



Original Article

Association of Elevated Heart Risk Score with Myocardial Infarction in Patients with Chest Pain

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ABSTRACT

The HEART score is a widely used diagnostic tool in patients with chest pain. This tool is a very effective method for the stratification of patients with chest pain in the emergency department. It is composed of five components, i.e., history, ECG, age risk factors and troponins. **Objective:** To assess the importance of HEART score in our population. **Methods:** This study was conducted at emergency department of Ziauddin University Hospital, Karachi, Pakistan from 01 January 2021 to 30 June 2022. A cohort study of the HEART risk score in myocardial infarction (MI) patients presented with chest pain was conducted. 244 patients were selected by consecutive sampling and distributed into two groups i.e., non-exposed (HEART risk score 0-3) and exposed group (HEART risk score ≥ 4). The HEART risk score was calculated and patients were followed for the next 48 hours. **Results:** Patients of both groups were monitored for forty-eight hours and the results were myocardial infarction (MI) in 1 (0.8%) patient and 86 (70.5%) patients in group A (low risk) and group B (high risk) respectively. One patient (0.8%) in each group A (low risk) and in group B (high risk) left against medical advice (LAMA). One hundred twenty (98.4%) patients in group A and thirty-five (28.7%) patients in group B (high risk) were discharged. No patient (0.0%) expired in group A (low risk) and in group B (high risk) respectively. **Conclusions:** It was concluded from the study that the HEART risk score is very much helpful as a diagnostic tool in patients with chest pain, presented in the emergency

INTRODUCTION

Myocardial infarction (MI), commonly called "Heart Attack" is brought about due to complete or diminished stoppage of blood flow to the segment of the myocardium. It is commonly known as a "silent killer" because remains undetected for a prolonged period or also known as "catastrophic disease" deteriorates the dynamics of blood flow, resulting in sudden death [1]. A patient presented with pain or pressure or with any discomforted-on chest which is radiating either towards the neck, jaw, shoulder, or arm with previous history will be considered as myocardial infarction. Diagnosis will be confirmed on physical examination, electrocardiogram (ECG) and on the elevation of cardiac troponins. Early evaluation of myocardial

infarction increased the chances of heart reperfusion and blood flow restoration and rapid recovery of the patient [2, 3]. MI is the most common manifestation of coronary artery disease (CAD) which is the most commonly reported cause of mortality and disability throughout the world [4]. According to WHO, more than 12.2% of deaths in the world are reported due to ischemic disease (IHD), among which the majority of the deaths are reported from developing countries [5]. Approximately three million and four million people are suffering from STEMI and NSTEMI respectively. Whereas the rate of STEMI is two times higher in males as compared to females [6, 7]. Approximately 17.1 million deaths are reported in the world because of coronary heart

disease (CHD). CHD is considered the largest global contributor to mortality whereas approximately 39% of deaths have been reported in developing countries in patients with having age < 70 years [8, 9]. Risk of myocardial infarction is very much high in the Asian population and the approximate rate of myocardial infarction is 50% higher in the South Asian population [10, 11]. HEART risk score is a widely used diagnostic tool in patients with chest pain. It is composed of five components, i.e., history, ECG, age, risk factors and troponins. In this study, we have assessed whether the HEART score is an effective screening method to differentiate between chest pain of cardiac and non-cardiac origin.

METHODS

A cohort study of HEART risk score in patients presented with chest pain was conducted at the emergency department of Ziauddin University Hospital, Karachi from 01 January 2021 to 30 June 2022. 244 patients were selected by consecutive sampling and distributed into two groups namely group A (low-risk group with HEART risk score 0-3) and group B (high-risk group with HEART risk score \geq 4). Patients with previously known comorbid diabetes mellitus (DM), hypertension (HTN), ischemic heart disease (IHD), dyslipidaemia and those with a history of smoking, alcohol abuse and drug abuse were included in this study. While the patients with a history of trauma and the patients who could not be followed were excluded from our study. Informed consent was taken from patients. A detailed proforma was filled according to HEART risk score parameters. Group A patients were followed in the emergency department for the next forty-eight hours taking their ECG and troponin tests. Their initial HEART risk score was calculated. They were discharged from the emergency department as they are likely to fall into a low-risk group for a MACE (Major adverse cardiac Event). Their contact numbers were taken, and they were asked to fill in the requisite HEART risk score proforma. They were asked to return to the emergency department and repeat their troponin I and ECGs on an eight hourly basis till completion of three sets of ECGs and three sets of troponin I respectively. Their final HEART risk score was calculated based on all three ECGs and troponin I level. If they still had a HEART score of 0-3, they were safely discharged from the emergency department. If the HEART risk score falls greater than 4, he or she was admitted to the hospital, treated and managed as having a MACE (Major Adverse Cardiac Event). A 12-lead ECG was recorded with a sensitivity of 10 mm/mv and a paper speed of 25 mm/s from all patients on admission to the emergency room. ECG measurements were made manually by residents of the

emergency room. Serum samples for troponin levels were sent to the laboratory. ECG was seen by a doctor. The endpoint that we were looking for in our research was whether or not a patient who was presenting in the emergency department with chest pain was having a MACE (Major Adverse Cardiac Event). The application of the HEART risk score helps us effectively and rapidly to sort out patients with chest pain, who were undergoing MACE at any moment and to reduce such episodes shortly as well. MACE could be ST-segment elevation MI, Non-ST-segment elevation MI, or Stable or Un-stable angina. The analysis of data was done using SPSS version 20.0 and a p-value of \leq 0.05 was taken as statistically significant.

