COMPARATIVE ANALYSIS OF VARIOUS RISK ASSESSMENT SCORES FOR LOW RISK ACUTE CORONARY SYNDROME IN AN INDIAN SCENARIO – AN ED BASED OBSERVATIONAL STUDY.

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Abstract:

Chest pain is one of the most common presentation to emergency department (ED). The misdiagnosis or over-diagnosis of patients with acute chest pain can be associated with serious clinical events or is time-consuming and this places a heavy burden on overcrowded and resource constraint ED. To help overcome this issue various scores are formed to rule out acute coronary syndrome (ACS) in these patients. Those who do not meet the criteria of high risk ACS like raised cardiac biomarkers, ECG changes, etc are labeled as low risk ACS. These patients form the majority of patients. A multitude of risk score have been formulated to predict the outcome and risk stratify patients with chest pain. Our objective was to evaluate the utility of these score in Indian setting in low risk ACS patients.

We studied the various risk prediction score of 100 patients presenting to the ED of tertiary care teaching institute in an urban industrial area with low risk ACS. The scores that were calculated included HEART, TIMI, ADAPT, GRACE, NACPR and EDACS.

Of all the scores only the HEART score correlated well with identifying those who required further testing. Taking a score of less than 3 as a marker of low risk ACS we get a sensitivity of 95.83% (95CI - 89.67% to 98.85%) and specificity of 100%. The PPV is 100% and accuracy of 96%. All other scores were either not specific enough or had limited utility.

Keywords: Low risk ACS, ACS, HEART, TIMI, ADAPT, GRACE, NACPR, EDACS

Introduction:

One of the most common presentations at ED is the patients complaining of acute onset chest pain. Of these patients 7% will have ACS with 6%-10% having positive cardiac biomarkers at initial contact.^[1] Rest of the patients is labeled as low probability or low risk ACS who may require further evaluation.

Considering the sheer number of patients presenting with chest pain to ED it becomes a nightmare for the emergency physician to precisely identify patients with everything normal but a possibility of turning out to be ACS later. Admitting a patient who has every investigation and examination normal at presentation significantly increases cost and also has a psychological burden to the patient. On the other hand missing a diagnosis of ACS in such patients and letting them go is even a bigger nightmare. There is a lot of diagnostic uncertainty in the history provided by the patients. Initial evaluation findings are seldom positive. To help identify patients requiring further management risk stratification scores and accelerated diagnostic protocols (ADP) have been

generated and successfully implemented in various studies across the globe. Various guidelines have been formulated to incorporate these ADP. The most commonly used of these scores are HEART (History, ECG, Age, Risk factors and Troponin), TIMI(Thrombolysis In Myocardial Infarction), GRACE(Global Registry of Acute Coronary Events), NACP(North America Chest Pain Rule), ADAPT(Accelerated Diagnostic protocol to Access Patients with chest pain using contemporary Troponin as the only biomarker), EDACS(Emergency Department Assessment of Chest pain Score), etc. In the resource constraint Indian scenario the biggest dilemma of emergency physicians is to successfully rule in patients without high probability ACS. Although guidelines for management of low risk chest pain are provided these are largely limited due to the lack of validation studies and limited information related to the Indian patients.^[2]

We studied the utility and the predictive value of the most commonly used scores in our study. It may be noted that all the scores incorporate ECG changes and cardiac biomarkers in the decision making

process. As the patients with low risk ACS already have a negative ECG and cardiac biomarkers are not raised the total score value decreases.

Concise information of the commonly used scores is tabulated in table 1

Table 1:

