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To determine the prognostic accuracy of the HEART score as a predictor for major adverse cardiac events in patients presenting with chest pain to emergency department in a tertiary care hospital.

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ABSTRACT

INTRODUCTION: One of the main causes of sudden cardiac death in the emergency department is myocardial infarction. Although there are several scores that helped predict an identified acute coronary incident, there was no quantitative tool available to risk stratifying patients with chest pain to support more decisions. The study is aimed to determine the prognostic accuracy of the HEART score as a predictor for major adverse cardiac events in patients presenting with chest pain to the emergency medicine department (ED).

MATERIAL AND METHODS: Study included 83 adult patients presenting with Acute Myocardial Infarction who had chest pain attending to the ED were studied their HEART score to predict major adverse cardiac events.

RESULTS: 60.24% of males and 39.76% of females with mean age of 57.83 ± 12.85 years were presented to ED. 44.56% had hypertension, 46.99% of diabetes mellitus, 21.69% of smoking, 16.87% of alcoholism, 4.82% of obesity, and 3.61% of patients with family history of cardiac diseases. 28.92% had non-specific repolarization, and 33.73% of patients had significant ST-Depression. According to Heart score, 26.51% of patients had low risk, 39.76% of patients had moderate risk, and 33.73% of patients had high risk. More percentage of male patient's (67.9%) were in the high risk group of heart score than females (32.1%). ST-Depression cases were more in the high risk group (85.7%), and statistical significant association seen between ECG and the heart score (P<0.0001). among risk factors, Hypertension and Diabetes mellitus patients was more in the high risk groups with 48.6%, and 53.8% (P=0.001). 100% of high risk cases had ≥3 x normal limit of troponin, and there was a statistically association seen between troponin and heart score (P<0.0001). Diagnosis of HEART score of the low risk group showed that the risk factor had significantly higher AUC value (AUC = 0.801) than the age group (AUC = 0.778), history (AUC = 0.747), Troponin (AUC = 0.738), and ECG (AUC = 0.722). Out of 22 cases of the low risk group, 6 of Unstable angina (UA), 16 of NSTEMI, 4 of Percutaneous coronary intervention (PCI), 2 CABG, and 1 cardiovascular (CV) death. For moderate risk group (n=33), 13 of UA, 17 of NSTEMI, 3 of STEMI, 20 of PCI, 14 of CABG, and 12 of CV deaths. For high risk group (n=28), 10 UA, 14 of NSTEMI, 3 of STEMI, 9 of PCI, 6 of CABG, and 4 number of CV death.

CONCLUSIONS: It was concluded that the HEART score should be used as the primary clinical decision tool for the risk stratification and a good predictor of major adverse cardiac events in patients presenting with chest pain to the emergency department to promote their safe and efficient nature in a community hospital setting.

KEY WORDS: Acute coronary syndrome, emergency department, chest pain, score, HEART.

INTRODUCTION

The idea of acute myocardial infarction has developed to accommodate increasingly receptive indicators of myocardial necrosis and imaging techniques that allow a deeper understanding of the pathogenic processes of Acute Coronary Syndrome (ACS) [1]. Clinician aims to distinguish between patients who have ACS and others who have other disorders. Although different historical characteristics and laboratory values can help classify patients with true ACS, none are sufficiently specific to use them individually. The ability at an earlier stage to identify patients without myocardial infarction has the potential to decrease patient anxiety, promote focused clinical evaluation to identify alternative diagnoses, and increase the distribution of resources by minimizing unnecessary hospitalization and testing. However, it was challenging to detect myocardial infarction by recognizing that this condition may occur in patients without atherosclerotic plaque rupture and intraluminal thrombosis, but with an imbalance in the supply and demand myocardial oxygen in the sense of another acute illness, such as pneumonia or tachyarrhythmia. Older age, anterior wall MI, systemic hypertension, diabetes mellitus, multi vessel CAD, prior MI or prior angina, initial heart failure diagnosis, STEMI, and left bundle branch block are risk factors in the sense of MI [2].

The majority of patients with chest pain undergo rigorous diagnostic testing to rule out ACS, often resulting in lengthy and expensive referral to ED, with only a limited percentage of these patients actually being diagnosed with ACS. This will place pressure on crowded ED and reduce the provision of services for patients in need of immediate medical treatment. Therefore, the early detection of patients with chest pain who are at high risk of experiencing adverse heart conditions has been a pressing problem for the ED. For risk stratifying chest pain patients in the Emergency Department, multiple existing clinical scores were used.

Although there are several scores such as TIMI, GRACE that helped predict an identified acute coronary incident, there was no quantitative tool available to risk stratifying patients with chest pain to support more decisions, including early discharge or observation or intervention.3

The HEART Score was framed by Six et al.4 using the History, ECG finding, Age, Risk factors, Troponin, all taken down on the spot at presentation, introduced an analytical approach to risk stratifying patients easily.

