

## Editorial

# Less is Probably more in the Work-up of Patients Presenting to the Emergency Department with Low-Risk Chest Pain

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Approximately 6 million patients present to the emergency department (ED) annually with a complaint of chest pain or other symptoms suggestive of myocardial ischemia and the estimated cost to the US economy is \$10 to \$12 billion [1-2]. Those whose initial cardiac enzyme testing is negative, electrocardiogram (ECG) is non-diagnostic, and who are otherwise hemodynamically stable have been shown to be at low-risk for a major cardiovascular event [3]. The majority of these patients do not have a cardiac cause of their symptoms,[4] and an optimal management strategy is unknown.

The American Heart Association (AHA) recommends that all patients presenting to the ED with low-risk chest pain receive a study to provoke ischemia or detect anatomic coronary artery disease (CAD) however, evidence for this strategy is lacking [5]. The Acute Cardiac Ischemia Time-Intensive Instrument (ACI-TIPI) trial found that approximately 2% of patients discharged from the ED had a diagnosis of missed myocardial infarction (MI) and another 2% had a diagnosis of missed unstable angina (UA) on subsequent follow-up [4]. This is often cited as rationale for observing low-risk chest pain patients and performing a stress test within 48 to 72 hours.

Several caveats to this interpretation should be kept in mind. First, there was no difference in outcomes between patients hospitalized or not with either MI or UA calling into question the validity and clinical impact of the missed diagnoses [4]. Next, cardiac enzyme testing is far more sensitive now than when the ACI-TIPI trial was performed. Than et al. recently demonstrated the safe use of a 2-hour accelerated diagnostic protocol to identify low-risk patients for early discharge. The rate of major cardiac events at 30 days was 0.9% [6]. Most importantly, one cannot extrapolate from the ACI-TIPI trial that stress testing would prevent missed diagnoses or improve clinical outcomes. Chan et al. prospectively studied 962 consecutive low-risk chest pain patients admitted to a telemetry bed over a 16 month period

and found no difference in 30 day cardiovascular outcomes among patients who received a stress test, either inpatient or outpatient, and those who did not [7].

While the possible benefits of an approach that involve routine stress testing in this patient population can be debated the unintended consequences, such as increased costs and unnecessary downstream testing cannot. In one study involving 1194 patients presenting to the ED with chest pain who met criteria for cardiac observation unit status, Khare et al. found that the prevalence of obstructive CAD was 1.5% and that the probability of having a false positive stress test was twice as high as the probability of detecting significant CAD [8]. In another study involving 220 patients, younger than 40 years, who presented to the ED with chest pain only 2.7% had a positive stress test.<sup>9</sup> Four of the 6 patients with positive results underwent angiography and none had evidence of obstructive CAD.<sup>9</sup> Penumetsa et al. performed a two year retrospective study of patients admitted to the chest pain observation unit of a large university medical center [10]. Overall, the rate of revascularization for all patients who underwent stress testing was 0.7% and 0.2% were readmitted with an MI in 30 days [10].

A likely improvement over the current management strategy for these patients would use an accelerated high-sensitivity troponin assay to rule out acute MI in combination with a clinically relevant risk stratification scheme to make an informed decision about who would benefit from a stress test or anatomic study. Examples of risk prediction tools studied in this population with some success include the thrombolysis in myocardial infarction (TIMI), CARDiac, and HEART scores [11-14]. The Diamond Criteria is an easy-to-use scoring system that is already used in conjunction with age and gender to determine the appropriateness of outpatient stress testing for suspected obstructive CAD [15]. The scheme is based on three readily determined characteristics which are generally accepted as being typical of ischemic cardiac discomfort: 1. Is the discomfort substernal? 2. Is it precipitated by exertion? 3. Is there prompt relief (within 30 seconds to 10 minutes) by rest or nitroglycerin? Patients with all 3 are classified as "typical", 2/3 as "atypical", and 1/3 or less as "nonanginal".<sup>14</sup>

Foy et al. found that the positive predictive value (PPV) of stress echocardiography and 30-day cardiovascular outcomes were significantly associated with the Diamond score in a cohort of 503 patients undergoing ED observation for suspected acute coronary syndrome [16]. Overall, 4.8% of patients had a positive stress echocardiogram and only 1.2% had angiographic evidence of obstructive CAD and underwent revascularization. The PPV of stress echocardiography for the entire cohort was 37.5% (6/16). In patients with typical chest pain, the positive predictive value of stress echocardiography was 75% (6/8) compared to 0% (0/8) for all others

subgroups ( $P = 0.007$ ). Six patients (14%) with typical chest pain went on to have PCI or CABG compared to 0% for all other subgroups ( $P < 0.001$ ). No patient in any subgroup died or was readmitted with an MI in 30 days.

The American College of Physician's (ACP) recently convened a working group to foster "high-value, cost-conscious" care. They identified several general principles for the appropriate use of diagnostic tests. According to the working group, diagnostic tests should not be performed if (1) the results will not change management; (2) the likelihood of a false positive result is higher than the likelihood of a true positive one; and (3) the downstream risks and costs of false positive tests are significant [17]. Based on these principles, stress echocardiography and other imaging modalities whose diagnostic accuracy is roughly equivalent such a nuclear imaging and coronary CT, for low risk chest pain patients in the ED with nonanginal symptoms fulfills the criteria for low-value care.

The findings by Foy et al. suggest that applying the Diamond criteria could improve utilization of stress echocardiography and other cardiovascular imaging studies for patients who present to the ED with low-risk chest pain. Future investigations should focus on refining clinical scoring systems in this patient population and ultimately, on performing a randomized trial to compare the routine use of provocative cardiac testing/anatomic imaging modalities to a strategy that limits advanced cardiac testing with an emphasis on hard cardiovascular endpoints such as death and hospitalization for MI.

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