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Reliability of Physical Examination and Electrocardiogram in Determination of Acute Myocardial Infarction: A Hospital Based Study

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ABSTRACT

Although acute myocardial infarction (AMI) is a common disorder that makes people seek emergency healthcare, there is little evidence on the diagnostic accuracy of symptoms and signs, for the diagnosis of acute myocardial infarction.

Aims: Current study was done to evaluate the diagnostic accuracy of physical examination & electrocardiogram for detecting acute myocardial infarction compared to the reference standard.

Material: Of the 481 patients enrolled, we evaluated 450 patients, 279 (62%) men and 171 women (38%); aged 20 years to 90 years. The patients with acute myocardial infarction were aged almost similar to those without infarction (58.6 vs. 57.1 years).

Results: The prevalence of acute myocardial infarction was 41% (187 of 450). Of the 187 patients with acute AMI, 145 (78%) were assigned a discharge diagnosis of ST elevated myocardial infarction (STEMI) and 42 (22%) were assigned a diagnosis of non-ST elevated myocardial infarction. A total of 34 of 145 (23%) patients with STEMI died, compared to 4 of 42(10%) patients with non-STEMI.

Conclusion: Our study concluded that no single sign or symptom or a laboratory diagnostic method with possible acute MI proved effective enough alone to rule in or out AMI.

Key Words: Myocardial infarction, Electrocardiogram, STEMI, smoking, Obesity, Hypertension and diabetes

INTRODUCTION

History and physical examination are key elements used by physicians to triage patients with acute chest pain. Typically physicians take a quick but focused history (quality, size, intensity, radiation and aggravation of pain), note the presence or absence of risk factors (smoking, obesity, hypertension and diabetes) and perform a physical examination (vital signs, assessment of heart size, third heart sound and crackles). In the initial management of patients presenting with suspected MI, the history and physical examination help physicians decide which diagnostic tests to order (ECG, biomarkers of AMI, biomarkers, chest radiogram or endoscopy) or plan therapeutic interventions (aspirin, streptokinase or primary angioplasty). Acute coronary syndrome (ACS) is a unifying term characterized by acute myocardial ischemia. It is associated with an increased risk of cardiac death and myonecrosis [1]. It includes acute myocardial infarction (ST elevation and non-ST elevation) and unstable angina. Classify and diagnose the disease is important because the management differs. STEMI represents the most lethal form of ACS[2]. In which, there is the total cessation of coronary blood flow in the territory of the occluded artery and the resultant ST-segment elevation in ECG. Physical findings do not help much for diagnosis of ACS; rather they help physicians assess the severity of ACS (e.g. tachycardia, tachypnea and crackles indicating acute left ventricular failure) and prognosis of the disease. Transient ST-segment depression of at least 0.5 mm that appears during chest pain and disappears after relief provides objective evidence of transient myocardial ischemia. Another common finding is the persistent negative T wave over-involved areas. Some ECG may show Q waves from an old infarction or a left bundle branch block (LBBB) from prior extensive left ventricular damage. Because of dynamic changes, it is recommended of continuous ECG monitoring in the first 24 to 48 hours [3,4].

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Rapid diagnosis is a pivotal component of the management of STEMI patients [2]. Early diagnosis can be achieved with these above criteria to reduce both the door-to-needle and door-to-balloon time. So the cornerstone of ST-elevation myocardial infarction (STEMI) therapy is a rapid and accurate evaluation. All patients presenting with a complaint of chest pain should be rapidly triaged. Despite all, It has been estimated that up to one-third of patients with STEMI do not describe the classical clinical picture[3] On the other hand, because of the multitude of etiologies producing chest pain, it is very difficult to rule in or rule out the ACS[5].

SUBJECTS AND METHODS

Our study was conducted in an intensive care unit of a tertiary care centre of the Department of Medicine. The ICU is well equipped with ventilators, monitoring systems, resuscitators and electronic hospital information system. Our study is a prospective cross-sectional study in which consecutive patients with acute chest pain and possible ACS presenting to the intensive care unit were registered. Before we began the study, we formulated the research questionnaire, wrote research protocol, and obtained approval from the institutional research committee. We conducted this study according to the principles of the Declaration of Helsinki. The diagnosis of acute myocardial infarction was based on the criteria proposed by the World Health Organization (WHO). We summarized data with the mean and median as measures of central tendency and standard deviations and interquartile ranges as measures of spread for continuous variables. Data were analysed using SPSS (Statistical package for social sciences) software.