However, there were some flaws in the HEART score so that the components were not given a weighting in the score according to their significance. The Erlanger HEART3 Score framed by using the probability ratio analysis to give sufficient weight to the individual components of the HEART score and to provide three additional variables during the initial emergency room assessment, namely Sex of the patient, 2nd ECG at the second hour, and Serial Troponin levels at the second hour, was therefore improved on the HEART score.5

To assess their 14-day risk of significant adverse cardiac outcomes, the TIMI score is one of the most well-known risk score derived and confirmed in a group of inpatients with dysfunctional angina and non-ST-elevation myocardial infarction (NSTEMI) (Major Adverse Cardiac Event - MACE). A combined finding causing death, myocardial infarction, and revascularization (PCI/CABG) are MACE. Conflicting results have been correlated with the use of this device for the identification of low-risk chest pain patients. The HEART score was primarily designed to classify ED patients with chest pain at low risk of short- term MACE that could then be released with sufficient follow-up from the ED and patients at high risk of MACE who would need emergency care.

Current study undertaken to evaluate prognostic accuracy of the HEART score for prediction of MACE in ED patients presenting with chest pain. Present study also identify the cardiac interventions, and mortality based on HEART scores.

MATERIAL AND METHODS

Study design: This prospective observational study was done at a tertiary care hospital with a duration from November 2018to October 2020 in the Department of Emergency Medicine, Narayana Medical College and Hospital, Nellore. A total of 83 patients admitted in the emergency department who had chest pain were selected for the study. Patient's >18 years of age, who were presenting with chest pain to the Emergency Department were included. Pregnancy, Trauma, Malnutrition, CKD patients, and Respiratory Diseases were excluded. Patients were informed about the meeting of the inclusion criteria during presenting at the Emergency Department, Narayana Medical College Hospital, Nellore by attending duty doctor at the emergency department at any time 24x7. The HEARTS3 score was framed for the patient with the History, ECG, Age, History of Risk factors, Troponin, Sex, Serial ECG and Serial troponin at two hours.

The patient was followed up and was observed for any MACE, such as Myocardial Infarction, Cardiogenic shock, Cardiac arrest, and all cause cardiac death, up to seven days of initial presentation.

HISTORY: The patient's nature of chest pain were assessed from the history. As guided by the 2014 AHA ACC guideline for NSTEMI ACS, NSTEMI ACS most commonly presents as a pressure-type chest pain that typically occurs at rest or minimal exertion lasting for 10 minutes or more. The patients presenting with all the characteristics mentioned above are classified to have probable ischemic chest pain. The patients presenting with some of the above mentioned characteristics of chest pain are classified to have possible ischemic chest pain. Features not characteristic of ischemic chest pain include:

- Pleuritic pain (sharp or knifelike pain provoked by respiration or cough);
- Primary or sole location of discomfort in the middle or lower abdomen;
- Pain localized by the tip of 1 finger, particularly at the left ventricular apex or costochondral junction;

- Pain reproduced with movement or palpation of the chest wall or arms;
- Brief episodes of pain lasting a few seconds or less;
- Pain that is of maximal intensity at onset; and
- Pain that radiates to lower extremities.

The patients presenting with any one of the above mentioned presentations are classified to have probable Non cardiac chest pain.

ECG: An ECG is obtained on arrival to the emergency room and is looked for the presence of ST segment elevation in continuous leads and they are excluded from the study. ECG with straight line or downs loaping ST depression 0.05mVor more or symmetrical T inversion 0.2mV or more in continuous leads are grouped as probable ischemia and are given 3 points. The presence of chamber hypertrophy, old infarct or bundle branch block on ECG can confound changes of ACS and are grouped to have possible ischemia and are given 1 point. The ECG is repeated after 2 hours of presentation and is looked for the appearance of ischemic change and points are given.

AGE: Points are given as per the patient's age

RISK factors: The number of risk factors present among Diabetes mellitus, hypertension, hyperlipidemia, smoking in the past one month, family history of Coronary Artery Disease will be enquired and the patient's BMI will be measured and will be categorized for obesity if the BMI is ≥30 kg/meter2. Points will be given as per the number of risk factors present.

TROPONIN: The patient's blood is drawn and Troponin T levels are measured on arrival and is taken as the baseline Troponin T. The 99th percentile of the upper reference level as determined by the lab is taken as the cut-off and is given points according to whether the Baseline Troponin T is below the cut off or 1to 3 times the cut off or more than three times the cut off.

SEX: Point given depends on the gender.

