Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Medicine

A Comparative Study on the Heart Score with Emergency Department Assessment of Chest Pain Score (EDACS) in Prediction of MACE (Major Adverse Cardiac Events) Among Patients Presenting With Undifferentiated Chest Pain in North Indian Setting

Dr. MC Srivastava[1], Dr. Shriwastav Ashish Shrikrishana[2*], Dr. Santosh Kumar Chaubey[3]

[1]Associate Professor, Department of Medicine, Prasad Institute of Medical Sciences, Sarai Shahzaidi, Banthra, Lucknow, UP, India
[2]Assistant Professor Department of Medicine, Prasad Institute of Medical Sciences, Sarai Shahzaidi, Banthra, Lucknow, UP, India
[3]Junior Resident, Department of Surgery, Prasad Institute of Medical Sciences, Sarai Shahzaidi, Banthra, Lucknow, UP, India

DOI: 10.36347/sjams.2021.v09i08.011 | **Received:** 15.07.2021 | **Accepted:** 19.08.2021 | **Published:** 23.08.2021

***Corresponding author:** Dr. Shriwastav Ashish Shrikrishana

Abstract **Original Research Article**

Objective: To compare the heart score with emergency department assessment of chest pain score (EDACS) in prediction of MACE (Major Adverse Cardiac Events) among patients presenting with undifferentiated chest pain in north Indian setting. ***Methods:*** This study was conducted in the Department of Medicine, Prasad Institute of Medical Sciences. Lucknow. The study was approved by the Ethical Committee of the Institute. The consent was taken from each participant before including in the study. All patients presenting to Emergency department with undifferentiated chest pain were included in the study. A total of 118 patients were included in the study. ***Results:*** About one third of patients were below 50 years of age (35.6%) followed by 61-70 (34.7%) and 50-60 (29.7%) years. The mean age of patients was 58.33±12.86 years. Majority of patients were males (71.2%). The incidence of MACE was 53.4%. Both HEART and EDACS score were significantly ($p<0.01$) higher among patients whom MACE was present than absent. HEART score>5 correctly predicted 39% MACE cases with sensitivity and specificity of 73% and 49.1% respectively. However, EDACS score>16 correctly predicted 40.7% MACE cases with sensitivity and specificity of 76.2% and 54.5% respectively. ***Conclusion:*** This study shows that HEART and EDACS scores have good sensitivity in predicting MACE at the emergency department. The HEART and EDACS scores for chest pain patients at the emergency department provides the clinician with a quick and reliable predictor of outcome shortly after arrival of the patient, without computer-required calculating. In patients with high HEART scores (7-10) the high risk of MACE may indicate more aggressive policies.

Key words: Emergency department, HEART score, EDACS score, MACE.

INTRODUCTION

Chest pain is a common presenting symptom in the emergency department (ED). Many chest pain patients are admitted to the hospital due to the possibility of life threatening conditions, such as acute myocardial infarction (AMI). It is however, not feasible to admit all chest pain patients due to limited healthcare resources. Therefore, distinguishing acute coronary syndrome (ACS) from other cardiac and non-cardiac diseases is crucial. It is essential to quickly and accurately identify patients who are at high and low risk of developing major adverse cardiac events (MACE) in order to optimally allocate ED and hospital resources (Long *et al*., 2017; Backus *et al*., 2011).

Risk stratification of ED chest pain patients has been extensively studied in recent years. However, there is currently no widely accepted risk stratification method for ED chest pain patients. Initial ED risk scores were adopted from those created for post-ACS risk stratification such as the Thrombolysis in Myocardial Infarction (TIMI) score and the Global Registry of Acute Coronary Events (GRACE) score, among others. However, because these risk scoring tools were not specifically designed for ED chest pain patients, their performance in the ED has been marginal (Sakamoto *et al.*, 2016; Hollander *et al.*, 2016).

