

The Use of Coronary Computed Tomography Angiography to Rule Out CAD in the ED

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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.

Article

Litt HI, Gastonis C, Snyder B, et al. CT angiography for safe discharge of patients with possible acute coronary syndromes. *N Engl J Med*. 2012;366(15):1393-1403.

For more information on evidence-based medicine (EBM) terms, see the EBM Toolkit at <http://www.aafp.org/afp/ebmtoolkit>.

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Is coronary CTA good enough to allow for the safe discharge of low-to intermediate-risk patients with chest pain?

Mark: We know that we overadmit patients with chest pain to the hospital. Most of these patients turn out to have a noncardiac cause for the chest pain. Is it possible to use coronary computed tomography angiography (CTA) to stratify risk and identify a subset of patients that can be safely discharged from the emergency department (ED)?

What does this article say?

Mark: This is a randomized trial of 1,370 patients in the ED with chest pain who were admitted for a “rule out” and had a low to intermediate risk of cardiac disease, as judged by the ED physician. Of these patients, 908 were randomized to receive coronary CTA and 462 to receive standard care. Patients were 30 years or older, had no ischemia on initial electrocardiography, and had a thrombolysis in myocardial infarction (TIMI) score of 0 to 2.¹ The TIMI score is used to categorize the risk of death or ischemic events in patients with unstable angina

or non-ST elevation myocardial infarction. However, a patient can have an elevated troponin level and still have a TIMI score of 1 (not someone most of us would consider low to intermediate risk).

Exclusion criteria included obviously non-cardiac chest pain, initial electrocardiography showing ischemia, or coexisting disease requiring admission. Data were collected using a structured form. The primary outcome was absence of myocardial infarction or cardiac death within 30 days of study enrollment. This was determined by reviewing hospital records, or by contacting the patient or a secondary contact. If the authors were unable to contact anyone, they looked at the records of all surrounding hospitals to determine if the patient had been seen or admitted. If no visit was recorded, the Social Security Death Master File was searched. A power analysis was performed, which predicted the need for 910 patients in the coronary CTA group, assuming a 5 percent drop-out rate. The study used intention-to-treat data analysis.

Of the 908 patients randomized to coronary CTA, 84 percent completed the study, but this ranged from 67 to 93 percent depending on the institution. Reasons for exclusion included creatinine clearance of less than 60 mL per minute per 1.73 m² (1 mL per second per m²), a previous test to rule out pulmonary embolism at the same visit, and inability to lower the heart rate with metoprolol. Unless the heart rate is lowered, coronary CTA images are blurry.

The study showed that patients with a negative coronary CTA result (defined as less than 50 percent stenosis) had a 0 percent

risk of death or myocardial infarction (95% confidence interval, 0 to 0.57 percent) in the 30 days following the coronary CTA; the findings in the standard care group were identical.

Forty-seven percent of patients in the coronary CTA group were discharged from the ED, compared with 22 percent of those in the standard care group. Those in the coronary CTA group had a shorter length of hospitalization (18 versus 25 hours)—*coronary CTA saved only seven hours of hospital time.*

Should we believe this study?

Bob: Well, they did some things right. Here are some things to look for in a well-done study:

- A power analysis. Does the number of study participants allow the researchers to confidently say that there is no difference if no difference is present? This avoids a situation in which there are not enough participants to find a difference even if one is there (a type II error). Because there was an 18 percent drop-out rate in the coronary CTA group (patients who didn't get the test), they didn't quite meet their power numbers, which were predicated on a 5 percent drop-out rate.
- Structured data collection. Are the same data collected on all participants in a uniform manner? For instance, a simple chart review may be misleading because some data may be missing (e.g., weight measurement if the patient came to the ED by ambulance).
- Compulsive follow-up of study participants to ensure all participant outcomes are accounted for.

Andrea: One weakness is that the inclusion criteria are pretty subjective (e.g., an ED physician deciding that a “rule out” is needed). How this applies to your patients is unknown. You may use different criteria when you decide which patients with chest pain need a “rule out.”

Mark: Even though CAD was detected in 9 percent of the coronary CTA group and in 3.5 percent of the standard care group, there was no difference in outcomes at one month. This tells me that the 5.5 percent of “disease” missed in the standard care group was not significant disease. This raises the question of whether *any* of the CAD detected represented significant disease. Maybe this is a low enough risk group that not performing a test would have worked just as well.

In fact, their clinical definition of unstable angina required at least 70 percent stenosis, not the 50 percent that they considered as a positive study. There is some inconsistency here. They are essentially saying that the

50 percent stenosis defined as a positive study likely was not the cause of a patient's angina (see the supplementary material in *The New England Journal of Medicine* article for more information).

Bob: Remember that a 100 percent negative predictive value means nothing if no one in the group you are testing has the disease—doing no test would also have a 100 percent negative predictive value.

Mark: One other weakness is that only one of the readers interpreted the coronary CTA. It is helpful to have two readers interpret the results and see if they agree. The sensitivity and specificity of every reader for stenosis is going to be different. Some will overdiagnose stenosis and others will underdiagnose it.

Bob: We need to ask whether this study is generalizable. The coronary CTA readers all met the highest level of training and certification for CTA reading. This is likely not the case at all institutions. This is efficacy versus effectiveness. Efficacy is how a test, drug, etc., performs in a study, and effectiveness is how it performs when it is released to the general population. The efficacy of a test or drug is often better than its effectiveness.

Andrea: In addition, the study authors didn't consider the risk of radiation as an outcome. The added risk of a fatal cancer after a single 64-slice CT scan is approximately one in 143 for a 20-year-old woman, one in 284 for a 40-year-old woman, and one in 466 for a 60-year-old woman. The numbers are somewhat lower for men.² Yes, we know these numbers may not be exact, but we stand by our position.³

Mark: Finally, there was no difference in outcomes regardless of whether the patient received coronary CTA or standard care. So, we are saving seven hours in the hospital in return for significant radiation exposure. Additionally, coronary CTA leads to considerably higher downstream costs and attendant adverse outcomes from unnecessary testing.⁴

What should the family physician do?

Mark: This study does not change our practice. Coronary CTA and standard care were equally effective at identifying a low-risk population. Yes, the test saved seven hospital hours, but at the expense of radiation exposure, higher downstream costs, the risk of additional procedures, and more use of resources.⁴ Maybe we can be more efficient in doing stress tests. This would save time without the downsides of coronary CTA. ►

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Main Points

- Coronary CTA and standard care are equally good at predicting 30-day outcomes in low- to intermediate-risk patients who present to the ED with chest pain. In this study, the only difference between the two groups was seven hours of hospital time.
- Downstream costs are higher with coronary CTA, and there is no change in outcomes. It is important to consider potential harms from radiation and unnecessary interventions that are performed after a positive test result.
- The TIMI score categorizes the risk of death or ischemic events in patients with unstable angina or non-ST elevation myocardial infarction.

EBM Points

- Efficacy is how a test, drug, etc., performs in a study setting. Effectiveness is how it performs in the general population. Usually, results are better for efficacy than for effectiveness.
- A power analysis ensures that there are enough participants enrolled in a study to find a difference, if there is one. This avoids a type II error, which is when there are not enough participants to find a difference.
- Doing no test will have a 100 percent negative predictive value if no one in the population you are studying has the disease.

If you conduct a journal club and would like to know the next article that will be discussed, please e-mail afpjournals@aafp.org with “AFP Journal Club notification” in the subject line.

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Author disclosure: No relevant financial affiliations to disclose.

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