA	**25**	**65**	**0.345**

The mean age of the patients having MACE was 61.71 ± 9.31 yrs while patients without MACE had a mean age of 51.34 ±6.02 yrs. The patients with MACE had a significantly higher age when compared to patients without MACE.(P ≤ 0.01)

The patients with MACE had a significantly higher incidence of Diabetes Mellitus [20(52.6%) vs 38(32.75%)] (p =0.0345)

No significant association was found between patients with MACE and without MACE in respect to gender, hypertension, history of CAD and dyslipidemia.

ASSOCIATION OF CLINICAL AND ECG CHARACTERISTICS WITH MACE

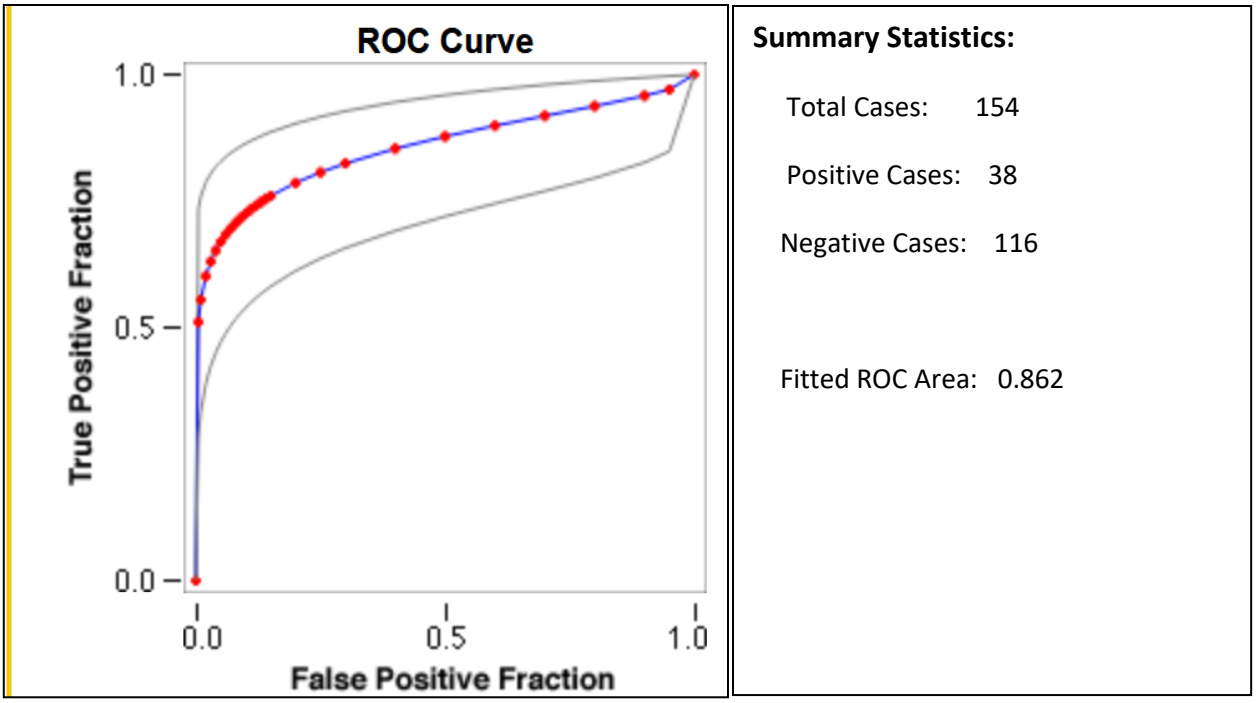
	MACE PRESENT	MACE ABSENT	P VALUE
HR (MEAN)	**93.71 ± 13.70**	**90.27 ± 10.50**	**0.107**
LVEF(MEAN)	**45.52 ± 6.41**	**48.04 ± 5.85**	**0.025**
SBP(MEAN)	**123.94 ± 14.19**	**125.7 ± 10.06**	**0.402**
QRS(MEAN)	**80.36 ± 10.52**	**79.71 ± 7.83**	**0.685**
ST DEV>0.5(N)	**20**	**59**	**1.055**
TIMI SCORE(MEAN)	**3.76±0.75**	**2.24±0.84**	**≤0.001**
TIMI SCORE>2(N)	**33**	**51**	**≤0.001**
KILLIP CLASS > 1, N	**28**	**15**	**0.004**
MULTIVESSEL CAD	**18**	**39**	**0.175**

TIMI SCORE AND MACE

The mean TIMI score in patients with MACE was 3.76±0.75 and was significantly higher in patients without MACE 2.24±0.84 (p≤0.001).

In 33 of the 38 patients with MACE the TIMI SCORE was more than 2 while 51 of the 116 patients without MACE had TIMI SCORE>2. The number of patients with TIMI SCORE>2 had significantly higher rate of MACE . (p≤0.001).