RESULTS

The HEART risk score of patients was evaluated on five parameters including the history of the patient, electrocardiogram (ECG) of the patient, age of patient, presence or absence of risk factors and level of troponin in the blood of patients. History of patients was slightly or non-suspicious in 7 (5.7%) patients in group A (low-risk group) and 0 (0.0%) patients in group B (high-risk group), moderately suspicious in 114 (93.4%) patients and 67 (54.9%) patients and highly suspicious in 1 (0.8%) patient and 55 (45.1%) patients in group A (low risk) and group B (high risk) respectively (Table 1).

Table 1: Distribution of HEART risk score (History) in group A and group B

History	Group A N (%)	Group B N (%)
Slightly or non-suspicious	7 (5.7)	0 (0)
Moderately suspicious	114 (93.4)	67 (54.9)
Highly suspicious	1 (0.8)	55 (45.1)

ECG of patients was normal in 28 (23%) patients and 6 (4.9%) patients, non-specific repolarization disturbance/LBBB/ PM in 93 (76.2%) patients and 64 (52.5%) patients and significant ST-deviation in 1 (0.8%) patient and 52 (42.6%) patients in group A (low risk) and group B (high risk) respectively (Table 2).

Table 2: Distribution of HEART risk score (ECG) in group A and group B

History	Group A N (%)	Group B N (%)
Normal	28 (23)	6 (4.9)
Non-specific repolarization disturbance/LBBB/PM	93 (76.2)	64 (52.5)
Significant ST-deviation	1 (0.8)	52 (42.6)

The age of patients was \leq 45 years in 112 (91.8%) patients and 10 (8.2%) patients, > 45 and < 65 years in 10 (8.2%) patients and 62 (50.8%) patients and \geq 65 years in 0 (0.0%) patients and 50 (41.0%) patients in group A (low risk) and in group B (high risk) respectively (Table 3).

Table 3: Distribution of HEART risk score (Age) in group A and group B

History	Group A N (%)	Group B N (%)
≤ 45 Years	112 (91.8)	10 (8.2)
> 45 and < 65 Years	10 (8.2)	62 (50.8)
≥ 65 Years	0 (0.0)	50 (41.0)

Risk factors in patients were categorized as; no risk factors known in 33 (27.0%) patients and 5 (4.1%) patients, 1 or 2 Risk factors in 88 (72.1%) patients and 90 (73.8%) patients and ≥ 3 Risk factors or history of atherosclerotic disease in 1 (0.8%) patient and 27 (22.1%) patients in group A (low risk) and group B (high risk) respectively (Figure 1).

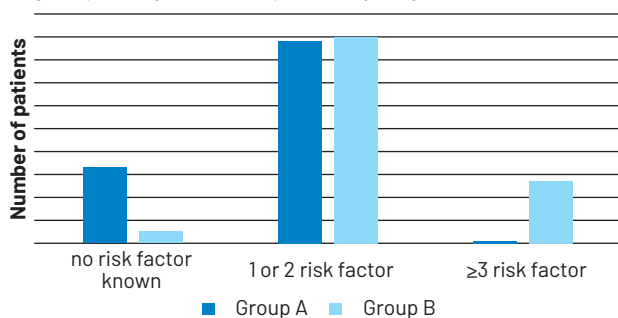


Figure 1: Distribution of HEART risk score (risk factors) in groups A and B

Troponin level in patients was ≤ 1 × normal limit in 121 (99.2%) patients and 44 (36.1%) patients, > 1 and < 3 × normal limit in 1 (0.8%) patient and 53 (43.4%) patients and ≥ 3 × normal limit in 0 (0.0%) patients and 25 (20.5%) patients in group A (low risk) and in group B (high risk) respectively (Figure 2).

