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Chest pain risk score among Emergency Department patients: Systematic review

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ABSTRACT

Background: It's crucial to quickly and precisely stratify patients' risks based on chest pain in the emergency room. This group of patients were divided into three risk categories based on the HEART score, which predicts the short-term occurrence of serious adverse cardiac events. To compile data on the prognostic value of chest pain risk scores among ED patients who have had MI excluded, we carried out a systematic review. *Method:* we conducted this Systematic review in accordance to PRISMA guidelines, we conducted a literature search through databases for studies included adult patients with MI excluded by a high-sensitivity troponin test between 2012 and 2022. Searches were conducted across six electronic databases. 6 studies were included in the systematic review. *Results:* At various cutoff values, risk scores such as the GRACE score, NOT rule, TIMI score, History, Age, ECG, Risk Factors, and HEART Score were evaluated, and the TIMI score were performed in included studies. The majority of participants in all the studies were men. Throughout the included trials, there was significant variation in the incidence of the primary outcome (30-day MACE). *Conclusion:* The highest number of individuals at low risk of 30-day MACE was correctly recognized by the HEART score cutoff value of 3 or below.

Keywords: Emergency department, chest pain, myocardial infarction

1. INTRODUCTION

Globally, chest discomfort and ACS symptoms are the main reason people attend emergency rooms. ED doctors have to quickly determine which patient had ACS during these encounters (Soltani et al., 2016). Recently revised clinical practice guidelines state that ED doctors should use a mix of clinical judgement, ECG abnormalities, and hs-cTn to rule out acute ACS (Gulati et al., 2021). The data favours a step-by-step method in which the history, physical examination, and interpretation of the ECG aid in the prompt diagnosis of STEMI, and then the algorithmic application of hs-cTn testing determines whether or not NSTEMI is present (McRae et al., 2022; Lee et al., 2020). Although individuals at high risk who may benefit from inpatient therapy are reliably identified by hs-cTn algorithms, the majority of patients are eventually categorized as low or unclear risk.

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They can accomplish this with such amazing precision that a 30-day risk of MACE is less than 2% for a concentration of hs-cTn below the assay's limit of detection, obtained three hours after the beginning of symptoms (Olsson et al., 2021). Nevertheless, in order to identify symptomatic coronary disease, some individuals with low-risk hs-cTn values can benefit from further testing (Nestelberger et al., 2016). It has been suggested that decision paths based on clinical risk scores be used to guide the judicious and effective utilization of functional or anatomic testing in suitable patients, as well as to properly predict the pre-test likelihood (Rubini-Giménez et al., 2013). In order to determine which patients, have a low risk of cardiac events after discharge and do not require risk stratification with noninvasive testing, we carried out this study to find and summarise studies evaluating the performance of chest pain risk scores in the population of patients who have had MI excluded.

2. METHOD

Study design

The PRISMA guidelines criteria were followed in the execution of this systematic review investigation (Page et al., 2021). We gathered research on the predictive efficacy of various chest pain risk prediction scores when applied to patients with excluded MI in the ED using the hs-cTn test.

Search strategy

Searches were conducted across six electronic databases (Embase, Scopus, Cochrane Central, Web of Science, CINAHL, and Ovid Medline) to locate publications published between 2012 and 2022. Terms pertaining to the population, risk prediction scores, research designs, and relevant cardiac troponin tests were incorporated into the search method. Only articles published in English were included. A review of the included studies' reference lists was conducted in order to find any pertinent papers that were missed by the electronic literature search.

Study selection

After duplicate data were eliminated, writers separately checked abstracts and titles to predetermined standards. After being chosen for inclusion, the full-text articles of the abstracts underwent an eligibility screening. All of the writers were accessible to settle any disputes during the two phases of the selection procedure. Overall, 1955 studies were collected, after duplication removal 1542 remained which were screened for abstract and title and we excluded 1421 leaving 121 full text articles to be assessed against inclusion criteria, then 115 articles excluded with reasons and 6 studies remained and included in the systematic review.

Inclusion criteria

Research was considered in this review if it included adult patients who came to the ED with chest pain as their main complaint, measured the performance of risk scores in a group of patients whose MI was excluded, and evaluated the prognostic value of at least one risk prediction score used in the ED for 30-day MACE.

Exclusion criteria

Studies that evaluated troponin-only prognostication methods or just employed modern cardiac troponin tests were excluded.