Statistical analysis

The data has been entered into MS-Excel and statistical analysis has been done by using MedCalc Statistical Software version 18.10 (MedCalc Software, Ostend, Belgium) and SPSS version 25.0(IBM SPSS, Armonk, New York, USA). For categorical variables, the data values are represented as number and percentages. To test the association between the groups, chi-square test was used. For continuous variables, the data values are shown as mean and standard deviation or median (interquartile ranges). To represent a sensitivity/specificity pair corresponding to a particular decision, Receiver Operating Characteristic (ROC) curve analysis was used to test the parameters of diagnostic accuracy and how well a parameter can distinguish between the diagnostic groups, the area under the ROC curve (AUC). i.e.

sensitivity, specificity, negative predictive value (NPV) and positive predictive value (PPV) for the prediction of 30-day MACEs were calculated with their corresponding 95% confidence intervals using exact binomial confidence intervals. All the p-values having less than 0.05 were considered as statistical significant..

RESULTS

In total of 83 patients, myocardial infarction is one of the major cause of sudden death in ED. In the age group, 16 (16.28%) patients were having <45 years, 44 (53.01%) patients were having between 45 to 65 years, and 23 (27.71%) patients were having more than 65 years. 50 (60.24%) patients were males, and 33 (39.76%) patients were females. i.e., in the present study, males were predominant than females (Table 1). In ECG, 31 (37.35%) patients were having normal in ECG, 24 (28.92%) patients were having non-specific repolarization, 28 (33.73%) patients were having significant ST-Depression in ECG. In Troponin, 54 (65.06%) patients were had < normal limit, 9 (10.84%) patients had > 1 to < 3 × Normal Limit, and 20 (24.10%) patients were had ≥ 3 × Normal Limit (Table 2).

In Heart score, 22 (26.51%) patients were having low risk, 33 (39.76%) patients were having moderate risk, and 28 (33.73%) patients were having high risk.

Association between sex and Heart score: Among 22 patients of low risk group, 9 (40.9%) patients were males and 13 (59.1%) patients were females. Among 33 patients of moderate risk group, 22 (66.7%) patients were males and 11 (33.3%) patients were females, among 28 patients of high risk group, 19 (67.9%) patients were males and 9 (32.1%) patients were females. However, there is no association between the sex and heart score (P=0.096).

Association between giddiness and Heart score: 54 (65.1%) patients were having giddiness. The association between giddiness and heart score, 19 (86.4%) patients in low risk group, 17 (51.5%) patients in moderate risk group, and 18 (64.3%) patients in high risk group had giddiness. There was a significantly association between the giddiness and the heart score (P=0.029).

Association between generalized weakness and Heart score: 58 (69.9%) patients had generalized weakness. 20 (90.9%) patients in low risk group, 19 (57.6%) patients in moderate risk group, and 19 (67.9%) patients in high risk group had generalized weakness. There was a significantly association between the generalized weakness and the heart score (P=0.029).

Association between syncope and Heart score: Five (6.0%) patients had syncope. None of patients in low risk group and moderate risk group, and 5 (17.9%) patients in high risk group had syncope. There was a significantly association between the syncope and the heart score (P=0.005).

Association between epigastric discomfort and Heart score: 40 (48.2%) patients had epigastric discomfort. 13 (59.1%) patients in low risk group, 13 (39.4%) patients in moderate risk group, and 14 (50%) patients in high risk group had epigastric discomfort. However, there was no statistically significant association between the epigastric discomfort and the heart score (P=0.349).

Table 1. Patient's characteristics.

Variable (s)		Number (n)	Percentage (%)
Age Group	≤ 45 Years	16	19.28%
	> 45 to < 65 Years	44	53.01%
	≥ 65 Years	23	27.71%
Sex	Male	50	60.24%
	Female	33	39.76%
Risk Factors	No Risk Factors	24	28.92%
	1 or 2 Risk Factors	46	55.42%
	≥ Risk Factors	13	15.66%
	Giddiness	54	65.06%
	Alcohol	14	16.87%
	Obesity	4	4.82%
	Smoking	18	21.69%
	DM	39	46.99%
	HTN	37	44.58%
	Family Hitory	3	3.61%
	Generalized Weakness	58	69.88%
	Syncope	5	6.02%
	Epigastric Discomfort	40	48.19%
	Nausea	43	51.81%
	Vomiting	43	51.81%
	Altered Mental Status	28	33.73%
History	Non-Suspicious	3	3.61%
	Moderately Suspicious	25	30.12%
	Highly Suspicious	55	66.27%
ECG	Normal	31	37.35%
	Non-Specific Repolarization	24	28.92%
	Significant ST-Depression	28	33.73%
TROPONIN	< Normal Limit	54	65.06%
	> 1 to < 3 × Normal Limit	9	10.84%
	≥ 3 × Normal Limit	20	24.10%
Heart Score	Low Risk (0 - 3)	22	26.51%
	Moderate Risk (4 - 6)	33	39.76%
	High Risk (7 - 10)	28	33.73%

Table 2. Association between ECG and Heart score.