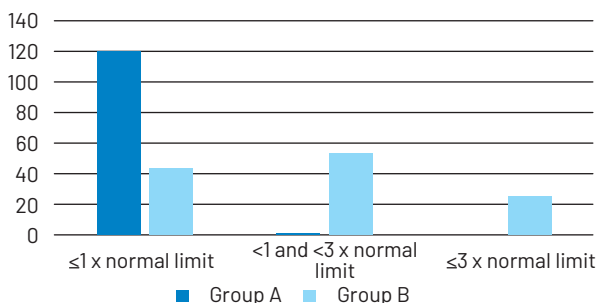


Figure 2: Distribution of HEART risk score (troponin) in groups A and B

Patients of both groups were monitored for forty-eight hours and the results were myocardial infarction (MI) in 1 (0.8%) patient and 86 (70.5%) patients in group A (low risk) and group B (high risk) respectively. One patient (0.8%) in each group A (low risk) and in group B (high risk) left against medical advice (LAMA). One hundred twenty (98.4%) patients in group A and thirty-five (28.7%) patients in group B (high risk) were discharged. No patient (0.0%) expired in group A (low risk) and group B (high risk) respectively (Figure 3).

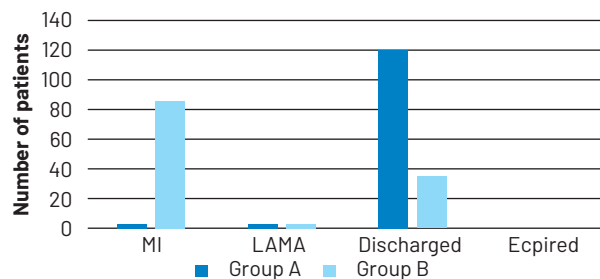


Figure 3: Distribution of outcome in groups A and B

DISCUSSION

Chest pain is among the most commonly observed reasons for a patient visiting the emergency department (ED). In the majority of the cases, chest pain is reported due to a heart problem, but it may occur due to several other reasons that should be identified and distinguished. In ED, the patient is quickly assessed and diagnosed, especially in the case of ST-Elevation Myocardial Infarction (STEMI). However, STEMI is not the only reason behind chest pain, it accounts for only a small percentage of total cases of chest pain. In heart disease, MI is the common reason for chest pain but several other diseases such as pulmonary embolism, pleural and/or pericardial irritations, hyperventilation, gastrointestinal reflux, and cholecystitis may also be responsible for chest pain [12]. In ED, early diagnosis of the disease is very much important and a challenge for appropriate treatment, but segregation of high-risk patients from low-risk patients or patients without any diseases is also very important because it consumes physician time and health care resources. So, patients should be early identified into high and low-risk groups and managed accordingly. Such as low-risk group patients should be clinically assessed, diagnosed, managed and discharged with or without medication and advice of follow-up, whereas high-risk group patients should be clinically assessed, diagnosed and admitted for further management or discharged with medications and with the advice of follow-up [13, 14]. Early risk assessment of MI patients presenting with chest pain in ED is very important. Therefore, different researchers work on the development of scoring systems for MI risk evaluation and distributing patients into low and high risk. Groups. Recently, several scoring systems are used either in ED or intensive care unit of cardiology for segregating patients of MI with high risk or low that helps in appropriate management [15, 16]. Some of the commonly used scoring systems are PURSUIT, TIMI, GRACE, FRISC Sanchis, Florence and HEART. The HEART risk score was developed in 2008. HEART score uses five parameters including the history of the patient, age, presence of risk factors, ECG and level of troponin for the final decision of MI [17]. In the current research, 244 patients presented with chest pain were evaluated and

distributed into two groups, i.e., the first group was a low-risk group having a HEART risk score between 0-3 with 122 patients and the second group with high risk having HEART risk score between 4-10 with 122 patients. Both group patients were evaluated for forty-eight hours and MI as Major Adverse Cardiac Event (MACE) was reported in only one (0.8%) patient in a low-risk group and MI as MACE was reported in 86 (70.5%) patients in the high-risk group. A similar study by Six *et al.*, reported the risk of MACE in 2.5%, 20.3% and 72.7% patients having HEART risk 0-3, 4-6 and ≥ 7 respectively [18]. Another study by Mahler *et al.*, reported a 0% risk of MACE in the low-risk group and a 22.7% risk of MACE in the high-risk group [19, 20]. Both groups' evaluation indicates that patients with HEART risk score 0-3 have a 0.8% risk of MACE so these patients should be early discharged with medication and advice of follow-up, whereas patients with HEART risk score 4-10 should not be discharged early from ED. They should be admitted to the hospital and carefully monitored and treated according to standard protocols.

CONCLUSIONS

It was concluded from the study that the HEART risk score is very much helpful as a diagnostic tool in patients with chest pain, presented in the emergency department. The HEART risk score helps segregate the patients into low and high risk of development of MACE. HEART score is very much helpful for a cardiologist in early diagnosis and selection of appropriate treatment. The most important advantages of the HEART risk score are its simplicity, quickness, easiness and reliability in predicting the MACE in patients presenting in ED with chest pain. Results of this study demonstrate that the HEART risk score substantially reduces healthcare utilization among patients with chest pain, presenting to the emergency department, without missing adverse cardiac events or increasing cardiac-related ED visits.

Authors Contribution

Conceptualization: AGR

Methodology: AGR, AA

Formal analysis: AGR

Writing-review and editing: AGR, AA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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