

Can ECG Rule Out ACS if Performed While the Patient Is Having Chest Pain?

MARK A. GRABER, MD, FACEP, *University of Iowa Carver College of Medicine, Iowa City, Iowa*

ANDREA DARBY-STEWART, MD, *Scottsdale Healthcare Family Medicine Residency, Scottsdale, Arizona*

ROBERT DACHS, MD, FAAFP, *Ellis Hospital Family Medicine Residency Program, Schenectady, New York*

Purpose

In *AFP Journal Club*, three presenters review an interesting journal article in a conversational manner. These articles involve “hot topics” that affect family physicians or “bust” commonly held medical myths. The presenters give their opinions about the clinical value of the individual study discussed. The opinions reflect the views of the presenters, not those of *AFP* or the AAFP.

This Month's Article

Turnipseed SD, Trythall WS, Diercks DB, et al. Frequency of acute coronary syndrome in patients with normal electrocardiogram performed during presence or absence of chest pain. *Acad Emerg Med*. 2009;16(6):495-499.

For more information on EBM terms, see the EBM Toolkit at <http://www.aafp.org/afp/ebmtoolkit>.

Is negative electrocardiography performed while the patient is having chest pain good at ruling out acute coronary syndrome?

What does this article say?

Mark: This is a prospective, *observational* study to determine if negative electrocardiography (ECG) performed while the patient is having chest pain can reliably rule out coronary disease. Eligible participants presented to the emergency department with chest pain and had normal initial ECG. Eligibility criteria also included age older than 25 years, two negative troponins over six hours, and admission for a cardiac workup. Patients meeting inclusion criteria were noted to be either pain free or having pain during the initial ECG. They were then followed to see if the incidence of acute coronary syndrome (ACS) differed in those with and without pain during ECG. In other words, does negative ECG performed in patients with pain reliably rule out ACS?

A total of 387 (22 percent) of the patients with chest pain met the inclusion criteria.

The mean age was 56 years, and 51 percent were men. Overall, 126 patients (33 percent) did not have chest pain during ECG and 261 patients (67 percent) did have chest pain during ECG. ACS was ultimately diagnosed in 67 patients based on a positive stress test, a positive troponin test, or coronary artery stenosis of greater than 70 percent. Sixteen percent of the group with negative ECG performed during chest pain ultimately proved to have ACS, versus 20 percent of those with positive ECG performed while not having chest pain (odds ratio = 0.77; 95% confidence interval = 0.45 to 1.33; $P = .4$). Importantly, 31 percent of admitted patients did not have a confirmatory test.

Should we believe this study?

Mark: No—the first problem with this study is selection bias. Only patients who met the threshold for admission were included in the study. Some patients with true disease may have been sent home, underestimating the number of patients with a negative ECG who have ACS.

Andrea: A second problem is what is called verification bias, which is also known as workup bias. Ideally, when determining the sensitivity and specificity of a new test, everyone should get the new test and the criterion standard (previously called the “gold standard”) test. For example, say we want to know how good a treadmill test is at picking up coronary artery disease. Everyone should have both the treadmill test and a cardiac catheterization. This is the only way you are going to know how good your stress test is.

Bob: What happens too often is that only those with a positive screening test (in this

example, the treadmill test) go on to have the criterion standard test (in this example, cardiac catheterization). We are reluctant to do the criterion standard test, which may be invasive, in those with a negative screening test. Do you really want to put all of the patients with a negative treadmill test at risk by doing cardiac catheterization or exposing them to the radiation of a nuclear study? But, this is really what you need to do if you want to know how good a treadmill test is. In this study, 31 percent of admitted patients did not have a confirmatory study. So, we know that verification/workup bias was at play.

Mark: This same sort of problem is seen throughout the literature. Some common examples are:

- C-reactive protein test and computed tomography (CT) for appendicitis: Did all of the patients with a negative C-reactive protein test or CT get the criterion standard test (appendectomy)?

- CT and D-dimer testing for pulmonary embolism: Did all of the patients with a negative D-dimer test or negative CT get the criterion standard test (angiography)?

- 64-slice CT for coronary artery disease: Did all of the patients with negative CT get the criterion standard test (cardiac catheterization)?

Bob: Finally, this was an observational study, which means there was no set intervention (e.g., cardiac catheterization, stress echocardiography) for all patients. Thus, there is a lot more uncertainty to the results. Not all patients in an observational study will have the same workup, treatment, etc.

What should the family physician do?

Mark: Other, better-done studies do support the concept that a negative ECG performed during chest pain does not rule out coronary artery disease. In fact, up to 20 percent of initial ECGs performed in patients with myocardial infarction (let alone ACS) are

negative, and others will have nonspecific changes.^{1,2}

Andrea: The consideration of ACS is a gestalt: “Does the patient’s story, age, gender, history, and risk factors lead you to believe there is a significant pretest probability that a patient has ACS? If so, he or she needs an evaluation. If not, send the patient home.”

Main Points

- A negative ECG does not rule out cardiac disease, even when it is performed during chest pain.

EBM Points

- Verification bias or workup bias exists when not everyone in a study gets the definitive, criterion standard test. This generally makes the new test look better because real cases of disease are missed when patients with a negative new test are sent home.
- Observational studies are not the best design for testing some hypotheses. If we really wanted to know how good ECG is, we would have designed a study that had the initial ECG performed in the emergency department and then had cardiac catheterization performed in all of the patients. This is the only way to get the true sensitivity and specificity of ECG. Observational studies let things take their course without a prescribed, randomized intervention. This adds a lot of uncertainty to the data by (in this case) not controlling the subsequent workup.

Address correspondence to Mark A. Graber, MD, FACEP, at mark-graber@uiowa.edu. Reprints are not available from the authors.

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