Data extraction

Using a uniform data collection form, pertinent research and outcome data were gathered. Date of publication, sample size, nationality, hs-cTn assay type, study type, risk score evaluated, patient outcome and cutoff values data were among the data abstracted from each study.

3. RESULTS

1542 distinct entries in all were found using the database and further searches (Figure 1). Six papers were included in this review after an abstract and full-text review. The investigations that were included were carried out in the following countries: Australia Khan et al., (2021), Switzerland Ratmann et al., (2021), Israel Marcusohn et al., (2020), the United States McCord et al., (2017), and the United Kingdom (Carlton et al., 2018). The methodology and key conclusions were displayed in (Table 1). These studies assessed the predictive performance of risk scores in 20,959 patients overall, with research sample sizes varying from 89 to 9236. At various cutoff values, risk scores such as the GRACE score Marcusohn et al., (2020), the NOT rule Ratmann et al., (2021), the TIMI

score McCord et al., (2017), Willems et al., (2014), the History, Age, ECG, Risk Factors, and HEART Score were evaluated Khan et al., (2021), McCord et al., (2017), Willems et al., (2014), and the TIMI score (McCord et al., 2017).

Information, such as sample features, the calculated risk scores, mean age, and troponin assay were presented in (Table 2). The evidence quality varied, with two studies having a low bias risk, one having a high risk, and one having characteristics that made it difficult to determine how risk of bias it was. Lack of information about the patient sample or the use of an improper diagnostic criteria for its outcome measures raised concerns about bias. The demographics that were provided showed that the research participants' mean ages varied from 46.3 to 61 years. The majority of participants in all the studies were men, with the Willems et al., (2014) research having the largest percentage of men. Throughout the included trials, there was significant variation in the incidence of the primary outcome, 30-day MACE; the research by Ratmann et al., (2021), had the highest incidence. Revascularization, not acute MI or mortality, was frequently the driving force behind MACE rates when a breakdown of the composite outcome components was presented.