Given the relatively low yield of this historic approach to possible ACS, researchers have created risk scores to identify patients at low risk of major adverse cardiac events (MACE). Among these, the modified History, Electrocardiogram, Age, Risk factors and Troponin (HEART) score and the Emergency

Department Assessment of Chest pain Score (EDACS), both of which treat abnormal troponin values as independent, non–low-risk factors, stand out with the best specificities (ranging from 40% to 60%) in achieving negative predictive value (NPV) estimates >99% for 30- to 45-day MACE, specifically when applied alongside accelerated diagnostic protocols employing cardiac troponin I (cTnI) measurement at ED arrival and 2 to 3 h later. Used in this fashion, both scores have demonstrated improvements in operational efficiency and downstream resource utilization (Than *et al*., 2016; Flaws *et al*., 2016).

This study was conducted to compare the heart score with emergency department assessment of chest pain score (EDACS) in prediction of MACE (Major Adverse Cardiac Events) among patients presenting with undifferentiated chest pain in north Indian setting.

MATERIAL AND METHODS

This study was conducted in the Department of Medicine, Prasad Institute of Medical Sciences. Lucknow. The study was approved by the Ethical Committee of the Institute. The consent was taken from each participant before including in the study. All patients presenting to Emergency department with undifferentiated chest pain were included in the study. A total of 118 patients were included in the study.

Patients with non-traumatic chest pain coming to the emergency department were prospectively assessed on demographic characteristics of patients (age and gender) their signs, symptoms and physical examination. These data included all factors recorded for calculating HEART Score and EDACS Score. It included: age, gender, history of patient, ECG changes, risk factors (diabetes mellitus, diagnosed hypertension, hypercholesterolaemia, family history of coronary artery disease and obesity), symptoms (diaphoresis, radiation to arm or shoulder) and blood test (cardiac enzymes).

STATISTICAL ANALYSIS

All the analysis was carried out on SPSS 16.0 version (Chicago, Inc., USA). The results are presented in frequencies, percentages and mean±SD. The Unpaired t-test was used to compare continuous variables and Chi-square test was used to compare categorical variables. The receiving operating curve (ROC) analysis was carried out. The area under the curve (AUC) with its 95% confidence interval (CI) was calculated. The sensitivity, specificity, positive predictive value (PPV) and negative positive predictive value (NPV) with its 95% CI was calculated. The p-value<0.05 was considered significant.

RESULTS

About one third of patients were below 50 years of age (35.6%) followed by 61-70 (34.7%) and 50-60 (29.7%) years. The mean age of patients was 58.33±12.86 years. Majority of patients were males (71.2%) (Table-1) The incidence of MACE was 53.4% (Table-2).

Both HEART and EDACS score were significantly (p<0.01) higher among patients whom MACE was present than absent (Table-3).

HEART score>5 correctly predicted 39% MACE cases with sensitivity and specificity of 73% and 49.1% respectively. However, EDACS score>16 correctly predicted 40.7% MACE cases with sensitivity and specificity of 76.2% and 54.5% respectively (Table-4 & Fig.1).

Table-1: Age and sex distribution of patients

Age and sex	No. (n=118)	%
Age in years		
<50	42	35.6
50-60	35	29.7
61-70	41	34.7
Mean±SD	58.33±12.86	
Sex		
Male	84	71.2
Female	34	28.8

Table-2: Distribution of incidence of MACE

MACE	No. (n=118)	%
Present	63	53.4
Absent	55	46.6

Table-3: Comparison of HEART score and EDACS score with MACE

Scores	MACE		p-value[1]
	Present	Absent	
HEART score	6.350±1.53	5.58±1.55	0.002*
EDACS score	20.70±6.42	15.67±5.68	0.001*

