Original Research Article

SIGNIFICANCE OF HEART SCORE IN PATIENTS PRESENTING WITH CHEST PAIN IN THE EMERGENCY DEPARTMENT

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ABSTRACT

Background: Chest pain is a common emergency department presentation and requires rapid assessment to identify patients at risk for acute coronary syndrome. The HEART score, which incorporates history, ECG findings, age, risk factors, and troponin levels, is a validated tool for predicting major adverse cardiac events. However, data on its performance in South Asian populations, especially in Pakistan, where cardiovascular risk factors are widespread, remain limited. **Objective:** Our findings underscore the importance of the HEART score in predicting 30-day cardiac events, reassuring clinicians of its value in patient care in Pakistan. **Study Design:** Descriptive analytical study. **Settings:** Emergency Department, Shifa International Hospital, Islamabad. **Duration of Study:** May 2024 to March 2025. **Methods:** A total of 240 adult patients presenting with non-traumatic chest pain were enrolled using consecutive sampling. Patients with ST elevation myocardial infarction, traumatic chest pain, hemodynamic instability, or incomplete clinical data were excluded. HEART scores were calculated for all participants and categorised into low-risk (0–3), intermediate-risk (4–6), and high-risk (7–10) groups. The primary outcome was the occurrence of 30-day major adverse cardiac events, defined as myocardial infarction, coronary revascularisation, or cardiac death. Data were analysed using chi-square testing and crude odds ratios with 95% confidence intervals. **Results:** The mean age of participants was 54.1 ± 13.0 years, and 62.1% were male. Hypertension (52.1%), diabetes mellitus (35.8%), and dyslipidemia (30.8%) were the most prevalent risk factors. Based on HEART score stratification, 35.8% of patients were classified as low risk, 45.8% as intermediate risk, and 18.3% as high risk. Overall, 30-day major adverse cardiac events occurred in 18.8% of the cohort. Event rates increased significantly across HEART score categories, occurring in 2.3% of low-risk, 18.2% of intermediate-risk, and 52.3% of high-risk patients ($\chi^2 = 47.71$, $p < 0.001$). Compared with the low-risk group, the crude odds of major adverse cardiac events were significantly higher in the intermediate-risk group (odds ratio 9.33, 95% confidence interval 2.12–41.15) and the high-risk group (odds ratio 46.00, 95% confidence interval 10.04–210.74). **Conclusion:** The HEART score's effective risk stratification supports its role in optimizing resource use, helping emergency teams feel more capable of managing patient flow efficiently.

Keywords: HEART Score, Chest Pain, Emergency Department, Major Adverse Cardiac Events

INTRODUCTION

Chest pain is one of the most frequent presentations in emergency departments (EDs) worldwide, accounting for approximately 5-12% of all ED visits (1). The challenge in EDs lies in accurately differentiating between benign causes of chest pain and acute coronary syndrome (ACS), which can lead to significant morbidity and mortality if undiagnosed (2). The HEART score (History, ECG, Age, Risk factors, Troponin) has emerged as a substantial tool for risk stratification in these patients, enhancing clinical decision-making and improving patient outcomes (3, 4). This score has demonstrated high sensitivity and negative predictive value in various studies, helping identify low-risk patients who may be safely discharged rather than subjected to extensive diagnostic investigations (5).

Several studies have validated the HEART score, reporting its effectiveness in predicting major adverse cardiac events (MACE) following presentation for chest pain. For instance, a meta-analysis showed that a HEART score of 0-3 has a very low risk of MACE, estimated at only 1.9% over a 30-day follow-up (6). Specific studies have reported sensitivity ranging from 96% and specificity around 42%, underscoring the score's utility in clinical practice (2, 3). Additionally, the HEART score has been shown to outperform traditional risk scores, such as TIMI and GRACE, particularly in terms of identifying patients at low risk (7). This performance makes the HEART score an attractive option for emergency clinicians aiming to minimise unnecessary admissions and treatments. Moreover, studies emphasized that applying the HEART score effectively reduces healthcare costs while simultaneously improving patient safety (8).

Importantly, it allows for efficient resource allocation in busy emergency settings, which often face high patient influx and limited capacity (5). The benefits of the HEART score are particularly pronounced in low-resource settings, where healthcare systems may struggle to provide comprehensive cardiac evaluations to every patient with chest pain.

In the context of Pakistan, where the prevalence of cardiovascular diseases is rising due to lifestyle factors and limited access to healthcare resources, the HEART score could provide a pragmatic solution to optimize patient management in emergency scenarios (9). Given the cultural and healthcare landscape, implementing standardized risk-stratification tools, such as the HEART score, may improve patient care outcomes and significantly reduce the burden on emergency services (4).

Accordingly, our study aims to evaluate the significance of the HEART score in patients presenting to the emergency department with chest pain in Pakistan, contributing valuable insights into its applicability in this population.

