SPECIAL ARTICLE

Chest Pain in the Emergency Department

The Case Against Our Current Practice of Routine Noninvasive Testing

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Current clinical practice for patients presenting to the emergency department with a resolved episode of chest pain and no electrographic or biomarker abnormalities is to conduct routine noninvasive testing, in accordance with American College of Cardiology and American Heart Association guidelines. The rationale is to further reduce the risk of missing a myocardial infarction, a major source of suits filed against emergency department physicians. Patients with negative stress test results may be reassured, with low event rates in the subsequent 30 days. Patients with positive stress test results have higher 30-day event rates, and a small fraction undergo revascularization procedures. Despite this endorsement, open questions remain. Does our current practice lead to the stenting of asymptomatic patients in the inevitable cases where the inciting pain was noncardiac? And, most importantly, does our practice improve outcomes? Randomized trials evaluating routine stress testing in other contexts have yielded negative results, despite diagnosing significant coronary artery disease. Population data suggest that our current practice may be increasing the diagnosis of coronary artery disease and the rate of intervention while failing to decrease rates of myocardial infarction. We propose that randomized trials be conducted to evaluate whether any testing is better than no further intervention. Data from such an evidence-based approach has the potential to reverse our current practice.

Arch Intern Med. 2012;172(19):1506-1509.
Published online September 17, 2012.
doi:10.1001/archinternmed.2012.4037

A physician following current management guidelines for patients who present to the emergency department (ED) with chest pain begins by evaluating the patient for the acute coronary syndrome (ACS) using serial electrocardiograms (ECGs), and biomarkers. If ACS is diagnosed, the patient is admitted for evidence-based management. If ACS is excluded, and the chest pain does not recur, patients undergo further risk stratification with noninvasive tests such as exercise or chemical stress testing or coronary computed tomography angiography (CCTA). This approach is currently supported by the 2007 American College of Cardiology (ACC)/American Heart Association (AHA) guidelines[1] recommending that patients with resolved chest pain, without transient ST-segment depressions or T-wave inversions, and negative cardiac biomarker findings, undergo such testing prior to discharge or within 3 days. A scientific statement from the AHA[2] concurs with this recommendation, noting that patients with resolved chest pain and no objective evidence of ischemia "can be admitted to an observation unit"[2(p1757)] where, "a confirmatory test is performed . . . from exercise treadmill testing to cardiac imaging."[2(p1757)]

CME available online at www.jamaarchivescme.com and questions on page 1438

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RATIONALE FOR CURRENT RECOMMENDATIONS

Myocardial infarction (MI) is treated with a variety of evidence-based medical and procedural interventions that reduce the risk of recurrent MI, complications, and death. In addition, missed MI is one of the most frequent sources of claims filed against ED physicians,[3] with data suggesting that approximately 2% of patients presenting with MI are inappropriately discharged from the ED.[4] The logic underlying routine noninvasive testing among patients with a resolved episode of chest pain, without ECG or biomarker abnormalities, is to further reduce the likelihood that the patient had or will have an acute MI. Testing ideally delineates 2 groups of people: those with negative test results, who are at low risk of future events, and those with positive results, who are at higher risk. Patients with positive test results can then be targeted for more aggressive therapy, often including revascularization, and low-risk patients can safely be sent home.

There is evidence that exercise stress testing serves this function. Amsterdam et al[5] performed routine exercise ECG stress testing on 1000 consecutive patients who presented to the ED with nontraumatic chest pain, negative ECG findings, and at the discretion of physicians, a single negative cardiac serum biomarker test result. The stress test results were positive for ischemia in 13% of patients, negative in 64%, and nondiagnostic in 23%. At 30 days, test results predicted events. Among patients with negative results, only 1 (0.1%) had a non-Q-wave MI compared with 0 (0.0%) among those whose study results were nondiagnostic and 4 (3.2%) among those with positive stress test results. Revascularization occurred in 0 (0.0%), 7 (3.0%), and 12 (9.6%) patients, respectively. No deaths occurred in the study period. Thus, positive (and ambiguous) test results predicted most cardiac events and procedures.

Whether CCTA scans are equivalent to functional stress testing was recently examined. Litt et al[6] recruited patients older than 30 years with symptoms compatible with ACS, negative ECG and troponin findings, thrombolysis in MI (TIMI) risk scores of 0 to 2, and whose characteristics warranted admission and stress testing, in the judgment of the attending physician. Patients were randomized in a 2:1 ratio to CCTA or usual care, which included stress testing in most patients and some diagnostic testing in over 60%. At 30-day follow-up, there were no differences in mortality or ACS between the groups. In the usual care group, 3% of patients were diagnosed as having coronary artery disease (CAD) compared with 9% in the CCTA group. Revascularization occurred in 1% and 3% of patients, respectively.

