How accurate is the use of ECGs in the diagnosis of myocardial infarct?

Patrick H. Ginn, MD, MBA, Barbara Jamieson, MLS
Medical College of Wisconsin, Milwaukee

EVIDENCE-BASED ANSWER

The electrocardiogram (ECG) is a fairly accurate test in the diagnosis of myocardial infarction (MI). However, given more sensitive technologies, such as cardiac biomarker testing, its primary role should be as an important adjunct in the evaluation and detection of MI (strength of recommendation [SOR]: **A**).

The sensitivity of ECG for detection of MI is directly related to what is defined as positive findings on the ECG for MI. The single most specific ECG finding is the presence of new ST segment elevation of at least 1 mm (SOR: **A**). Other findings such as the development of new pathologic Q waves and ST depression can also be valuable in making the diagnosis.

CLINICAL COMMENTARY

In the absence of frankly positive findings on ECG, even subtle findings on physical exam can be powerful
As serum biomarkers begin to supplant the use of ECG in the diagnosis of acute MI, it is important to re-evaluate the overall approach to diagnosis. A focused history and physical examination, ideally by a physician who knows the patient's history, continues to be the cornerstone of diagnosis.

In the absence of frankly positive findings on ECG, even subtle findings can be powerful in diagnosing ischemia or infarction particularly when a prior ECG is available. Furthermore, ECGs are noninvasive and can provide clinical data more dynamically than serum biomarkers. When ordered in the proper clinical setting, I find serial ECGs to be more useful in assessing progression of infarction and the development of complications.

Michael D. Mendoza, MD, MPH
Department of Family Medicine,
Pritzker School of Medicine, The University of Chicago

▮ Evidence summary

Electrocardiograms have been a mainstay in the evaluation for MI for many years. A systematic review of the workup of acute chest pain found that the ECG was the most useful bedside test for MI.[1] In this review, ST segment elevation and Q waves were found to be equally reliable predictors of MI (positive likelihood ratio [LR+] = 22). A normal ECG was also found to be the most important bedside finding for ruling out the diagnosis of MI (LR– = 0.2).

New ST segment elevation is the most important ECG feature in increasing the probability of diagnosing an MI, with LRs ranging from 5.7 to 53.9.[2] Another systematic review revealed similar findings where ST segment elevation (most commonly defined as at least 1 mm in 2 or more contiguous limb leads or at least 2 mm in

2 contiguous precordial leads) had a LR+ = 13.1 (95% confidence interval [CI], 8.28–20.6).[3] This review also found that a "completely normal" ECG is reasonably useful in ruling out MI with a LR− = 0.14 (95% CI, 0.11–0.20).[3]

In 2001, a working group of the National Heart Attack Alert Program (NHAAP) performed a systematic review to define the accuracy of "out of hospital" ECG in the diagnosis of acute cardiac ischemia (ACI) and MI. Based on the 8 studies for which data were available, the random effects pooled sensitivity for acute MI was 68% (95% CI, 59%–76%), the specificity was 97% (95% CI, 89%–92%), and the diagnostic odds ratio (DOR) was 104 (95% CI, 48–224).[4] (The DOR is the change in post-test odds from a negative test to a positive test. It is used as a summary measure in meta-analyses of diagnostic studies. A DOR of 1 represents a useless test, with higher values representing more useful tests.)

There were sparse data available in our search results that specifically addressed the effect of serial ECGs on accuracy of diagnosis of MI. Another systematic review performed by a NHAAP working group evaluating different technologies in the emergency department diagnosis of ACI found only 1 study on the accuracy of serial ECGs in acute MI (sensitivity 39%, specificity 88%).[5]

As part of the Myocardial Infarction Triage and Intervention Project, the investigators found that when compared with a single ECG, serial exams increased the diagnostic sensitivity for acute coronary syndrome from ~34% to 46% with a reduction in specificity from 96% to 93% and positive predictive value from 88% to 84%.[6] This particular study was unusual in that it used the hospital discharge diagnosis to define the outcome. In most other studies, cardiac enzymes were used as the gold standard for defining outcome.

Recommendations from others

In 2000, the European Society of Cardiology and the American College of Cardiology (ACC) issued a joint consensus statement redefining MI in which ECG findings such as ST segment elevation or new Q waves were insufficient for the diagnosis of MI without concomitant detection of elevated blood levels of cardiac biomarkers such as troponins.[7]

The ACC also published guidelines for management of ST elevation MIs in 2004 that recommended obtaining a 12-lead ECG on all patients presenting with symptoms suggestive of MI. If the initial ECG was not diagnostic, the guideline suggested obtaining either serial ECGs at 5- to 10-minute intervals or continuous 12-lead ST segment monitoring in order to detect the development of ST elevation.[8]

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FAST TRACK

New ST segment elevation on ECG makes diagnosis of MI more likely