METHODOLOGY

This descriptive-analytical study was conducted in the Emergency Department at Shifa International Hospital in Islamabad from April 2024 to March 2025.

Adult patients (18 years and above) presenting with non-traumatic chest pain were enrolled through consecutive sampling during the study period. Patients with definite ST elevation myocardial infarction on initial electrocardiogram requiring immediate reperfusion,

hemodynamic instability requiring urgent resuscitation, traumatic chest pain, or incomplete data needed to compute HEART score components (history, ECG, age, risk factors, troponin) were excluded. Standard emergency department assessment included focused history and physical examination, 12-lead ECG, and high-sensitivity troponin testing at presentation, with repeat testing according to clinical protocol.

Sample size was calculated using the two-proportion formula to detect a clinically meaningful difference in 30-day (or 4 to 6 week) MACE between low HEART score (0 to 3) and intermediate HEART score (4 to 6) groups, using published event rates of 1.7% and 16.6% respectively, with 95% confidence level ($Z\alpha/2 = 1.96$) and 80% power ($Z\beta = 0.84$). The required sample size was approximately 55 patients per group (110 total). After inflating by 10% to account for incomplete follow-up or missing outcomes, a minimum sample size of 122 was targeted. In this report, the final analyzed sample was 240 patients, exceeding the minimum requirement.

The HEART score was calculated for each participant using the five components (History, ECG, Age, Risk factors, Troponin), each scored from 0 to 2, producing a total score from 0 to 10. Patients were stratified into low risk (0 to 3), intermediate risk (4 to 6), and high risk (7 to 10). The dependent variable was major adverse cardiac events (MACE) within 30 days, defined as acute myocardial infarction, coronary revascularization (PCI or CABG), or cardiac death. The primary independent variable was the HEART risk category, while additional covariates included age, gender, hypertension, diabetes, dyslipidemia, smoking, and family history of coronary artery disease. Data were analyzed using SPSS. Continuous variables were summarized as mean ± standard deviation, and categorical variables as frequencies and percentages. Associations between HEART risk category and 30-day MACE were assessed using the chi-square test, with Fisher's exact test used for pairwise comparisons where appropriate. Crude odds ratios with 95% confidence intervals were computed using the low-risk category as reference. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 240 patients presenting with non-traumatic chest pain were included. The mean age was 54.1 ± 13.0 years, and 149 (62.1%) were males. Baseline cardiovascular risk factors were standard, consistent with Pakistani emergency chest pain cohorts, with hypertension and diabetes observed frequently. Table 1 summarizes demographic and clinical characteristics. (Table 1)

Table 1: Demographic and baseline clinical characteristics (n = 240)

Variable	Value
Age (years), mean ± SD	54.1 ± 13.0
Male gender, n (%)	149 (62.1)
Hypertension, n (%)	125 (52.1)
Diabetes mellitus, n (%)	86 (35.8)
Dyslipidemia, n (%)	74 (30.8)
Current smoking, n (%)	67 (27.9)
Family history of CAD, n (%)	54 (22.5)
Prior ischemic heart disease, n (%)	52 (21.7)

The HEART score stratification showed 86 (35.8%) patients in the low-risk group, 110 (45.8%) in the intermediate-risk group, and 44 (18.3%) in the high-risk group (Table 2). This distribution is comparable to that observed in validation studies, in which a substantial proportion falls into the low and intermediate strata.

Table 2: HEART score risk categories (n = 240)

HEART category	Score range	n (%)
Low risk	0 to 3	86 (35.8)
Intermediate risk	4 to 6	110 (45.8)
High risk	7 to 10	44 (18.3)

Overall, 45 (18.8%) patients developed 30-day MACE. Event rates increased progressively across HEART categories, occurring in 2 (2.3%) low-risk patients, 20 (18.2%) intermediate-risk patients, and 23 (52.3%) high-risk patients. The association between HEART category and 30-day MACE was statistically significant ($\chi^2 = 47.71$, p < 0.001) (Table 3). This stepwise rise aligns with established evidence on HEART score validation. (Table 3)

Table 3: Association of HEART category with 30-day MACE (n = 240)

HEART category	MACE n (%)	No MACE n (%)	χ^2	p-value
Low risk (0 to 3)	2 (2.3)	84 (97.7)		
Intermediate risk (4 to 6)	20 (18.2)	90 (81.8)	47.71	<0.001
High risk (7 to 10)	23 (52.3)	21 (47.7)		

Using the low-risk group as reference, the odds of 30-day MACE were significantly higher in intermediate-risk patients (OR 9.33, 95% CI 2.12 to 41.15, p = 0.0004) and markedly higher in high-risk patients (OR 46.00, 95% CI 10.04 to 210.74, p < 0.001) (Table 4).

