Utility of Physician Selection of Cardiac Tests in a Chest Pain Unit to Exclude Acute Coronary Syndrome Among Patients Without a History of Coronary Artery Disease

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There are few data on the utility of physician selection of cardiac tests, including no-test, in a chest pain unit (CPU) to rule out acute coronary syndrome in low-risk patients without a history of coronary artery disease. We analyzed consecutive low-risk patients admitted to our CPU between 2012 and 2014 and determined the proportion of patients selected for testing, the type of initial cardiac test selected, and the incidence of major adverse cardiac events (MACEs) at 30 days and 6 months. The study group comprised 619 patients: mean age 57 years (27 to 92), 332 women (54%), and 360 (58%) with multiple cardiac risk factors. Cardiac testing included 283 no-test (46%); 179 exercise treadmill (29%); 113 myocardial perfusion stress scintigraphy (18%); <10% each for exercise stress echocardiography and coronary angiography. Testing was negative in 296 (88%), nondiagnostic in 30 (9%), and positive in 10 patients (3%). There were no MACEs at 30 days in any patients, and at 6 months, MACEs were 5 (1.1%). Length of stay was less in no-test than in tested patients (5.4 hours vs 9.8 hours, p <0.0001), and there was no difference in incidence of MACE at 6 months in no-test vs tested patients (2 MACEs vs 3 MACEs). Physician selection of cardiac tests, including no-test, promptly identified patients at low risk of acute coronary syndrome who could be safely and rapidly discharged from the CPU. Exclusion of cardiac testing shortened length of stay and was not associated with increase in MACE at 6 months.   © 2018 Elsevier Inc. All rights reserved. (Am J Cardiol 2018;121:825–829)

Of the >8 million annual emergency department visits for chest pain in this country,[1] only a minority are the result of a life-threatening condition.[2] The goal of evaluation of these patients is to rapidly identify those at low risk of acute coronary syndrome (ACS) or other serious condition who can be discharged directly from the emergency department and patients at higher risk who require hospital admission. Chest pain units (CPUs) have been developed to provide a safe, accurate means of excluding ACS and its complications in low-risk patients.[2,3] Evaluation in CPUs usually involves clinical assessment, serial electrocardiograms, cardiac injury markers, and further testing if indicated. This strategy includes cardiac functional or anatomic testing[2,4–6]; however, recent evidence suggests the utility of physician selection of patients for cardiac testing.[7,8] This approach can decrease length of stay and improve resource utilization while maintaining patient safety and accuracy. However, data regarding CPU evaluation without confirmatory cardiac testing are limited.[7] Furthermore, it is possible that physician selection of patients for cardiac testing

can be extended to include selection of the specific type of test from among the multiple available methods. This concept has not been previously reported. To address the need for information on physician selection of cardiac tests in the CPU, we analyzed a cohort of low-risk patients without a history of coronary artery disease (CAD) evaluated for chest pain in our emergency department–based CPU. We hypothesized that a strategy of physician selection of cardiac tests, including no-test, can safely and efficiently exclude ACS and allow safe and early discharge.

Methods

We analyzed a prospectively collected database of all consecutive low-risk patients admitted to the CPU of the University of California, Davis, Medical Center, an urban academic tertiary care institution, from January 1, 2012, to January 1, 2014. During this interval, the annual number of adult patient visits to our emergency department averaged approximately 55,000. Triage of patients to the CPU was based on our established criteria for low risk of ACS and its complications: hemodynamic stability, no arrhythmias, normal or near-normal electrocardiogram (ST depression no greater than 0.5 mm, normal T waves, no arrhythmia beyond rare premature atrial or ventricular contractions), and negative initial troponin I.[2] We excluded patients with a previous diagnosis of CAD.

The primary outcomes were (1) selection of patients for cardiac testing or no-test; (2) the type of initial cardiac test selected, which included no-test, exercise treadmill test (ETT),

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stress myocardial perfusion study, exercise stress echocardiography, or coronary angiography; and (3) the incidence of major adverse cardiac events (MACEs) including cardiac death, myocardial infarction, and revascularization at 30-day and 6-month follow-up. The decision to utilize a cardiac test was made by the CPU attending physician who selected the test and referred the patient for testing. Our CPU attending physicians are internists who also undergo additional, specialized training in management of patients presenting with chest pain and are dedicated to and full time at that position. The follow-up period began when patients were discharged home from the CPU or, if they were admitted to hospital, when the patient was discharged from the index admission. Secondary outcomes were the results of the cardiac tests and length of stay in the CPU.