			Heart Score			Total
			Low Risk (0 - 3)	Moderate Risk (4 - 6)	High Risk (7 - 10)	
ECG	Normal	Count	13	18	0	31
		% within ECG	41.9%	58.1%	0.0%	100.0%
		% within Heart_Score	59.1%	54.5%	0.0%	37.3%
	Non- Specific Repolarization	Count	8	12	4	24
		% within ECG	33.3%	50.0%	16.7%	100.0%
		% within Heart Score	36.4%	36.4%	14.3%	28.9%
	Significant ST-Depression	Count	1	3	24	28
		% within ECG	3.6%	10.7%	85.7%	100.0%
		% within Heart Score	4.5%	9.1%	85.7%	33.7%
	Total	Count	22	33	28	83
		% within ECG	26.5%	39.8%	33.7%	100.0%
		% within Heart Score	100.0%	100.0%	100.0%	100.0%

Association between nausea and Heart score: 43 (51.8%) patients had nausea. 14 (63.6%) patients in low risk group, 16 (48.5%) patients in moderate risk group, and 13 (46.4%) patients in high risk group had nausea. There was no statistically significant association between the nausea and the heart score (P=0.427).

Association between vomiting and Heart score: 43 (51.8%) patients had vomiting. 15 (68.2%) patients in low risk group, 15 (45.5%) patients in moderate risk group, and 13 (46.4%) patients in high risk group had vomiting. There was no statistically significant association between the nausea and the heart score (P=0.2).

Association between Altered Mental status and Heart score: 28 (33.7%) patients had altered mental status. 12 (54.5%) patients in low risk group, 9 (27.3%) patients in moderate risk group, and 7 (25.0%) patients in high risk group had altered mental status. However, there was no statistically significant association between the altered mental status and the heart score (P=0.054).

Association between history and Heart score: In a total of 83 patients, 3 (3.6%) patients had non-suspicious, 25 (30.1%) patients had moderately suspicious, and 55 (66.3%) patients had highly suspicious. In low risk group, none of the patient had non-suspicious, 16 (72.7%) patients had moderately suspicious and 6 (27.3%) patients had highly suspicious. In moderate risk group, 3 (9.1%) patients had non-suspicious, 9 (27.3%) patients had moderately suspicious, and 21 (63.6%) patients had highly suspicious. In high risk group, none (0.0%) of the patients in non- suspicious, and moderately suspicious and 28 (100%) patients had highly suspicious, and there was a statistically significant association between the history and the heart score (P<0.0001).

In total of 22 patients of low risk group, 13 (59.1%) patients had normal, 8 (36.4%) patients had non-specific repolarization, and only one (4.5%) patient has significant ST-Depression. In a total of 33 patients of moderate risk group, 18 (54.5%) patients had normal, 12 (36.4%) patients had non-specific repolarization, and 3 (9.1%) patients had significant ST-Depression. In a total of 28 patients of high risk group, none of patient has normal, 4 (14.3%) patients had non-specific repolarization, and 24 (85.7%) patient has significant ST-Depression. There was a statistically significant association between the ECG and the heart score (P<0.0001).

Association between age group and Heart score: In a total of 22 patients of low risk group, 11 (50.0%) patients had ≤45 years, 10 (45.5%) patients had aged between 45 and 65 years, and only one (4.5%) patient has ≥65 years. In a total of 33 patients of moderate risk group, 2 (6.1%) patients had ≤45 years, 18 (54.5%) patients had aged between 45 and 65 years, and 13 (39.4%) patients had ≥65 years. In a total of 28 patients of high risk group, 3 (10.7%) patients had ≤45 years, 16 (57.1%) patients had aged between 45 and 65 years, and 9 (32.1%) patient had ≥65 years. There was a statistically significant association between the age group and the heart score (P<0.0001).

Association between hypertension and Heart score: 3 (13.6%) patients had hypertension in low risk group, 16 (48.5%) patients had hypertension in moderate risk group, 18 (64.3%) patients had hypertension in high risk group. There was a statistically significant association between hypertension and the heart score (P=0.001) (Table 3).

For 2 (9.1%) patients had diabetes in low risk group, 16 (48.5%) patients had diabetes in moderate risk group, 21 (75%) patients had diabetes in high risk group. There was a statistically significant association between diabetes and the heart score (P<0.0001) (Table 4).

Table 3. Association between hypertension and Heart score.

			Heart Score			Total
			Low Risk (0 - 3)	Moderate Risk (4 - 6)	High Risk (7 - 10)	
HTN	NO	Count	19	17	10	46
		% within HTN	41.3%	37.0%	21.7%	100.0%
		% within Heart Score	86.4%	51.5%	35.7%	55.4%
	YES	Count	3	16	18	37
		% within HTN	8.1%	43.2%	48.6%	100.0%
		% within Heart Score	13.6%	48.5%	64.3%	44.6%
	Total	Count	22	33	28	83
		% within HTN	26.5%	39.8%	33.7%	100.0%
		% within Heart Score	100.0%	100.0%	100.0%	100.0%

Table 4. Association between hypertension and Heart score.