RESULTS

We used STARD (Standards for Reporting Diagnostic Accuracy Study) guidelines to report this study. We screened patients, 30 years of age and older suspected to have acute myocardial infarction and admitted to the intensive care unit. A total number of patients presenting with acute chest pain and admitted to the intensive care unit were 481. Out of which 31 were excluded due to death or incomplete data. So final study subjects were 450. Out of which 187 had AMI & 263 had chest pain other than AMI. Table 1 shows that the third heart sound and crackles modestly increased the probability of AMI in our study. However, their absence did not help us in ruling out AMI **showed in table no 1.**

Table 1: Diagnostic Accuracy of Physical Examination

Findings		With AMI	Without AMI	Total	P value
Chest tenderness	Present	4	38	42	<0.001
	Absent	183	225	408	
Third Heart Sound	Present	29	18	47	0.003
	Absent	158	244	402	
Crackles	Present	37	35	72	0.065
	Absent	150	228	378	

Table 2: Diagnostic Accuracy of Electrocardiogram

Findings		With AMI	With-out AMI	Total	P-value
Any ST-segment elevation	Present	142	21	163	<0.001
	Absent	45	242	287	
New ST-segment elevation	Present	3	0	3	0.039
	Absent	184	263	447	
New conduction defect	Present	2	4	6	0.685
	Absent	184	259	443	
New Q wave	Present	4	0	4	0.017
	Absent	183	263	446	
Any Q wave	Present	52	15	67	<0.001
	Absent	135	248	383	
Any ST depression	Present	19	27	46	0.971
	Absent	168	236	404	
Peaked or inverted T wave	Present	25	40	65	0.584
	Absent	162	223	385	

Table 2 shows that the new ST-segment elevation was the most important feature in increasing the probability of MI. However, very few patients in our study had an ECG recorded in the past, and for those who had a previous ECG, ECG was either lost, misplaced, or had faded with time. New ST-segment elevation could be documented in only 4 of 187 patients and thus generated an LR of 8.5 but the width of 95% confidence intervals suggests a lack of statistical significance. We found that any ST-segment elevation generated an LRS of 9.5, indicating that patients with a discharge diagnosis of AMI were almost 10 times more likely to have elevated ST-segment compared to those without MI. Similarly, any Q wave was 28% sensitive and 92% specific suggesting that patients with AMI were about five times as likely to show Q wave in their ECG, compared to those, without AMI. By contrast, the incidence of new Q was only 4 of 187 and suggested that this ECG feature lacked the precision to confidently rule in or AMI. Any ST-segment depression, whether new or known to be present previously, and new T wave peaking or inversion were all almost as likely to occur in patients with, as opposed to those without, AMI.

DISCUSSION

Pain reproduced by palpation or tender chest reduced the probability of AMI. These variables can help physicians rapidly decide about the diagnosis, but of their own are not sufficiently sensitive or specific enough to rule in or rule out acute myocardial infarction. Five of the studies [4-8] included consecutive patients presenting to the emergency department with acute chest pain, seven studies included [9-15] patients admitted to the ICU for suspected MI and 2 included [16,17, 18] patients with chest pain who were brought to the emergency department by paramedics. In this study, we compare and contrast our results with those from the studies that enrolled patients with suspected AMI in the ICU setting. [9-15] Previous research [16] shows that the three components of the physical examination associated with likelihood ratio greater than 2 are: the presence of third heart sound, hypotension and pulmonary crackles on auscultation. We found that the third heart sound and crackles modestly increased the probability of AMI in our study. However, their absence did not help us in ruling out AMI.

To analyze the diagnostic accuracy of ECG to distinguish patients of AMI from those without, we used discharge diagnosis as the reference standard for the diagnosis of AMI. We did so because the use of ECG as the reference standard would have created incorporation bias: ECG would have been both index test as well as the reference standard. This approach has been used by Kudenchuk et al. [17] in their previous work. The authors showed that among 1189 patients with acute chest pain (391 with AMI), the positive predictive value of the computer- and physician-interpreted ECG was, respectively, 94% and 86% and the negative predictive value was 81% and 85%.

We used several features of ECG to help in the diagnosis of AMI. The most common characteristics included the presence of Q waves, ST-segment elevation or depression and T wave inversion. New ST-segment elevation, as shown by previous work, [6,13,14,17] is the most important feature in increasing the probability of MI. However, very few patients in our study had an ECG recorded in the past, and for those who had a previous ECG, ECG was either lost, misplaced, or had faded with time. New ST-segment elevation could be documented in only 4 of 187 patients. We found that ST-segment elevation generated indicating that patients with a discharge diagnosis of AMI were almost 10 times more likely to have elevated ST-segment compared to those without MI. Similarly, any Q wave was 28% sensitive and 92% specific suggesting that patients with AMI were about five times as likely to show Q wave in their ECG, compared to those, without AMI.

Any ST-segment depression, whether new or known to be present previously, and new T wave peaking or inversion were all almost as likely to occur in patients. This contrasts with the finding reported earlier which showed that ST depression and peaked or inverted T wave were three times more likely to be associated with AMI. [19,20]

CONCLUSION

To sum up, our study shows that the presence of any of the following clinical findings increases the likelihood of MI: a third heart sound and crackles. ST-segment elevation and Q waves on ECG increase the likelihood of MI. The presence of any one of the following reduces the likelihood of MI: Pain reproduced by palpation or tender chest. The presence of hypertension, diabetes, smoking, obesity or hyperlipidemia did not affect the probability estimate that an episode of chest pain represents AMI. These findings may not be relevant for distinguishing between patients with acute ischemic syndrome requiring ICU admissions from those with less dangerous ischemia or non-ischemic pain. Although some features of history and few physical signs can increase or decrease the probability of AMI in patients presenting with acute chest pain, none of the symptom or sign is accurate enough to lead to a large and conclusive change from pre-test to the post-test probability of AMI. Nor does their absence lead to the clinically meaningful shift from pre-test to the post-test probability of Acute Myocardial Infarction (AMI).

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