Together, these studies[5,6] provide the rationale for our current practice: stress testing allows identification of a group of patients at low risk for future events, who may be spared hospital admission and discharged safely, and another group at higher risk, who may require further testing or revascularization.

DOES NONINVASIVE TESTING IMPROVE OUTCOMES?

Despite the fact that stress testing or CCTA results in identification of patients at higher risk for adverse outcomes, it is not clear that the interventions based on these test results lead to improved outcomes. In the study by Amsterdam et al,[5] 9.6% of patients with positive stress test results underwent revascularization, but because of limited follow-up and the lack of a control group, there is no proof that this yielded benefit.

There are several reasons why interventions based on positive noninvasive test findings might not result in improved outcomes. The inciting pain may have been noncardiac, yet it prompted a cascade of events that led to the diagnosis of CAD and revascularization of asymptomatic lesions. Other patients may have had angina and significant coronary lesions, but landmark randomized trials[7] have shown that medical management is the best initial strategy for most such patients. In the study by Litt et al,[6] although CCTA led to a diagnosis of CAD and revascularization at 3-fold the rate of usual care, outcomes were not improved. Finally, the most important question facing any recommended testing program is whether the test improves outcomes. In the case of resolved chest pain, no trial has examined this question. Randomized trials of routine stress testing in other populations have not shown benefit. The Detection of Ischemia in Asymptomatic Diabetics (DIAD) study[8] randomized 1123 participants with type 2 diabetes and no symptoms of CAD to adenosine-stress radionuclide myocardial perfusion imaging or usual care. At a mean of 4.8 years, there was no reduction in the rate of cardiac death or MI, despite the fact that stress testing led to more revascularization.

The Dutch Echocardiographic Cardiac Risk Evaluation Applying Stress Echo-II (DECREASE-II) study[9] randomized 770 intermediate-risk patients scheduled for vascular surgery to receive preoperative stress testing or no testing. A small number of patients in the stress test group were referred for coronary revascularization before vascular surgery, but there was no improvement in 30-day rates of cardiac death or myocardial infarction between groups.

Both of these trials enrolled asymptomatic, high-risk populations; therefore, the findings might not be applicable to low-risk patients such as those seen in the ED with chest pain but no evidence of MI. However, both DIAD[8] and DECREASE-II[9] provide examples of the type of study needed to validate current practice, and both show how stress testing may not yield improved outcomes, even while detecting CAD.

THE PROBLEM

Despite a significant investment of financial resources in our current system, there is direct evidence that we are not reducing the rate of cardiovascular events. Lucas et al[10] examined temporal trends in MI, the use of stress testing, and revascularization from 1993 to 2001 among Medicare beneficiaries. During this time, there was nearly a 3-fold increase in the use of imaging stress tests (from 29 to 82 per 1000 beneficiaries), a doubling in the rate of primary coronary angioplasty, and a 7-fold increase in the use of coronary stents since their appearance in 1995. The rate of hospitalization from acute MI, however, did not change over this period (8.6 to 8.7 per 1000 beneficiaries). Thus, our current practice may simply be increasing the diagnosis of CAD, without preventing negative outcomes (such as MI), a problem increasingly recognized as overdiagnosis in medicine.[11] With nearly 6 million visits to the ED for chest pain,[12] the extent of this problem is enormous.

The impetus for our current practice—a desire not to miss MI—is indeed a noble aim. The frequently cited statistic that 2% of patients presenting with MI are inappropriately discharged from the ED[4] is based on data from 1993, prior to routine use of cardiac serum biomarker testing. Use of biomarkers, and the development of more sensitive assays,[13] may already have reduced the missed-MI rate. Thus, the historical circumstances that provide impetus for our current practice may no longer be applicable.

SUMMARY

The studies cited herein make the case that noninvasive testing is safe and can alter management for patients who present with isolated chest pain and reassuring ECG and biomarker findings. However, no study shows that this approach reduces future events or mortality. Such events must be true clinical outcomes, such as ACS, and not merely the decision to undergo further intervention. Revascularization is not a reliable end point in this context. In addition, trials must follow observe patients for a reasonable duration to exclude countervailing harms and adverse effects on quality of life.