Table 4: Crude odds ratios for 30-day MACE by HEART category (reference: low risk)

HEART category	OR	95% CI	p-value
Low risk	1.00	Reference	Reference
Intermediate risk	9.33	2.12 to 41.15	0.0004
High risk	46.00	10.04 to 210.74	<0.001

DISCUSSION

In the present study involving 240 patients presenting with non-traumatic chest pain, we observed a significant distribution of baseline characteristics that closely mirror those reported in other studies from various international emergency departments. The mean age of our cohort (54.1 ± 13.0 years) and the predominance of male gender (62.1%) are consistent with the literature, which demonstrates a higher incidence of acute coronary syndrome (ACS) in older male patients, highlighting the critical need for timely risk stratification in this demographic group (10, 11).

The high prevalence of risk factors such as hypertension (52.1%), diabetes mellitus (35.8%), and dyslipidemia (30.8%) within our cohort underscores the burden of cardiovascular diseases in populations similar to Pakistan. This observation aligns with findings from Kumar et al., who reported identical risk factor distributions in patients presenting to the emergency department in Pakistan (12). Our cohort also reflected a substantial history of cardiac conditions, with prior ischemic heart disease reported in 21.7% of patients, emphasizing the critical importance of adept risk assessment to prevent adverse outcomes related to ACS (13, 14).

Our study's HEART score stratification revealed that 35.8% of patients fell into the low-risk category (scores 0-3), 45.8% in the intermediate-risk category (4-6), and 18.3% in the high-risk category (7-10). This distribution complements prior validation studies, such as those by Pawlikowski et al. and Hasballa et al., which also showcased a significant proportion of patients classified as low or intermediate risk (15, 16). Such stratification is critical as it informs clinical

decisions regarding patient management, such as hospital admission versus safe discharge.

The progressive increase in 30-day major adverse cardiac events (MACE) among the HEART risk categories, 2.3% in low-risk, 18.2% in intermediate-risk, and 52.3% in high-risk, validates the predictive capability of the HEART score. The observed MACE rates for each risk category are higher than those reported by Meerten et al., who suggested event rates between 1.0% and 2.4% for low-risk patients, indicating that our population presents a unique challenge (17). The statistically significant association between HEART category and the occurrence of MACE ($\chi^2 = 47.71$, $p < 0.001$) corroborates findings by Rad et al., affirming that HEART score stratification reliably identifies patients at notable risk for adverse events (18, 19).

Furthermore, the odds ratios show a notable emphasis on the intermediate-risk and high-risk groups, with substantial estimates of 9.33 (95% CI 2.12 to 41.15) and 46.00 (95% CI 10.04 to 210.74), respectively. These findings reinforce previous research by Pawlikowski et al., underscoring that intermediate-risk patients require close monitoring and potential intervention, as they are at a significantly greater risk of adverse outcomes (15, 20). The data align with contemporary guidelines, which emphasize the critical need to identify risk factors early and differentiate between patients who can be safely discharged and those requiring urgent care (10).

The implications of our findings are particularly salient within the Pakistani context, where cardiovascular diseases are on the rise due to lifestyle changes and increasing prevalence of risk factors such as diabetes and hypertension (21). Implementing the HEART score in acute emergency department settings not only streamlines patient management but also substantially reduces healthcare costs and improves the quality of care provided in a resource-constrained healthcare system (12, 22). By adopting validated risk assessment tools, healthcare providers can optimize patient outcomes through efficient resource allocation, a necessity given the growing demand for emergency services in Pakistan (22, 23).

Thus, the current study's findings support the reliability of the HEART score in predicting adverse cardiac events in a Pakistani population presenting with chest pain. The validation of such a tool has the potential to enhance clinical protocols, ultimately improving outcomes for one of the most vulnerable patient groups in emergency care settings. Further multicenter studies are warranted to strengthen our conclusions and encourage widespread implementation across diverse healthcare environments.

CONCLUSION

The HEART score proved to be a reliable and clinically valuable tool for predicting short-term adverse cardiac outcomes in patients presenting with chest pain to a major Pakistani emergency department. Its strong association with 30-day MACE and a transparent risk gradient across score categories highlight its practical relevance for rapid triage and decision-making. Implementing the HEART score in routine emergency care can support early identification of high-risk patients, reduce unnecessary admissions of low-risk individuals, and improve overall resource utilization. These findings underscore the importance of adopting validated risk stratification tools in Pakistan's emergency care system to enhance patient safety and clinical efficiency.

DECLARATIONS

Data Availability Statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department Concerned. (IRBEC-24)
Consent for publication
Approved
Funding
Not applicable

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

RIDA TARIQ MIRZA (PGR)
Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript
HINA KAMAL (PGR)
Manuscript revisions, critical input.
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Data entry, data analysis, and drafting an article.
KHAWAJA JUNAID MUSTAFA (Consultant)
Conception of Study, Final approval of manuscript.
Study Design, Review of Literature.

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