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Original Contributions

IMMEDIATE STRESS ECHOCARDIOGRAPHY FOR LOW-RISK CHEST PAIN PATIENTS IN THE EMERGENCY DEPARTMENT: A PROSPECTIVE OBSERVATIONAL COHORT STUDY

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Abstract—Background: Evaluation and disposition of low-risk chest pain (CP) patients in the emergency department (ED) is time consuming and expensive. Low-risk CP often results in hospital admission to rule out myocardial infarction, which leads to additional costs and delays. **Objective:** Our aim was to assess whether an immediate exercise stress echocardiogram (IESE) in the ED will allow safe, efficient, and cost-effective evaluation and discharge of patients with low-risk CP. **Methods:** Low-risk CP patients (TIMI [Thrombolysis in Myocardial Infarction] score 0–1) presenting to the ED with normal electrocardiogram, no history of coronary artery disease, and negative troponin T received IESE. We followed these patients for major adverse cardiac events and compared them to a control cohort of similar-risk patients admitted with traditional care at 1 and 6 months. **Results:** We enrolled 216 patients, 117 IESE and 109 control. We obtained follow-up at 1 and 6 months in 94% of the IESE group and 88% in the control group. There was no difference in diagnostic catheterization or percutaneous coronary intervention between the 2 groups (6.0% and 1.7% vs. 6.4% and 1.8%; $p = 0.89$). Median time from triage to discharge was significantly shorter with IESE (572.6 min vs. 1466.0 min), resulting in significantly lower cost (\$4380.50

vs. \$6191.70). There were no adverse events related to IESE or early discharge. **Conclusions:** In our study, IESE for low-risk CP patients presenting to the ED has the potential to be equally safe, more expeditious, and more cost effective than admission to an observation unit. © 2017 Elsevier Inc. All rights reserved.

Keywords—chest pain; stress echocardiography; emergency department

INTRODUCTION

Chest pain (CP) is the second most common complaint of patients presenting to the emergency department (ED) (1). Every year, > 5 million people will present to EDs in the United States with a chief complaint of CP (2). CP has many different potential etiologies, ranging from benign to life threatening. Risk scores, such as the TIMI (Thrombolysis in Myocardial Infarction) score, allow physicians to stratify patients based on their risk of having an acute coronary event (ACE) into low, intermediate, and high risk. Patients with TIMI scores in the “low risk” range have a < 5% chance of having an ACE (3,4).

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Although stratification tools are effective, even the low-risk CP patients have the potential for an adverse event. This leads to difficult disposition decisions for emergency physicians. While safe discharge is possible in most of these low-risk patients, providers also must consider the consequences of discharging a patient who is having an ACE. In some studies, as many as 2% of ACE patients experience inadvertent discharge from the ED (5). Aside from the moral implications, the legal consequences can be significant. These patients are the most expensive cause of malpractice litigation against emergency medicine providers and comprise 20% of all malpractice claims (6). As a result, 23-h observation unit admission with serial biomarkers to rule out myocardial infarction is a common treatment approach in low-risk CP patients. These admissions typically include cardiac stress testing, with or without imaging. The American College of Cardiology/American Heart Association guidelines suggest that discharge and outpatient stress testing within 72 h may be reasonable and safe for low-risk CP patients (7). Admission to the hospital results in heavy resource utilization for a low-risk patient population. Various studies have investigated approaches to find a faster, more cost-effective method of safely discharging these patients directly from the ED (7–10). These include the use of stress electrocardiography (ECG), myocardial perfusion imaging, and computed tomography angiography (CTA) of the coronary arteries (7–10).

Few studies have investigated stress echocardiography in this setting (7,8,11). We sought to evaluate the use of immediate exercise stress echocardiography (IESE) in low-risk patients (TIMI score 0–1) after initial triage and a single negative troponin. Additionally, we wanted to determine whether IESE is more expedient and cost effective compared to hospital admission to an observation unit, biomarkers, and further testing.

METHODS

Study Population and Follow-up

We performed a prospective observational cohort study of patients who received an IESE. The Department of Emergency Medicine and Section of Cardiology collaborated to develop the protocol. Our protocol identified ED patients with CP who were at low risk for CAD and who could perform IESE for the evaluation of coronary ischemia. We performed our study at a regional academic medical center with an annual ED volume of > 115,000 patients. Patients older than 18 years without a history of coronary disease or myocardial infarction who

presented to the ED with CP, an ECG without significant ischemic changes, a negative initial troponin T, a TIMI risk score of 0 or 1, and were able to walk on a treadmill were eligible for the study. Selection of patients for IESE was at the discretion of the emergency physician. We conducted our study between October 2, 2011 and February 2, 2013. The echocardiography laboratory was available for ED stress echocardiograms from 6 AM to 4 PM, Monday through Friday. Patients who performed IESE remained in the ED until testing was completed. The decision to admit or discharge the patient after the stress echocardiogram was at the discretion of the emergency physician. Evaluation of any patients admitted after the stress echocardiogram was at the discretion of the admitting physician.

We enrolled a cohort of similar CP patients admitted during weekdays to our observation unit to “rule out” a myocardial infarction as a comparison group (“standard care”). The workup of these patients was at the discretion of the admitting physician (Figure 1).

We contacted patients by telephone at 1 month and 6 months after discharge from their index visit. Our study defined self-reported primary cardiac events as death (per caregivers’ report), myocardial infarction, or the need for revascularization. We confirmed all events by chart review to evaluate hospital course and final diagnosis. Additional data included length of stay in the ED and hospital, as well as the need for cardiac catheterization or other cardiac imaging during the index admission and at follow-up. The Institutional Review Board reviewed and approved the protocol.

IESE Protocol

Our study required all stress echocardiograms to be in the presence of either a board-certified or board-eligible cardiologist with at least level II training in echocardiography (Figure 1). The cardiologist obtained a brief history and reviewed the baseline echocardiogram before starting the exercise portion. The cardiologist could cancel the test if he or she felt the patient was not low risk (\geq TIMI 2), or if there were wall motion abnormalities present on the baseline echocardiogram. If the cardiologist determined the patient was an appropriate candidate, the patient would then perform a symptom-limited exercise stress test utilizing the Bruce protocol. We obtained stress echocardiographic images within 1 min of recovery. All stress echocardiograms utilized the same equipment (IE33; Philips Medical Systems, Andover, MA). A final report of the stress echocardiogram accompanied the patient back to the ED, where the physician made the decision to admit, discharge, or further evaluate the patient.

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