Sr. no	Risk score	Components	Sub components	Points given	Criteria for low risk ACS/total score
1	HEART	History	Highly suspicious	2	≤3
			Moderately suspicious	1	
			Slightly suspicious	0	
		ECG	ST depression	2	
			Nonspecific	1	
			Normal	0	
		Age in years	≥65	2	
			45-65	1	
			≤45	0	
		Risk factors	≥3	2	
			≤1-2	1	
		Troponin	Positive	1	
			Negative	0	
2	TIMI	Age	≥65	1	0
		Risk factors	≥3	1	
		Coronary stenosis ≥50%	1		
		Aspirin use within 7 days	1		
		Elevated cardiac biomarkers	1		
		≥2 anginal events in 24 hrs	1		
		ST segment deviation of ≥0.05mv on ECG	1		
3	GRACE	Age	Graded from 0-258		≤72
		Heart rate			
		Systolic blood pressure			
		Creatinine level			
		Killip class			
		ST depression on ECG			
		Elevated cardiac biomarkers			
4	ADAPT	Cardiac arrest on presentation			No positive score
		TIMI score ≥1	Positive score		
		Ischemic changes on ECG	Positive score		
5	NACPR	Elevated troponin	Positive score		No positive score
		Ischemic ECG	Positive score		
		History of CAD	Positive score		
		Pain typical for ACS	Positive score		
		Initial and 6hr troponin	Positive score		
6	EDACS	Age >50 years	Positive score		<16 with no new ischemia on ECG and negative biomarkers
		Age	Variable from 2-20		
			Known CAD	4	
			≥3 risk factors		
		Symptoms	Diaphoresis	3	
			Radiation of pain	5	
			Pain with inspiration	-4	

Pain on palpation -6

Table 2. Risk Assessment Scores for Evaluating Low-Risk Chest Pain in the ED^[3]

Most computer algorithms, risk scores, and clinical decision rules have been unsuccessful at identifying a very-low-risk (<2%) cohort that does not require further testing. The HEART score is one tool that identifies low-risk patients who are eligible for evaluation and possible early discharge home from the ED. 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. The HEART score facilitates communication, and it can be used as a guidance to correctly place patients into low, intermediate and high risk groups. Although other scores like TIMI and GRACE scores are already recommended by European and American guidelines; these scores were specifically generated from data of patients with acute coronary syndromes. Contrary to this the HEART score is generated for a wider population presenting with chest pain that may or may not have ACS. HEART score has better utility in emergency department as it takes into account history, relatively easy to calculate and helps in proper management of the patients. ^[4]

Methods

A cohort of 100 patients presenting to the emergency department of a tertiary teaching institute belonging to age 18 years to 80 years was taken for the study. IEC clearance for the study was obtained before the start of study. Inclusion criteria included patients who were having acute onset chest pain of less than 3 days duration with normal or near normal ECG and negative initial biomarkers. Patients with other significant diagnosis were excluded. Patients with non-cardiac chest pain and with other symptoms like fever, cough, etc were also excluded. Patients who had history of trauma or were critically ill were not included in the study. Data was entered in Microsoft excel and analyzed accordingly. Statistic calculations were done with the help of online application from medcalc.com. As this was a completely observational study the normal course of treatment of patients was studied.

Funding

All the costs regarding the treatment were born by patients themselves.

RESULTS

A total of 100 patients were studied and 4 of them were diagnosed with ACS during their evaluation in hospital. Various risk scores were calculated initially and the endpoint of the study was either the diagnosis of ACS or ruling out the same on further evaluation. Most of the patients presenting with chest pain and a possibility of low probability acute coronary syndrome had low score on all risk scores.

Table 2:

Score	Cutoff	Sensitivity % (CI)	Specificity % (CI)	+LR (CI)	-LR (CI)	PPV(CI)	NPV(CI)	Accuracy % (CI)
HEART	≤3	95.8 (89.67-99.85)	100 (39.76-100)	-	0.04 (0.02-0.11)	100	50 (24.7-72.3)	96 (90.07-98.9)
TIMI	0	84.38 (75.54-90.98)	50 (6.76-93.24)	1.69 (0.63-4.51)	0.31 (0.11-0.92)	97.59 (93.81-99.09)	11.76 (4.31-28.29)	83 (74.18-89.77)
GRACE	≤72	88.54(80.42-94.14)	25 (0.63-80.59)	1.18 (0.67-2.09)	0.46 (0.08-2.73)	96.59 (94.12-98.04)	8.33 (1.5-35.17)	86 (77.63-92.19)
ADAPT	0	84.38 (75.54-90.98)	50 (6.76-93.24)	1.69 (0.63-4.51)	0.31 (0.11-0.92)	97.59 (93.81-99.09)	11.76 (4.31-28.29)	83 (74.18-89.77)
NACPR	0	93.75 (86.89-97.67)	75 (19.41-99.37)	3.75 (0.69-20.49)	0.08 (0.03-0.22)	98.9 (94.28-99.8)	33.33 (16.08-56.62)	93 (86.11-97.14)
EDACS	<16	96.88 (91.14-99.35)	25 (0.63-80.59)	1.29 (0.73-2.28)	0.12 (0.02-0.95)	96.88 (94.62-98.2)	25 (4.19-71.74)	94 (87.4-97.77)