			Heart Score			Total
			Low Risk (0 - 3)	Moderate Risk (4 - 6)	High Risk (7 - 10)	
DM	NO	Count	20	17	7	44
		% within DM	45.5%	38.6%	15.9%	100.0%
		% within Heart Score	90.9%	51.5%	25.0%	53.0%
	YES	Count	2	16	21	39
		% within DM	5.1%	41.0%	53.8%	100.0%
		% within Heart Score	9.1%	48.5%	75.0%	47.0%
	Total	Count	22	33	28	83
		% within DM	26.5%	39.8%	33.7%	100.0%
		% within Heart Score	100.0%	100.0%	100.0%	100.0%

Association between smoking and Heart score: 3 (13.6%) patients were smokers in low risk group, 7 (21.2%) patients were smokers in moderate risk group, 8 (28.6%) patients were smokers in high risk group. There was no statistically significant association between smokers and the heart score (P=0.444).

Association between obesity and Heart score: None of the patients had obesity in the low risk group and moderate risk group, 4 (14.3%) patients had obesity in high risk group. There was a statistically significant association between obesity and the heart score (P=0.016).

Association between family history and Heart score: None of the patients had family history in low risk group, 2 (6.1%) patients had family history in moderate risk group, only one (3.6%) patient has family history in high risk group. There was no statistically significant association between family history and the heart score (P=0.499). 3 (13.6%) patients had alcohol in low risk group, 6 (18.2%) patients had alcohol in moderate risk group, 5 (17.9%) patients had alcohol in high risk group, and there was a statistically significant association between alcohol and the heart score (P=0.894).

Association between risk factors and Heart score: In low risk group, 15 (68.2%) patients had no risk factors, 7 (31.8%) patients had 1 or 2 risk factors, none of the patients had ≥ 3 risk factors. In moderate risk group, 8 (24.2%) patients had no risk factors, 21 (63.6%) patients had 1 or 2 risk factors, 4 (12.1%) patients had ≥ 3 risk factors. In high risk group, 1 (3.6%) patients had no risk factors, 18 (64.3%) patients had 1 or 2 risk factors, 9 (32.1%) patients had ≥ 3 risk factors. There was a statistically significant association between risk factors and the heart score (P<0.0001) (Figure 1).

In low risk group, 22 (100.0%) patients had < normal limit, none (0.0%) patients had > 1 to < 3 × Normal Limit and ≥ 3 × Normal Limit. In moderate risk group, 31 (93.9%) patients had < normal limit, 2 (6.1%) patients had > 1 to < 3 × Normal Limit, none of patients had ≥ 3 × Normal Limit. In high risk group, 1 (3.6%) patients had < normal limit, 7 (25.0%) patients had > 1 to < 3 × Normal Limit, 20 (71.4%) patients

had ≥ 3 risk factors. There was a statistically significant association between troponin and the heart score (P<0.0001, Very High Significant). Occurrence of Major Adverse Cardiac Events (MACEs) according to the HEART score: According to HEART score, 9 patients had HEART score-2, 13 patients had HEART score-3, 24 patients had HEART score-4, 6 patients had HEART score-5, 3 patients had HEART score-6, 6 patients had HEART score-7, 15 patients had HEART score-8, 7 patients had HEART score-9, and none of the patients had HEART score-0, 1, and 10 (Figure 2) (Table 5).

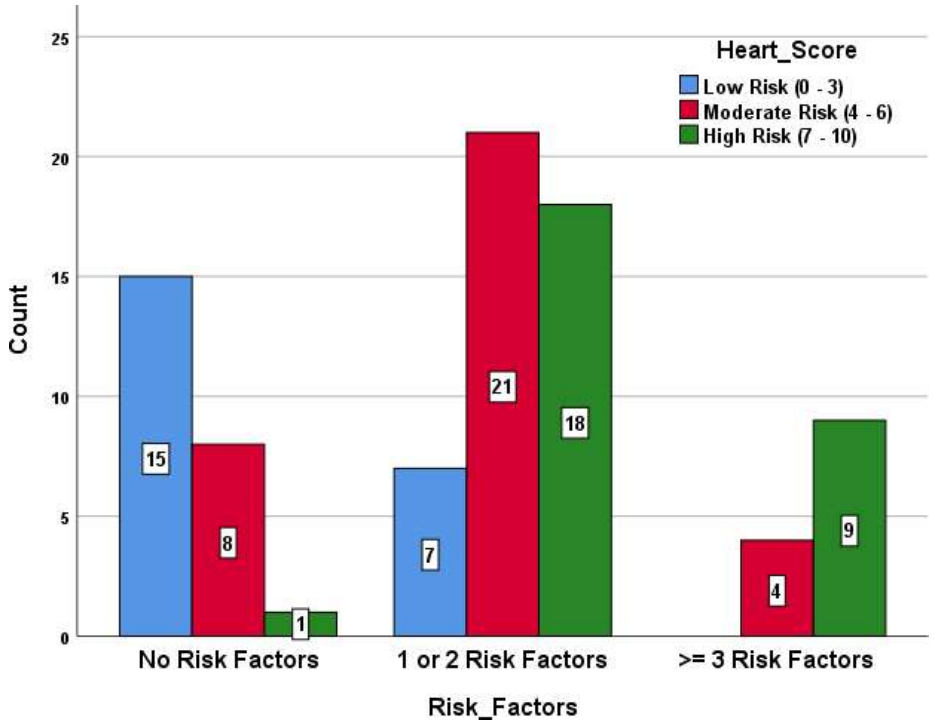

Figure 1. Association between risk factors and Heart score.