[1]Mann-Whitney U test, *Significant

Table-4: Predictive value of HEART and EDACS score in predicting MACE

HEART score cutoff	MACE				Total	
	Present		Absent			
	No.	%	No.	%	No.	%
HEART score cutoff						
>5	46	39.0	28	23.7	74	62.7
≤5	17	14.4	27	22.9	44	37.3
Total	63	53.4	55	46.6	118	100.0
Predictive values, % (95%CI)						
AUC	0.66 (0.56-0.76), p=0.002*					
Sensitivity	73.0 (62.1-84.0)					
Specificity	49.1 (35.9-62.3)					
PPV	62.2 (51.1-73.2)					
NPV	61.4 (47.0-75.8)					
EDACS score						
EDACS score cutoff						
>16	48	40.7	25	21.2	73	61.9
≤16	15	12.7	30	25.4	45	38.1
Total	63	53.4	55	46.6	118	100.0
Predictive values, % (95%CI)						
AUC	0.72 (0.63-0.81), p=0.0001*					
Sensitivity	76.2 (65.7-86.7)					
Specificity	54.5 (41.4-67.7)					
PPV	65.8 (54.9-76.6)					
NPV	66.7 (52.9-80.4)					

*Significant

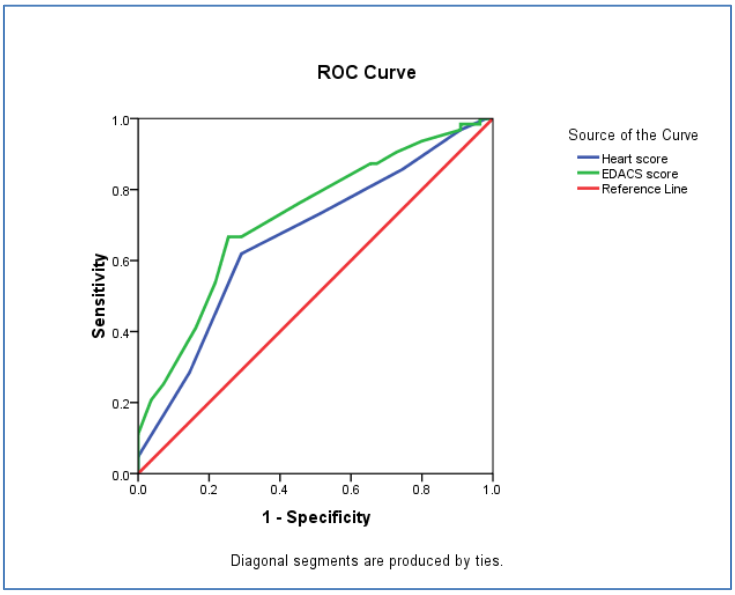

Fig-1: ROC curve showing sensitivity and specificity of HEART and EDACS score in predicting MACE

DISCUSSION

Up to 6.3% of emergency department (ED) visits are related to chest pain. An urgent question in these patients is whether they have an acute coronary syndrome (ACS), as any delay in diagnosis and treatment can have a negative impact on their prognosis (Thygesen *et al*., 2012).

Normal values of troponin and a normal electrocardiogram (ECG) still do not exclude ACS completely. As a result, many patients presenting with chest pain are currently hospitalized and extensively evaluated with non-invasive stress testing or imaging, or with an invasive coronary angiography. However, of all chest pain patients 25% have an ACS. If patients at low risk for ACS could be recognized early in the diagnostic process, it has the potential to reduce patient burden, length of stay at the ED, frequency of hospitalization and costs (Six *et al*., 2012; Hoffmann *et al*., 2012).

This study found that about one third of patients were below 50 years of age (35.6%) followed by 61-70 (34.7%) and 50-60 (29.7%) years. The mean age of patients was 58.33±12.86 years. Majority of patients were males (71.2%). In the study by Mark *et al*. (2018), 42.70% were males and the median age was 59 years. Poldervaart *et al*. (2016) found that the mean age of these patients was 62 years and 54% were male.

