

Single Resting hsTnT Level Predicts Abnormal Myocardial Stress Test in Acute Chest Pain Patients With Normal Initial Standard Troponin

Waleed Ahmed, MD,* Christopher L. Schlett, MD, MPH,*
Shanmugam Uthamalingam, MD,* Quynh A. Truong, MD, MPH,*†
Wolfgang Koenig, MD,‡ Ian S. Rogers, MD, MPH,* Ron Blankstein, MD,*
John T. Nagurney, MD, MPH,§ Ahmed Tawakol, MD,* James L. Januzzi, MD,†
Udo Hoffmann, MD, MPH*†
Boston, Massachusetts; and Ulm, Germany

OBJECTIVES The goal of this study was to determine the ability of a single, resting high-sensitivity troponin T (hsTnT) measurement to predict abnormal myocardial perfusion imaging (MPI) in patients presenting with acute chest pain to the emergency department (ED).

BACKGROUND HsTnT assays precisely detect very low levels of troponin T, which may be a surrogate for the presence and extent of myocardial ischemia.

METHODS We included all patients from the ROMICAT I (Rule Out Myocardial Infarction Using Computer Assisted Tomography) trial, an observational cohort study, who underwent both single-photon emission computed tomography (SPECT)-MPI stress testing and 64-slice computed tomography angiography (CTA) and in whom hsTnT measurements were available. We assessed the discriminatory value of hsTnT for abnormal SPECT-MPI and the association of reversible myocardial ischemia by SPECT-MPI and the extent of coronary atherosclerosis by CTA to hsTnT levels.

RESULTS Of the 138 patients (mean age 54 ± 11 years, 46% male), 19 (13.7%) had abnormal SPECT-MPI. Median hsTnT levels were significantly different between patients with normal and abnormal SPECT-MPI (9.41 pg/ml [interquartile range (IQR): 5.73 to 19.20 pg/ml] vs. 4.89 pg/ml [IQR: 2.34 to 7.68 pg/ml], $p = 0.001$). Sensitivity of 80% and 90% to detect abnormal SPECT-MPI was reached at hsTnT levels as low as 5.73 and 4.26 pg/ml, respectively. Corresponding specificity was 62% and 46%, and negative predictive value was 96% and 96%, respectively. HsTnT levels had good discriminatory ability for prediction of abnormal SPECT-MPI (area under the curve: 0.739, 95% confidence interval: 0.609 to 0.868). Both reversible myocardial ischemia and the extent of coronary atherosclerosis (combined model $r^2 = 0.19$ with partial $r^2 = 0.12$ and $r^2 = 0.05$, respectively) independently and incrementally predicted the measured hsTnT levels.

CONCLUSIONS In patients with acute chest pain, myocardial perfusion abnormalities and coronary artery disease are predicted by resting hsTnT levels. Prospective evaluations are warranted to confirm whether resting hsTnT could serve as a powerful triage tool in chest pain patients in the ED before diagnostic testing and improve the effectiveness of patient management. (J Am Coll Cardiol Img 2013;6:72–82) © 2013 by the American College of Cardiology Foundation

Traditionally, cardiac troponin T (TnT) has been considered a specific marker for myocardial necrosis and thus represents a diagnostic hallmark for the diagnosis of acute myocardial infarction as well as a predictor of major adverse cardiac events (1,2). Although conventional TnT assays were unreliable for the detection of troponin <0.01 ng/ml, a novel, so-called “high-sensitivity” assay demonstrates greatly improved precision and thus permits the reliable detection of much lower concentrations of TnT with great precision (99th

acute chest pain to the ED, but without objective evidence of ACS on admission, we assessed the discriminatory power of resting hsTnT levels to predict abnormal rest and stress SPECT-MPI. In addition, we assessed whether both myocardial ischemia and coronary atherosclerosis independently predict hsTnT, which would establish hsTnT as a surrogate marker for myocardial injury both in patients with nonobstructive or obstructive CAD.

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percentile of hsTnT for a normal reference population: 13 pg/ml, imprecision <10%) (3–6). Hitherto, the new assays detect measurable amounts of TnT at lower levels than those pre-specified for myocardial necrosis, even in patients without symptoms of cardiovascular disease, and predict cardiovascular morbidity and mortality in patients with and without overt coronary artery disease (CAD) (7–10). In addition, Sabatine et al. (11) recently demonstrated a stress-induced rise in cardiac troponin I levels as measured with a high-sensitivity assay that correlated with reversible myocardial ischemia as demonstrated by single-photon emission computed tomography–myocardial perfusion imaging (SPECT-MPI). These observations led to the intriguing hypothesis that these new assays may permit tracking of CAD development over time and also permit the detection of acute myocardial ischemia. This hypothesis has been supported by our previous results demonstrating that hsTnT assays permit improved detection of acute coronary syndromes (ACS) as compared with conventional TnT among patients presenting with acute chest pain to the emergency department (ED), because patients later classified as having unstable angina are identified sooner using hsTnT (12). In addition, this study demonstrated a close association of hsTnT with cardiac structure and function as determined by computed tomography (CT).

To further determine the potential role of hsTnT to risk stratify patients presenting with

METHODS

Patient population. Details of the ROMICAT (Rule Out Myocardial Infarction Using Computer Assisted Tomography) study have been previously reported (13). Briefly, ROMICAT was a double-blinded, single-center, prospective observational cohort study of consecutive adult patients at low-to-intermediate likelihood of ACS presenting to the ED of Massachusetts General Hospital with acute chest pain, and whose initial electrocardiogram (ECG) and biomarkers were not indicative of a high likelihood for ACS. The enrollment period was a cumulative period of 18 months ending May 2007. Exclusion criteria were atrial fibrillation, serum creatinine >1.3 mg/dl, and personal history of CAD. All eligible patients who consented underwent ECG-gated contrast-enhanced 64-slice multidetector CT. All patients and caregivers were blinded to the findings of the CT. Patients received standard of care to rule out ACS during index hospitalization, including serial ECGs, biomarkers, and cardiac testing (stress test or cardiac catheterization), as clinically utilized by the physicians caring for the patient. The institutional review board approved the study protocol, and all patients provided written informed consent.

For this study, we only included patients who underwent clinically indicated rest and stress

ABBREVIATIONS AND ACRONYMS

ACS	= acute coronary syndrome
AUC	= area under the curve
CAD	= coronary artery disease
CI	= confidence interval
CT	= computed tomography
CTA	= computed tomography angiography
ECG	= electrocardiogram
ED	= emergency department
hsTnT	= high-sensitivity troponin T
IQR	= interquartile range
MPI	= myocardial perfusion imaging
NPV	= negative predictive value
PPV	= positive predictive value
SDS	= summed difference score
SPECT	= single-photon emission computed tomography
SRS	= summed rest score
SSS	= summed stress score
TID	= transient ischemic dilation
TnT	= troponin T

‡Division of Cardiology, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts; and the §Department of Cardiology, University of Ulm, Ulm, Germany. This work was supported by the NIH (R01 HL080053). The reagents for high-sensitivity troponin assays were provided free by Roche Diagnostics. Drs. Ahmed, Uthamalingam, and Rogers received support from NIH grant T32HL076136. Dr. Truong also received support from NIH grants K23HL098370 and L30HL093896. Dr. Januzzi has received grant support from Roche Diagnostics, Siemens Diagnostics, and BRAHMS. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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