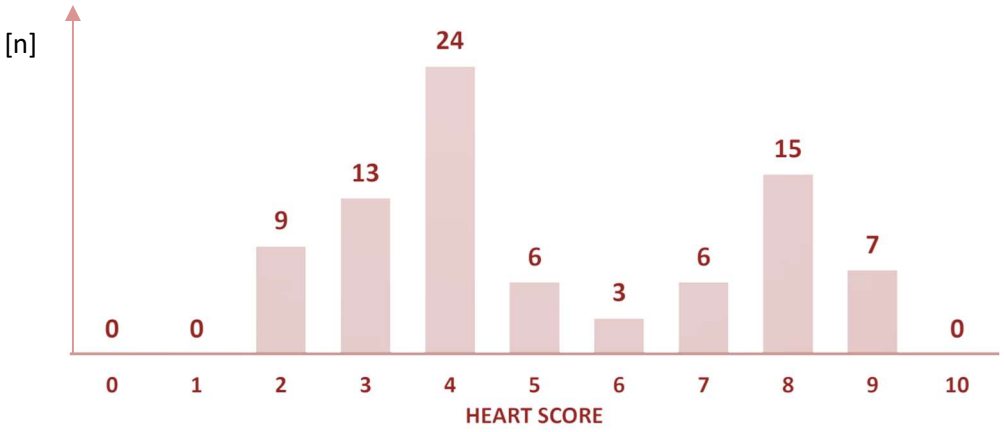

Figure 2. Occurrence of Major Adverse Cardiac Events (MACEs) according to HEART score.

Table 5. Association between troponin and Heart score.

			Heart Score			
			Low Risk (0 - 3)	Moderate Risk (4 - 6)	High Risk (7 - 10)	Total
TROPONIN	< Normal Limit	Count	22	31	1	54
		% within troponin	40.7%	57.4%	1.9%	100.0%
		% within Heart Score	100.0%	93.9%	3.6%	65.1%
	> 1 to < 3 × Normal Limit	Count	0	2	7	9
		% within Troponin	0.0%	22.2%	77.8%	100.0%
		% within Heart Score	0.0%	6.1%	25.0%	10.8%
	≥ 3 × Normal Limit	Count	0	0	20	20
		% within Troponin	0.0%	0.0%	100.0%	100.0%
		% Within Heart Score	0.0%	0.0%	71.4%	24.1%
Total		Count	22	33	28	83
		% within Troponin	26.5%	39.8%	33.7%	100.0%
		% within Heart score	100.0%	100.0%	100.0%	100.0%

Area under the ROC curve (AUC) analysis of the HEART score for the low risk group: Risk factor (R) had significantly higher AUC value (AUC = 0.801; P<0.0001) than the age group (AUC = 0.778; P<0.0001), history (AUC = 0.747; P<0.0001), Troponin (AUC = 0.738, P<0.0001), and ECG (AUC = 0.722, P<0.0001) (Figure 3). According to Diagnosis tests, troponin has highest sensitivity level than the ECG (Sensitivity: 95.45%), the history (Sensitivity: 72.73%), risk factor (Sensitivity: 68.18%), and ECG (Sensitivity: 50%) (Table 6, 7).

Table 6. Area under the ROC curve (AUC) of the HEART score for low risk group.

Variables	AUC (95% C.I.)	Std. Error	Z statistic	P Value	Sensitivity	Specificity
History (H)	0.747 (0.64 to 0.84)	0.056	4.418	<0.0001**	72.73 (49.8 to 89.3)	80.33 (68.2 to 89.4)
ECG (E)	0.722 (0.61 to 0.82)	0.053	4.212	<0.0001**	95.45 (77.2 to 99.9)	44.26 (31.5 to 57.6)
Age Group (A)	0.778 (0.67 to 0.86)	0.051	5.445	<0.0001**	50.00 (28.2 to 71.8)	91.80 (81.9 to 97.3)
Risk Factors (R)	0.801 (0.70 to 0.88)	0.048	6.308	<0.0001*	68.18 (45.1 to 86.1)	85.25 (73.8 to 93.0)
TROPONIN (T)	0.738 (0.63 to 0.83)	0.032	7.374	<0.0001**	100.0 (84.6 to 100.0)	47.54 (34.6 to 60.7)

Table 7. Major Adverse Cardiac Events (MACE) & Cardiac Interventions according to the HEART score.