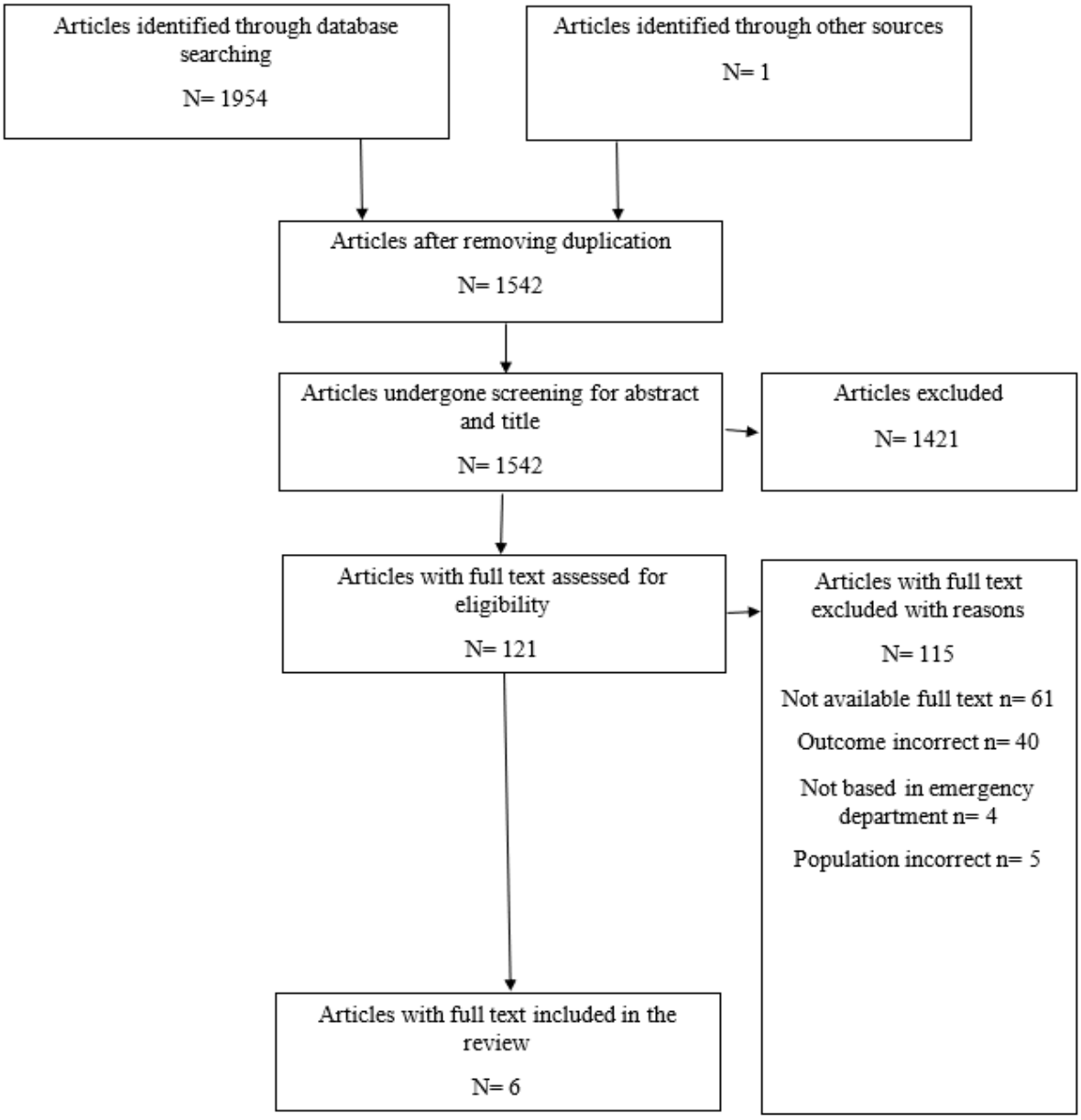

Figure 1 Consort chart of selected articles

Table 1 Population characteristics and main findings of included studies

Citation	Population characteristics	Main findings
Khan et al., 2021	Individuals randomised to the intervention arm of the RAPID-TnT study who presented to the ED with suspected ACS were included.	The inclusion of clinical risk scores in the rule-out profile did not show any improvement in classification performance for determining the composite of all-cause mortality or MI at 30 days or at index presentation.
Ratmann et al., 2021	The so-called No Objective Testing guidelines were developed by prospective research that used a 0/2-hour rule-out methodology to identify combinations of clinical factors for the purpose of selecting individuals who would not require objective functional or anatomic cardiac testing for CAD.	Using straightforward clinical criteria (: age <50, the third No Objective Testing rule, no history of AMI, and <3 risk factors), a significant fraction of individuals (about 25%) are found to be at minor risk of cardiovascular mortality or ACS for a period of up to 730 days. Consequently, it appears that in the majority of cases, objective cardiac testing is not required.
Marcusohn et al., 2020	Retrospective cohort research based on population at a sizable tertiary care facility. Thirteen thousand eight hundred patients who were released from the hospital after MI rule were included in the research group.	The 30-day adverse event rate is 2-4% for patients who arrive at the emergency department (ED) with chest discomfort, HsTnI less than 5 ng/L, and a GRACE score below 140. Using fast rule out algorithms for just low-risk patients with GRACE scores ≤ 73 is suggested by the disparities between the groups.
Carlton et al., 2018	A combined study of adult patients who were included in six prospective trials and who arrived at the emergency room complaining of chest discomfort with a non-ischaemic ECG. In addition to hs-cTnT or hs-cTnI, the authors assessed the sensitivity of TIMI score thresholds ranging from 0 to 2 for the primary outcome of significant adverse cardiac events that occur during a 30-day period.	For clinical application, a TIMI score cutoff of zero is advised. Using this standard, the percentage of patients who are deemed low risk (18% to 21%) and eligible for early discharge may be enough to motivate a change in procedure.
McCord et al., 2017	1282 individuals in the emergency room had their chances of having AMI assessed. hs-cTnT measurements were taken at 0, 1, 2, and 4 to 14 hours. At 30 days, MACEs were evaluated.	A low-risk group that would be eligible for immediate discharge from the emergency room was identified by serial testing of hs-cTnT over a one-hour period combined with the administration of an m-HS.
Willems et al., 2014	Included were 89 patients who presented with chest discomfort but had normal troponin levels that were not increased. At the time of admission (T1), four to six hours later (T2), and eight to ten hours later (T3), HsT levels were measured. The risk score for the incidence of MACE was determined using the HEART Score. A recorded case of MACE occurred thirty days following discharge.	Using the HEART Score and the HsT, most patients with chest discomfort can be safely released four to six hours following the onset of symptoms. On the other hand, patients who have a high HEART Score but an initially normal HsT require prolonged follow-up and a repeat HsT assessment.