ROC curve analysis showed that the optimal TIMI score cut-off value for predicting MACE was 3 with Standard error = 0.056, 95% confidence interval= 0.682 to 0.851. QTc > 0.463 s. Sensitivity: 75.4%. Specificity: 65.8% (AUC = 0.862, 95% CI: 0.682 to 0.851)



KILLIP CLASS AND MACE

28 OF THE 38 patients with MACE had **KILLIP CLASS > 1 ; while 15 of 116 patients without MACE** had **KILLIP CLASS > 1.** The no patients with **KILLIP CLASS > 1**had significantly higher rate of MACE . (p=0.004).

HEART RATE AND SYSTOLIC BLOOD PRESSURE WITH MACE

The mean heart rate at admission in patients having MACE was 93.71 ± 13.70 while in patients without MACE was 90.27 ± 10.50. No statistical significance was noted. (p=0.107)

The mean systolic blood pressure at admission in patients having MACE 123.94 ± 14.19 while in patients without MACE was 125.7 ± 10.06. No statistical significance was noted. (p=0.402)

No significant association was found between patients with MACE and without MACE when mean QRS and mean LVEF were compared.

The number of patients with multivessel CAD was not significantly higher in patients having MACE than in without. (P = 0.175)

The number of patients with ST deviation more than 0.5mm in patients having MACE was not found to be significantly higher than those without MACE.

DISCUSSION

The clinical examination and 12 lead ECG are the first tools in evaluation of patient presenting with symptoms suggestive of ACS**.** Several studies have been published showing that higher TIMI score and Killip class as an independent risk marker in NSTE-ACS with or without acute ischemic changes, both at 30-day post- discharge or long-term follow–up. (4 ,5).
This study was done with an aim to assess the correlation between TIMI score and Killip Classification an MACE in patients with Non ST elevation Myocardial Infarction.

A total number of 154 patients presenting with NSTEMI and admitted in the Department of Cardiology , NEIGRIHMS during the 1 year study period were evaluated in this study.

The mean age of the patients enrolled in the study was 53.90 ±8.24 yrs. Most of the patients were in 5^{th} , 6^{th} and 7^{th} decade of life. 106 (68.83 %) patients were male and 48 (31.14%) were female

ENDPOINT

The endpoint of 30-day MACE occurred in 38/154 patients (24.6%). Out of these patients, 4/154 (4.6%) patients died within 30 days ; 12/154 (7.79 %) patients had suffered recurrent non fatal MI within 30 days; 22/154 (14.2%) patients suffered Unstable Angina requiring repeat revascularization within 30 days. Rest of the patients did not suffer MACE.

The patients with MACE had a significantly higher incidence of Diabetes Mellitus [20(52.6%) vs 38(32.75%)] (p =0.0345)

No significant association was found between patients with MACE and without MACE in respect to gender , hypertension, history of CAD and dyslipidemia.

TIMI SCORE AND MACE

The mean TIMI score in patients with MACE was 3.76±0.75 and was significantly higher in patients without MACE 2.24±0.84 (p≤0.001).
The no patients with TIMI SCORE>2 had significantly higher rate of MACE . (p≤0.001).
The no patients with **KILLIP CLASS > 1** had significantly higher rate of MACE . (p=0.004). 28 OF THE 38 patients with MACE had **KILLIP CLASS > 1 ; while 15 of 116 patients without MACE** had **KILLIP CLASS > 1.**

David Roth et al showed that the Killip classification is a useful tool for early risk stratification of acute MI patients. Applying the TIMI score to patients classified as Killip 1 further stratified them into low-, medium- and high-risk subgroups significantly improving stratification by the Killip classification alone. (5)

U N Khot et al concluded that Killip classification is a powerful independent predictor of all-cause mortality in patients with non–ST-elevation acute coronary syndromes. Age, Killip classification, heart rate, systolic blood pressure, and ST depression should receive particular attention in the initial assessment of these patients. (4)

M J Abaneh et al conducted a study to to examine the validity and predictability of thrombolysis in myocardial infarction (TIMI) risk and HEART scores in patients presenting to the emergency department (ED) with chest pain and conclude that both TIMI and HEART risk scores were able to predict an elevated risk of major cardiovascular adverse events (MACE). The overall impression was that the TIMI risk score tended to underestimate risk in the study population. (6)

CONCLUSION

The mean TIMI score in patients with MACE was 3.76±0.75 and was significantly higher in patients without MACE 2.24±0.84 (p≤0.001). The number of patients with TIMI SCORE>2 had significantly higher rate of MACE . (p≤0.001). The number of patients with KILLIP CLASS > 1had significantly higher rate of MACE . (p=0.004). There is a significant

correlation between TIMI score and Killip Class in prognosis of patients with Non ST elevation Myocardial Infarction . TIMI score and Killip class are easily available tools to predict MACE.

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