	Low Risk (n=22)	Moderate Risk (n=33)	High Risk (n=28)	Total (n=83)
UA	6	13	10	29
NSTEMI	16	17	14	47
STEMI	0	3	4	7
PCI	4	20	9	33
CABG	2	14	6	22
CV Death	1	7	9	17

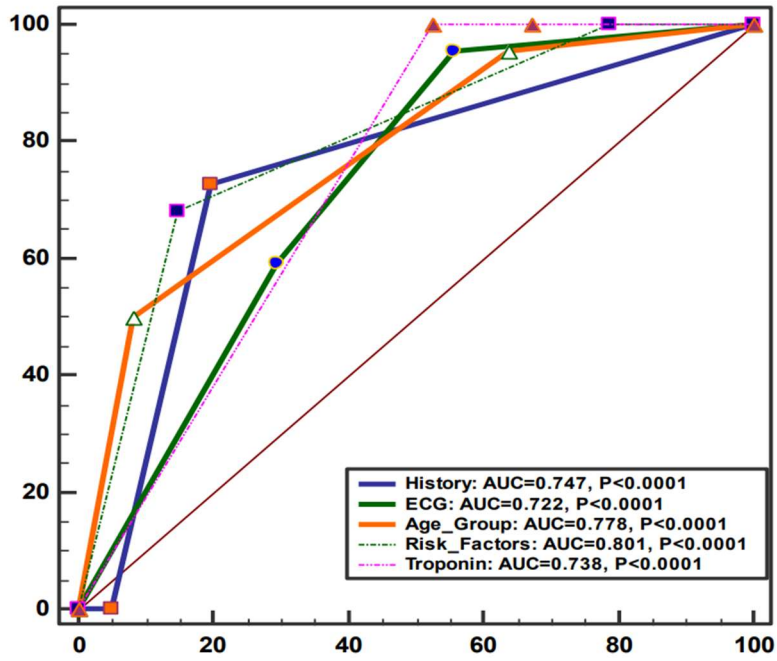

Figure 3. Comparison of ROC Curves of HEART score for low risk group.

DISCUSSION

The most prevalent aetiology of severe chest pain that is life-threatening is Acute Coronary Syndrome, consisting of Unstable Angina and Non-ST segment Elevation Myocardial Infarction known as NSTEMI and ST segment Elevation Myocardial Infarction known as STEMI.

The HEART score predicts the 6-week risk of a Major Adverse Cardiac Event, which is defined as “acute myocardial infarction (AMI), percutaneous coronary intervention (PCI), coronary artery bypass graft surgery (CABG), coronary angiography revealing procedurally correctable stenosis managed conservatively, or death due to any cause”.

When a patient enters ED with chest pain, the physician takes into account 5 categories: History, ECG, Age, Risk Factors, and Troponin (1 time, at presentation) with each category scored with 0, 1, or 2 points. In this study, the majority of the patients had age (53.01%) between 45 to 65 years. Males were predominant than females.44.58% of patients were having hypertension, 46.99% were diabetic, 21.69% were have habit of smoking, 4.82% were obesity patients, 3.61% were having family history, 16.87% were alcoholic, 28.92% were no risk factor patients, 55.42% were having one or two risk factors, and 15.66% were having more than three risk factors. 28.92% were having non-specific repolarization, 33.73% were having significant ST-Depression in ECG.

In the present study, in 22 patients of low risk group, 13 (59.1%) patients had normal, 8 (36.4%) patients had non-specific repolarization, and only one (4.5%) patient has significant ST-Depression. In a total of 33 patients of moderate risk group, 18 (54.5%) patients had normal, 12 (36.4%) patients had non-specific repolarization, and 3 (9.1%) patients had significant ST-Depression. In a total of 28 patients of high risk group, none of patient has normal, 4 (14.3%) patients had non-specific repolarization, and 24 (85.7%) patient has significant ST-Depression. There was a statistically significant association between the ECG and the heart score (P<0.0001).

In the present study, there was a statistically significant association between the age group and the heart score (P<0.0001). In this study, 3 (13.6%) patients had hypertension in low risk group, 16 (48.5%) patients had hypertension in moderate risk group, 18 (64.3%) patients had hypertension in high risk group. There was a statistically significant association between hypertension and the heart score (P=0.001). In this study, 2(9.1%) patients had diabetes in low risk group, 16(48.5%) patients had diabetes in moderate risk group, 21(75%) patients had diabetes in high risk group. There was a statistically significant association between diabetes and the heart score (P<0.0001). In this study, there was a statistically significant association between troponin and the heart score (P<0.0001). In a study of Poldervaart et al, Six-week incidence of MACEs during HEART care was 1.3% lower than during usual care (95% CI: 2.1 %to 3.0%). In low- risk patients, incidence of MACEs was 2.0% (95% CI, 1.2% to 3.3%) [6]. In a study of Arslan et al, the incidence of major adverse cardiac events in patients stratified as low-risk (35.0%), intermediate-risk (56.8%) and high-risk (8.2%) was 3.4%, 12.4% and 60.7%[7].

