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Research Article

Application of Appropriate-Use-Criteria to Single-Photon Emission Computed Tomography Myocardial Perfusion Imaging (SPECT-MPI) Test Results: A Retrospective Analysis

Biswas A[1]* and Ward JR[2]

Abstract

Background: The American College of Cardiology Foundation (ACCF)/ American Heart Association (AHA)/American Society of Nuclear Cardiology (ASNC) guidelines are designed to select those patients who would benefit the most from stress myocardial perfusion imaging. Unfortunately, these guidelines are infrequently used. Multiple studies have shown varying degrees of adherence to the appropriateness criteria, thus exposing patients to unnecessary radiation risk and imposing a financial burden on the health system.

Methods: We included 250 Stress Myocardial Perfusion Imaging studies conducted at the stress lab at a university affiliated hospital in Pittsburgh, Pennsylvania between October 2010 and January 2011. Appropriateness of the tests was determined based on the criteria suggested by the ACCF/AHA/ASNC.

Results and Conclusions: Of the 250 included, 148 (59.2%) tests were determined to be appropriate as per the Appropriate Use Criteria. There were 77 tests (30.8%) that were inappropriate and 25(10%) tests that were judged to be in the uncertain category respectively. Following the appropriateness criteria could help reduce the significantly high rates of inappropriate testing even at academic centers.

Keywords

Appropriate use criteria; Single-photon emission computed tomography; Myocardial perfusion scan; Risk stratification; Pretest risk

Background

Single-photon Emission Computed Tomography (SPECT)-Myocardial Perfusion Imaging (MPI) is a cost-effective and preferred mode of investigation to determine the risk of significant coronary artery disease (CAD). A negative stress study confers a 1% annual risk of myocardial infarction or cardiac death. A strategy of coronary catheterization for those with inducible ischemia on the SPECT-MPI study confers significant financial savings according to the multicenter Economics of Noninvasive Diagnosis (END) in the US and Economics of Myocardial Perfusion Imaging in Europe (EMPIRE) studies [1]. Recent data indicates dramatic rise in the use of SPECT-MPI among those with low risk cardiac status [2]. This has invited a debate over the wasteful ordering of these tests. Reimbursement for the test has taken a cut after the Deficit reduction Act of 2005. A significant number of such studies are being denied re-imbursement by insurance companies thus transferring the burden of payment on to the patient or the testing institution.

The American College of Cardiology Foundation (ACCF), American Heart Association (AHA), and American Society of Nuclear Cardiology (ASNC) collaborated to critically and systemically create, review and categorize clinical situations where the tests should be ordered [3]. Guidelines were first published in 2005 and subsequently updated in 2009 [3].

Methods

We retrospectively reviewed 327 Stress MPI studies conducted at the stress lab at a university-affiliated community hospital between October 2010 and January 2011. The study was approved by the Institutional Review board of the University of Pittsburgh. 250 tests meet our inclusion criteria. The collected data included patient demographics, specialty of the ordering physician, summed stress score, summed rest score, summed difference score, transient ischemic dilatation and percentage of jeopardized myocardium. Appropriateness of the test was determined using the appropriateness criteria taking into account each patient's clinical presentation, medical history and prior cardiac test results. Electronic medical record was accessed to find out indications for the test, their symptom assessment, Framingham Heart scores, EKG, results of prior stress tests and coronary angiogram if available, results of echocardiogram, surgical risk assessment as per ACC/AHA guidelines of 2007 [4]. Pretest Probability of CAD for symptomatic patients was determined using previously published methodology [5].

Findings

Of the 250 tests reviewed, 148 (59.2%) were determined to be appropriate, 77 (30.8%) inappropriate (Table 1) and 25 (10%) tests were judged to be in the uncertain category. A positive stress-test result is more likely on an appropriate indication (14.9% vs. 6.5%, $P<0.05$). Females were ordered tests on inappropriate indication more often than males (62.3% of inappropriately tested patients were

Table 1: Causes of inappropriate testing (77/250).

Cause of inappropriate testing	
Chest pain (in low risk patients) with a negative EKG	29/77(37.6%)
Pre-operative stress testing for low risk surgeries with good exercise capacity and minimal risk factors	20/77(26%)
Syncope	12/77 (15.5%)
Palpitations	6/77(7.7%)
Asymptomatic low risk (ATP III) patients	5/77 (6.5%)
Others (transient ischemic attack, atrial fibrillation, neck pain)	5/77 (6.7%)

***Corresponding author:** Abhishek Biswas, University of Florida, Pulmonary, Critical Care and Sleep Medicine, 1600 SW Archer Avenue, Gainesville, Florida 32610 USA, Tel: 352-273-8734; Fax: 352-273-9154; E-mail: abhibiswas78@gmail.com

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females vs. 49.6% of all patients, P<0.05). Within the appropriately tested category, we found that 36/148 (24.3 %) had a low pretest risk status. All of them had a negative stress result. We also saw that 62/77(80.5 %) of inappropriate tests had a low pretest risk status.

Discussion

This study reports a higher rate of inappropriateness than reported by Hendel et al. [6] (14.4%, range between centers 4-22%). A test ordered to detect coronary artery disease in asymptomatic low risk (ATP III) patients was the most common cause of inappropriate testing in his study. Tests ordered in low risk patients with chest pain with a normal EKG were the most common cause (37.6%) of inappropriate studies in our group. This accounted for 16% of inappropriate tests in his study. Difference in study location (ours being university affiliated-community hospital setting) could explain the difference in results.

A low pretest risk status was rarely associated with positive stress test result in our study. Thus, patients presenting with angina equivalents and a low pretest likelihood of CAD could potentially be discharged home and subsequently undergo outpatient workup. The process of deciding appropriateness is conceptually simple and could be a cost effective way to reduce unnecessary exposure to radiation for the patient and financial losses for the institution.

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Author Affiliations

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University of Florida, Pulmonary, Critical Care and Sleep Medicine, 1600 SW Archer Avenue, Gainesville, Florida 32610, USA
University of Pittsburgh Mercy Hospital, Heart and Vascular Institute, 1350 Locust St, Pittsburgh, PA 15219, USA