ETT was considered positive for ischemia based on exercise-induced ST segment depression of ≥1.0 mm for 60 to 80 milliseconds after the J point and negative for ischemia if there was <1.0 mm ST segment depression during exercise testing and heart rate reached ≥85% of age-predicted maximum. If there was no evidence of exercise-induced ischemia but peak exercise heart rate was <85% of predicted maximum, the ETT was defined as nondiagnostic. Stress myocardial perfusion study was positive if there was a new stress-induced myocardial perfusion defect. Exercise stress echocardiography was considered positive based on a new stress-induced left ventricular wall motion abnormality. For coronary angiography, the definition of obstructive CAD was ≥50% stenosis of the left main coronary artery and ≥70% stenosis of a coronary artery or major branch.

The CPU has a separate, prospectively collected database completed by the attending physician at the end of each patient's evaluation. Data that are entered include symptoms, demographic features, cardiac risk factors, history of CAD, baseline electrocardiogram, type of cardiac tests utilized, and test results. To determine the incidence of MACE, we reviewed all patients' medical records up to 6 months after their CPU evaluation; to determine all-cause mortality, we queried the Social Security Death Index for all patients.

This study was approved by the University of California, Davis, Human Subjects Review Committee. Continuous data are presented as mean ± SD and range or percentage. Continuous variables were analyzed by Student's t test, and categorical variables were analyzed by chi-square test. Dif-

ferences were considered significant if p <0.05. The JMP statistical package (SAS Institute Inc., Cary, North Carolina) (JMP 13.0.0 for Macintosh) was used for analysis.

Results

The study group comprised 619 patients (Table 1), with approximately equivalent representation of women and men and a wide range of ages (Figure 1). Of the entire study group, 336 patients (54%) underwent a cardiac test (Figure 2). The largest subgroup comprised patients who received no-test. Patients who underwent a cardiac test versus patients with no-test were more likely to be men but otherwise were similar in age and number of cardiac risk factors (Table 1).

Cardiac testing was most often negative and was positive in only 10 patients (3%) (Table 2). All patients with a negative cardiac test were discharged without further evaluation, except 1 patient with a negative ETT who underwent further testing with myocardial perfusion study, which was negative, resulting in discharge that day. The majority of patients with nondiagnostic cardiac tests were discharged without further evaluation, based on high functional capacity (average metabolic equivalents 12 and no exercise-induced chest pain). Three patients with a nondiagnostic ETT underwent further cardiac testing, all of which were normal. Of the 10 patients with positive cardiac tests (Table 2), coronary angiography was the initial test in 1 patient, which revealed obstructive CAD, and the patient received coronary artery
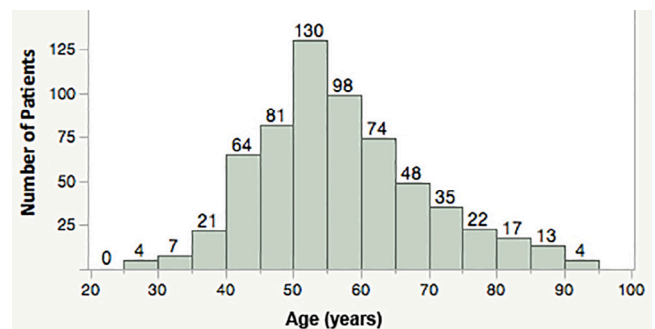
Figure 1. Age distribution of patients. Distribution of study cohort according to age. Numbers over bars indicate number of patients.

Table 1
Characteristics of patients

Variable	Total Patients (n = 619)	Cardiac Test		P-Value
		Yes (n = 336)	No (n = 283)	
Age* (years)	57 ± 12 (27-92)	58 ± 11 (32-92)	56 ± 13 (27-92)	ns
Men	55 ± 12 (27-89)	55 ± 11 (32-89)	53 ± 12 (27-89)	ns
Women	60 ± 12 (30-92)	60 ± 11 (34-92)	58 ± 13 (30-92)	ns
Men	287 (46%)	171 (51%)	116 (41%)	0.02
Cardiac Risk Factors				
0–1	259 (42%)	141 (42%)	118 (42%)	ns
≥2	360 (58%)	195 (58%)	165 (58%)	ns
Length of Stay† (hours)	7.8 ± 10	9.8 ± 12	5.4 ± 8	<0.0001

* Mean ± SD (range).
† Mean ± SD.