Table 2 Characteristics of included studies

Citation	Sample size	Percentage of male	Mean age in years	Troponin assay	MACE in 30 days
Khan et al., 2021	1638	53.2%	58.7	hs-cTnT	5.4%
Ratmann et al., 2021	2375	Not recorded	Not recorded	hs-cTnT	14%
Marcusohn et al., 2020	9236	60.4	46.3	hs-cTnT	2.3%
Carlton et al., 2018	7691	62.8	58.1	hs-cTnT	10.7%
McCord et al., 2017	661	58.2	58.3	hs-cTnT	0.91%
Willems et al., 2014	89	58.4	61	hs-cTnT	10.1%

4. DISCUSSION

In this study, we compiled data on how well various chest pain risk ratings predict outcomes when applied to individuals whose MI was excluded using hs-cTn tests. The evidence's quality varied. The majority of patients were categorised as low risk by the HEART score, among the risk scores examined in the studies included. Nonetheless, this cutoff value's sensitivity was only 93% when it came to eliminating 30-day MACE in low-risk patients. However, the majority of the relevant literature assesses how well these scores work in patients with undifferentiated chest pain, includes MI as one of the measured outcomes in the index presentation, and makes use of troponin assays. In light of this, this systematic review provides an overview of the data supporting the usefulness of these ratings for patients for whom risk scores are most pertinent for making decisions on noninvasive testing following ED discharge. We have focused on patients whose troponin testing rules out MI in order to make decisions about whether anatomic or functional cardiac testing is necessary following ED discharge.

Similarly, emergency risk assessment for coronary disease is not necessary for individuals whose chest discomfort is clearly caused by non-cardiac conditions such pneumonia or pulmonary embolism. It is noteworthy that the risk score sensitivity cutoffs found in these studies for 30-day MACE prediction comparable to hs-cTn sensitivity on its own. Short-term MACE risk is incredibly low for patients whose MI has been ruled out using a validated protocol of hs-cTn testing; most studies indicate rate of 30-day event less than 1 percent (Andruchow et al., 2019; Peacock et al., 2018). This suggests that when it comes to risk classification of individuals whose MI was excluded by hs-cTn tests, risk scores may not be very helpful. The usefulness and cost-effectiveness of routine urgent objective testing are questionable for this population, given the extremely 30-day MACE low risk for patients with nonischemic ECGs and very low concentrations of hs-cTnT on presentation 3 hours following symptom onset.

In contrast, guidelines from the "American College of Cardiology and the American Heart Association" suggest that patients experiencing chest pain should have coronary CT angiography, treadmill ECG, stress myocardial perfusion imaging, or stress echocardiography performed as early as possible to screen for CAD, provided that AMI was excluded (Amsterdam et al., 2014). Regardless of their unique clinical features, it might be claimed that patients found to be at low risk utilising a validated hscTn algorithm can be safely released from the ED without the requirement for any outpatient noninvasive testing. This is due to the fact that positive stress ECG findings in patients with low-risk are more likely to be false positives than real positives, and early outpatient stress testing has not been demonstrated to lower 30-day MACE (Natsui et al., 2019; Madsen et al., 2009). Clear discharge instructions and symptom development monitoring can better reflect a risk-benefit balance for this population, which is objectively low-risk.

5. CONCLUSION

Either a TIMI score of 1 or 3 in HEART score indicates a very low chance of 30-day MACE; however, more individuals are classified as low risk using the HEART score. Adverse cardiac events are uncommon among patients whose MI has been ruled out using a validated hs-cTn algorithm.

Abbreviation

HsT: High-sensitivity troponin T
MACE: Major adverse cardiac event
HEART: History, ECG, Age, Risk factors, and Troponin
AMI: Acute myocardial infarction
hs-cTnT: High-Sensitivity Troponin-T

TIMI: Thrombolysis In Myocardial Infarction
GRACE: Global registry of acute coronary events
hsTnI: High-sensitivity troponin I
CAD: Coronary artery disease
ACS: Acute coronary syndrome
ED: Emergency department
TnT: Cardiac troponin T
MI: Myocardial infarction
GRACE: Global Registry of Acute Coronary Events
NOT: No Objective Testing
EDACS: Emergency Department Assessment of Chest Pain Score
PRISMA: Preferred Reporting Items in Systematic Reviews and Meta-analyses
STEMI: ST-Segment Elevation Myocardial Infarction

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Ethical approval
Not applicable.

Conflict of interest
The authors declare that there is no conflict of interests.

Data and materials availability
All data sets collected during this study are available upon reasonable request from the corresponding author.

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