The incidence of MACE was 53.4% in the present study. Stopyra et al. (2018) observed that a MACE at 30 days was present in 10.7% (85/794) of patients with 12 deaths (1.5%), 66 MIs (8.3%), and 12 coronary revascularizations without MI (1.5%). Mark *et al*. (2018) reported that the overall 60-day MACE rate was 1.94%, whereas the overall 60-day MACE plus rate was 3.69%.

The current study observed that both HEART and EDACS score were significantly ($p<0.01$) higher among patients whom MACE was present than absent.

The use of the HEART score for chest pain patients at the emergency department provides the clinician with a reliable predictor of outcome, very soon after the arrival of the patient, based on already available clinical data and without computer-required calculating (Backus *et al*., 2013).

In the present study, HEART score >5 correctly predicted 39% MACE cases with sensitivity and specificity of 73% and 49.1% respectively. However, EDACS score>16 correctly predicted 40.7% MACE cases with sensitivity and specificity of 76.2% and 54.5% respectively. The favorable results of this validation study confirm other previous retrospective evaluation studies (Six *et al*., 2008; Backus *et al*., 2010). Fernando *et al*. (2019) showed that a HEART score above the low- risk threshold (≥4) had a sensitivity of 95.9% (95% confidence interval [CI] = 93.3%–97.5%) and specificity of 44.6% (95% CI = 38.8%–50.5%) for MACE. A high- risk HEART score (≥7) had a sensitivity of 39.5% (95% CI = 31.6%–48.1%) and specificity of 95.0% (95% CI = 92.6%–96.6%) for MACE. In another study (Stopyra *et al*., 2018), the modified HEART score identified 33.2% (264/794) of patients as low risk. Among low-risk patients, 1.9% (5/264) had MACE (two MIs and three revascularizations without MI). The sensitivity and NPV for 30-day MACE was 94.1% (95% CI, 86.8-98.1) and 98.1% (95% CI, 95.6-99.4), respectively.

The HEART score's strength is that all five variables included in the score are derived from clinical practice which makes it simple to calculate the score at the bedside, improving applicability for physicians. Interestingly, the HEART score was not developed using mathematical modelling from real-life data, but developed by a cardiologist based on clinical experience and later on validated in clinical databases (Six *et al*., 2008). A limitation of the HEART score is the subjectivity of the first element, (i.e. whether history taking indicates ACS), although it is widely accepted that this is a clinically relevant element. Furthermore, the score uses a cut-off of 1.7% as being "low risk", which can arguably be too high in some countries (Than *et al*., 2013).

CONCLUSION

This study shows that HEART and EDACS scores have good sensitivity in predicting MACE at the emergency department. The HEART and EDACS scores for chest pain patients at the emergency department provides the clinician with a quick and reliable predictor of outcome shortly after arrival of the patient, without computer-required calculating. In patients with high HEART scores (7-10) the high risk of MACE may indicate more aggressive policies.

REFERENCES

- Backus, B. E., Six, A. J., Kelder, J. C., Bosschaert, M. A. R., Mast, E. G., Mosterd, A., ... & Doevendans, P. A. (2013). A prospective validation of the HEART score for chest pain patients at the emergency department. *International journal of cardiology*, *168*(3), 2153-2158.
- Backus, B. E., Six, A. J., Kelder, J. C., Mast, T. P., van den Akker, F., Mast, E. G., ... & Doevendans, P. A. (2010). Chest pain in the emergency room: a multicenter validation of the HEART Score. *Critical pathways in cardiology*, *9*(3), 164-169.
- E Backus, B., J Six, A., H Kelder, J., B Gibler, W., L Moll, F., & A Doevendans, P. (2011). Risk scores for patients with chest pain: evaluation in the emergency department. *Current cardiology reviews*, *7*(1), 2-8.
- Fernando, S. M., Tran, A., Cheng, W., Rochwerg, B., Taljaard, M., Thiruganasambandamoorthy, V., ... & Perry, J. J. (2019). Prognostic accuracy of the HEART score for prediction of major adverse cardiac events in patients presenting with chest pain: a systematic review and meta-analysis. *Academic Emergency Medicine*, *26*(2), 140-151.
- Flaws, D., Than, M., Scheuermeyer, F. X., Christenson, J., Boychuk, B., Greenslade, J. H., ... & Cullen, L. (2016). External validation of the emergency department assessment of chest pain score accelerated diagnostic pathway (EDACS-ADP). *Emergency Medicine Journal*, *33*(9), 618-625.
- Hoffmann, U., Truong, Q. A., Schoenfeld, D. A., Chou, E. T., Woodard, P. K., Nagurney, J. T., ... & Udelson, J. E. (2012). Coronary CT angiography versus standard evaluation in acute chest pain. *New England Journal of Medicine*, *367*(4), 299-308.