In the present study, according to Diagnosis tests, troponin has highest sensitivity level than the ECG (Sensitivity: 95.45%), the history (Sensitivity: 72.73%), risk factor (Sensitivity: 68.18%), and ECG (Sensitivity: 50.00%). The risk factor had significantly higher AUC value (AUC = 0.801; P<0.0001) than the age group (AUC = 0.778; P<0.0001), history (AUC = 0.747; P<0.0001), Troponin (AUC = 0.738, P<0.0001), and ECG (AUC = 0.722, P<0.0001). In a study of Fernando et al.,[8] they showed that a HEART score above the low-risk threshold (≥4) had a sensitivity of 95.9% [93.3%–97.5%] and specificity of 44.6% [38.8%-50.5%] for MACE. A high-risk HEART score (≥7) had a sensitivity of 39.5% [31.6%–48.1%] and specificity of 95.0% [92.6%–96.6%] for MACE.

In a study of Tan et al.[9], the performance of modified HEART scores was comparable among the three assays for 30-day MACE (84.9–87.0% sensitivity, 95.6–96.0% NPV, 95%CI) and none of these had very high AUC and specificity (AUC 0.70–0.71, 53.7–56.7% specificity, 95% CI).

Torralba et al.[10] compared the performance of the HEART, TIMI, and GRACE scores for predicting major cardiovascular events. A HEART score of 3 or less had a sensitivity of 99.5% and a negative predictive value of 99% to classify low risk patients correctly; both values were higher than those obtained by the other scores. They concluded that the HEART score more effectively predicts cardiovascular events at 30 days of follow-up compared to the other scores (TIMI, and GRACE scores).

Huang et al [11] study compared the HEART and GRACE scores in predicting the short-term risk of a major adverse cardiac event (MACE) in patients with chest pain. The HEART and GRACE scores were both significantly higher in patients who developed a MACE than in those without ($P < 0.05$). The HEART and GRACE scores had c-statistic values of 0.811 [0.774–0.844] and 0.648 [0.603–0.688]. In a study of Kim et al [12], compared the 6 established chest pain risk scores (the HEART score, CAD basic model, CAD clinical model, TIMI, GRACE, uDF) for prediction of obstructive CAD and MACE. The AUC of the HEART score (0.792) was superior to those of the CAD clinical model (0.760), CAD basic model (0.749), TIMI (0.749), uDF (0.703), and GRACE (0.653). They concluded that the HEART score was superior to other cardiac risk scores in predicting both obstructive CAD and MACE.

In a study of Backus et al [13], 92 patients had an acute myocardial infarction (10.45%), 82 a percutaneous coronary intervention (9.32%), 36 a coronary artery bypass graft (4.09%), and 13 died (1.48%). Of 303 patients with HEART score 0 to 3, three (0.99%) had an endpoint. In a study of Backus et al.[14], 10.5% of patients PCI, 2.8% of patients CABG, 0.7% of patients death. In comparison to the above risk ratings, the HEART score was based on non- selective patients with chest pain in ED. In addition, for future decisions, the HEART score will also provide guidance to a doctor in ED. The HEART score stresses the relevance of medical history, which is a pillar of the professional diagnosis of chest pain patients.

Limitations of this study includes the sample is small and period of the follow-up is below six months, it is essential to highlight that the HEART score does not evaluate the duration of chest pain or the duration between the onset of chest pain and presentation to ED. The HEART score evaluates assessment in relation to ACS. Therefore, other conditions other than ACS, should not be evaluated by the HEART score. We had in our study patients with diagnosis such as pulmonary embolism, lung cancer, acute HF in patients with the HEART score 0-3.

With the provision of point of care echocardiographic imaging and the instruction of doctors in rapid echo screening, the involvement of Regional Wall Motion Abnormality may be integrated into the score to improvise the accuracy of the score.

CONCLUSIONS

HEART score should be used as the primary clinical decision tool for the risk stratification and a good predictor of major adverse cardiac events in patients presenting with chest pain to the emergency department to promote their safe and efficient nature in a community hospital setting. High risk category patients in HEART score requires more number of cardiac interventions and more number of cardiovascular deaths.

SUPPLEMENTARY INFORMATION

Funding: *No fund was received related to this study.*
Institutional Review Statement: *The study was conducted according to the guidelines of the Declaration of Helsinki.*
Informed Consent Statement: *Informed consent was obtained from all subjects involved in the study.*
Data Availability Statement: *The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.*
Conflicts of Interest: *The authors declare no conflicts of interest.*

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