Table 3. Statistical values of various scores to rule in low risk ACS

CI - confidence interval

Of all the scores only the HEART score correlated well with identifying those with high risk. Taking a score of less than 3 as a marker of low risk ACS we get a sensitivity of 95.83% (95CI-89.67% to 98.85%) and specificity of 100%. The positive predictive value is 100% and accuracy of 96%. As this score has been specifically created for patients presenting to ED it can be easily applied with certainty. It is the only score which incorporates nonspecific ECG changes which can help in scoring patients non-ischemic findings on ECG. Inclusion of serial biomarkers as in HEART pathways score increases the sensitivity as happened with our patients who turned out to be ACS during the stay in hospital. EDACS score was the next best score to rule in low risk ACS in patients presenting to ED with cardiac type of chest pain.

DISCUSSION

In a prospective observational evaluation of 100 patients presenting to ED with acute onset chest pain and normal or near normal ECG with negative initial cardiac biomarkers, HEART score stood out to be the most sensitive and specific risk assessment score to rule in low risk ACS. In a retrospective cohort study done by Simon et al^[5], similar results were obtained. Other scores like TIMI and also scores based on TIMI such as ASPECT, ADAPT, etc are designed for those with inpatient status or patients who have undergone previous evaluation. These scores have limited utility in the ED. Similarly GRACE score also requires a lot of variables and is cumbersome to calculate in ED setting. EDACS specifically developed for patients attending the ED is a relatively easy score to calculate but as shown in our study it has limited utility in those with low risk ACS. This score uses pain characteristics to rule out ACS from other causes of chest pain mostly muscular in nature. But in those patients who do not have an obvious muscular ache or tenderness it was found inferior to HEART score. Our finding correlates well with other studies based on HEART score like the one published by Mahler et al^[6] in 2015 which specifically tested the utility of HEART pathway for early discharge of the patients. In this study HEART pathway successfully decreased the inpatient time and was highly specific. The salient feature of our study was that we have specifically taken patients who were at low risk of ACS and were followed for the outcome of ACS. No similar studies have been done and this study takes a different perspective of the situation. All previous studies tried to rule out low risk ACS and rule in ACS. So the difference here was that we were trying to diagnose patients with low risk. This is important as the bulk of the patients is formed by these individuals and having a keen observation will help us decrease cost as well as decide disposition of such patients. A comparison of statistical findings pertaining to risk scores from various studies is depicted in table 4. As advocated in all these studies HEART score is the best score to be used in ED.

Table 3:

	J T Sakamoto et al ^[7]		P Van Der Berg et al ^[8]		Peter D W Reaney et al ^[9]		Wamala et al ^[10]		Our study	
	Sensitivity	Specificity	Sensitivity	Specificity	Sensitivity	Specificity	Sensitivity	Specificity	Sensitivity	Specificity
HEART	99	24.9	97	47	99	31	93	48	96	100
TIMI	87	37			97	27	84	61	84	50
GRACE	60	54			95	25	67	59	88	25
ADAPT							100	3	84	50
NACPR							99	16	94	75
EDACS							74	56	97	25

Table 4. Comparison of statistics of various studies for risk scores with our study

* It should be noted that the case definitions and cutoffs are different for all studies.

The % are rounded off to nearest whole numbers (>0.5)

Limitations:

It is important to note the limitations of the study before interpretations are drawn from our findings. As the study has a small sample size and was done in only one center the findings cannot be generalized. Similar studies in other cohorts of populations are required to generate a data that may be used in a generalized way. The study was specifically done in an ED of a tertiary care center. The presenting patients have significantly different expectations from those attending the general OPD or chest pain clinics. The patients are apprehensive and are intimidated by the idea of being admitted at a tertiary care centre for further evaluation. It was observed that the patient altered their history or presentation from time to time and left the study before complete evaluation for personal reasons or if their pain was relieved. Long term follow-up of the patients was not done.

Conclusions:

HEART score appears to be the best available risk assessment score for patients presenting with low risk ACS to emergency department. EDACS is the best assessment tool for undifferentiated chest pain assessment in ED. GRACE and TIMI scores depending on them are difficult to assess in an ED environment and are not as sensitive and specific as HEART and EDACS scores in patients with low risk ACS on initial evaluation.

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