To test the benefit of current ACC/AHA guidelines, we propose that randomized trials compare routine stress testing and/or CCTA to a strategy of no further intervention among patients with isolated chest pain and no ECG or biomarker abnormalities. Other groups,[14] doubtful of current practice, have shown that stress testing can be reduced by nearly half without any change in outcomes. The time has come to assess whether stress testing or CCTA can be omitted entirely. Data from such an evidence-based approach has the potential to reverse[15,16] our current management of resolved chest pain.

Accepted for Publication: June 6, 2012.
Published Online: September 17, 2012. doi:10.1001/archinternmed.2012.4037
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Author Contributions: *Study concept and design:* Prasad and Cheung. *Acquisition of data:* Prasad. *Analysis and interpretation of data:* Prasad, Cheung, and Cifu. *Drafting of the manuscript:* Prasad and Cheung. *Critical revision of the manuscript for important intellectual content:* Prasad, Cheung, and Cifu. *Statistical analysis:* Cheung. *Administrative, technical, and material support: Study supervision:* Prasad and Cifu.
Financial Disclosure: None reported.

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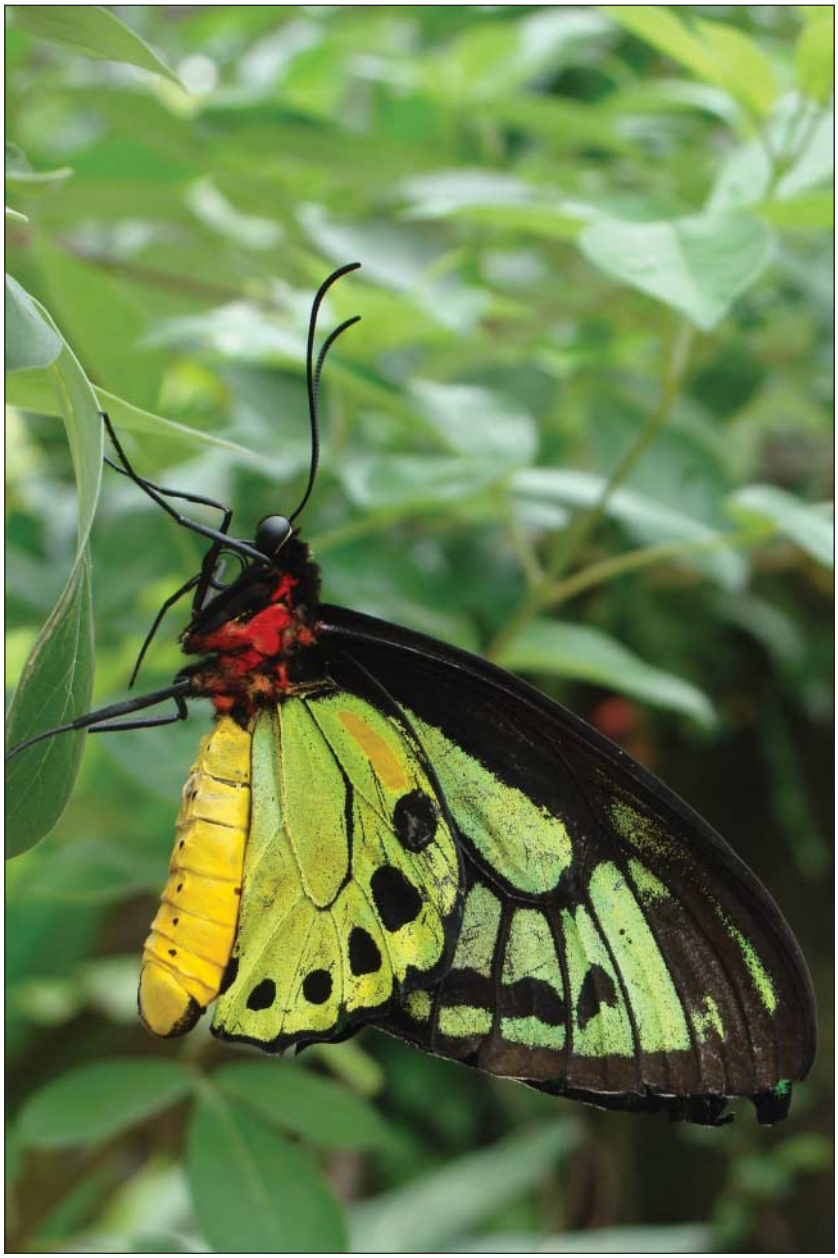

Surprisingly close.

Courtesy of: Neeti Kanodra, MBBS, Internal Medicine, Washington Hospital Center, Washington, DC.