- Hollander, J. E., Than, M., & Mueller, C. (2016). State-of-the-art evaluation of emergency department patients presenting with potential acute coronary syndromes. *Circulation*, *134*(7), 547-564.
- Jaffe, A. S. (2012). Third universal definition of myocardial infarction. *Clinical biochemistry*, *46*(1-2), 1-4.
- Long, B., & Koyfman, A. (2016). Best clinical practice: current controversies in evaluation of low-risk chest pain—part 1. *The Journal of emergency medicine*, *51*(6), 668-676.
- Mark, D. G., Huang, J., Chettipally, U., Kene, M. V., Anderson, M. L., Hess, E. P., ... & Kaiser Permanente CREST Network Investigators. (2018). Performance of coronary risk scores among patients with chest pain in the emergency department. *Journal of the American College of Cardiology*, *71*(6), 606-616.
- Poldervaart, J. M. (2016). *Risk stratification in chest pain patients* (pp. 1-187). Utrecht University.
- Sakamoto, J. T., Liu, N., Koh, Z. X., Fung, N. X. J., Heldeweg, M. L. A., Ng, J. C. J., & Ong, M. E. H. (2016). Comparing HEART, TIMI, and GRACE scores for prediction of 30-day major adverse cardiac events in high acuity chest pain patients in the emergency department. *International journal of cardiology*, *221*, 759-764.
- Six A.J., Backus B.E., Kelder J.C (2008). Chest pain in the emergency room: value of the HEART score, Neth. *Heart J. 16* (6): 191–196.
- Six, A. J., Backus, B. E., Kingma, A., & Kaandorp, S. I. (2012). Consumption of diagnostic procedures and other cardiology care in chest pain patients after presentation at the emergency department. *Netherlands Heart Journal*, *20*(12), 499-504.
- Stopyra, J. P., Harper, W. S., Higgins, T. J., Prokesova, J. V., Winslow, J. E., Nelson, R. D., ... & Mahler, S. A. (2018). Prehospital modified heart score predictive of 30-day adverse cardiac events. *Prehospital and disaster medicine*, *33*(1), 58-62.
- Stopyra, J. P., Harper, W. S., Higgins, T. J., Prokesova, J. V., Winslow, J. E., Nelson, R. D., ... & Mahler, S. A. (2018). Prehospital modified heart score predictive of 30-day adverse cardiac events. *Prehospital and disaster medicine*, *33*(1), 58-62.
- Than, M. P., Pickering, J. W., Aldous, S. J., Cullen, L., Frampton, C. M., Peacock, W. F., ... & Lord, S. J. (2016). Effectiveness of EDACS versus ADAPT accelerated diagnostic pathways for chest pain: a pragmatic randomized controlled trial embedded within practice. *Annals of emergency medicine*, *68*(1), 93-102.
- Than, M., Herbert, M., Flaws, D., Cullen, L., Hess, E., Hollander, J. E., ... & Jaffe, A. (2013). What is an acceptable risk of major adverse cardiac event in chest pain patients soon after discharge from the Emergency Department?: a clinical survey. *International journal of cardiology*, *166*(3), 752-754.