JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
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PUBLISHED BY ELSEVIER

VOL. 67, NO. 7, 2016
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2015.11.055

THE PRESENT AND FUTURE

REVIEW TOPIC OF THE WEEK

Diagnostic Strategies for the Evaluation of Chest Pain

Clinical Implications From SCOT-HEART and PROMISE

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ABSTRACT

SCOT-HEART (Scottish COmputed Tomography of the HEART) and PROMISE (PROspective Multicenter Imaging Study for Evaluation of chest pain) represent the 2 largest and most comprehensive cardiovascular imaging outcome trials in patients with stable chest pain and provide significant insights into patient diagnosis, management, and outcomes. These trials are particularly timely, given the well-recognized knowledge gaps and widespread use of noninvasive imaging. The overall goal of this review is to distill the data generated from these 2 pivotal trials to better inform the practicing clinician in the selection of noninvasive testing for stable chest pain. Similarities and differences between SCOT-HEART and PROMISE are highlighted, and clinical and practical implications are discussed. Both trials show that coronary computed tomography angiography should have a greater role in the diagnostic pathway of patients with stable chest pain. (J Am Coll Cardiol 2016;67:843-52) © 2016 by the American College of Cardiology Foundation.

Angina is highly prevalent in the general population and increases with age in both sexes, occurring in 10% to 11% of those >80 years of age (1). New-onset, stable chest pain is a common clinical problem that results in approximately 4 million stress tests annually in the United States (2). At the same time, patients diagnosed with noncardiac chest pain account for one-third of patients who subsequently die from cardiovascular disease or have an acute coronary syndrome during 5 years of follow-up (3). Therefore, despite several decades of noninvasive cardiovascular testing development and experience, improved diagnostic accuracy and risk stratification is still needed (4).

Significant variations in diagnostic strategies between European countries and the United States are well-documented and may be related to differences in health care systems, access to testing technologies, and risk tolerance (2,5,6). Furthermore, variation may be explained by the limited information on health-related outcomes in this stable, undiagnosed population, and there is little consensus about which test is preferable, or even when one is required (7-9). Major U.S. and European guidelines differ fairly substantially in their fundamental approach to determining the pre-test probability (PTP) of coronary artery disease (CAD) in symptomatic patients and how to proceed with test selection. Furthermore, both U.S. and European measures markedly overestimate PTP rates (10).

To address these issues systematically, 2 large, multicenter, open-label, randomized controlled trials explored the diagnostic evaluation of patients with symptoms that may represent coronary heart disease (CHD). The SCOT-HEART (Scottish COmputed Tomography of the HEART) (11) and PROMISE (PROspective Multicenter Imaging Study for Evaluation of chest pain) (12) trials sought to address an evidence

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Manuscript received September 15, 2015; revised manuscript received November 2, 2015, accepted November 12, 2015.

ABBREVIATIONS AND ACRONYMS

CAD = coronary artery disease

CCTA = coronary computed tomography angiography

CHD = coronary heart disease

ECG = electrocardiogram

ETT = exercise treadmill test

MI = myocardial infarction

gap in noninvasive testing in stable chest pain, an area in which few randomized trials have been conducted (7,13). Each examined the potential role of coronary computed tomography angiography (CCTA). Similarities between SCOT-HEART and PROMISE make it tempting to combine these studies (14,15). However, several salient differences in study populations and endpoints are critical to understanding the implications of each.

How do we best incorporate the results of 2 pivotal trials, SCOT-HEART and PROMISE, into current practice to provide optimal care for our patients? This review aims to provide a context for approaching noninvasive imaging by:

1. Describing the historically unmet clinical need for outcomes research in cardiovascular imaging;
2. Enumerating similarities and differences between SCOT-HEART and PROMISE;
3. Briefly summarizing other very recent trial results or ongoing trials; and
4. Providing a unified set of conclusions, drawing upon the findings of both SCOT-HEART and PROMISE.

A HISTORICAL UNMET NEED FOR CARDIOVASCULAR IMAGING OUTCOMES TRIALS

Despite the routine use of noninvasive testing for patients with stable chest pain of suspected cardiac etiology over the last several decades, until 2015, no large-scale randomized trial had evaluated the diagnosis, management, and outcomes of these patients. Most recent clinical trials for CCTA focused on assessing its accuracy and comparability for identification of CHD (16,17), or its effect on management of low-risk patients presenting to the emergency department with acute chest pain (18). However, few (if any) randomized studies directly compared the various anatomic and functional testing options in patients with stable chest pain using clinical endpoints.

HIERARCHY OF EVIDENCE IN CARDIOVASCULAR IMAGING OUTCOMES RESEARCH. In 1991, Fryback and Thornbury (19) devised hierarchical levels of diagnostic test evidence. This commonly-cited model for efficacy in imaging describes 6 hierarchical tiers of evidence: 1) technical efficacy; 2) diagnostic accuracy; 3) diagnostic thinking; 4) therapeutic efficacy; 5) patient outcomes; and 6) societal efficacy, including cost-effectiveness. Yet, only 1% of the over 700 recommendations for cardiovascular imaging in American College of Cardiology and American Heart Association guidelines are on the basis of Level of Evidence: A (20). Recent randomized trials that have assessed the effect of CCTA versus usual care among patients with suspected acute coronary syndromes in the emergency department, primarily with safety (21), hospital length-of-stay (18), and cost-effectiveness (22) endpoints, are not included in this review. The results of SCOT-HEART and PROMISE are, therefore,

FIGURE 1 Diagnostic Strategies for the Evaluation of Chest Pain

	SCOT-HEART trial (Scottish COmputed Tomography of the HEART)	PROMISE trial (PROspective Multicenter Imaging Study for Evaluation of chest pain)
Technical capabilities	64 slice +	64 slice +
Diagnostic performance	Pending	Pending
Diagnostic thinking	Increased certainty (= ICA)	Increased ICA
Therapeutic thinking	Increased preventative Rx	Increased preventative Rx
Therapeutic strategy	= PCI/CABG	Increased PCI/CABG
Clinical outcomes	+/- Improvement	No difference
Patient satisfaction	No difference at 6 weeks	Results pending
Costs	Pending	No difference

The **left column** shows the Fryback and Thornbury (19) model for assessing diagnostic test evidence on the basis of hierarchical levels of clinical outcomes. These levels range from technical quality and diagnostic/prognostic accuracy to establishing a test's effect on clinical decision-making to societal outcomes. The findings of both trials are summarized in the **middle and right columns**, providing a comparison of the types of evidence provided by each, as well as the results. CABG = coronary artery bypass graft; ICA = invasive coronary angiography; PCI = percutaneous coronary intervention; Rx = prescription.