Point-of-Care Testing for Cardiac Markers in Acute Coronary Syndromes and Heart Failure

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KEYWORDS

• Point-of-care • Acute coronary syndrome • Troponin
• Heart failure • B-type natriuretic peptide

Advances in technologies for performing and miniaturizing immunoassay testing have enabled the development of 15-minute whole-blood assays for various cardiac markers used in the evaluation of patients with acute coronary syndromes (ACS) and congestive heart failure. Many of the commercially available platforms have been previously described.[1,2] Available markers in point-of-care testing (POCT) formats include cardiac troponin I and T, creatine kinase isoenzyme containing M and B subunits (CK-MB), myoglobin, B-type natriuretic peptide (BNP), and N-terminal prohormone brain natriuretic peptide (NT-proBNP). Various combinations of these markers are available on small bench-top or handheld devices from a variety of manufacturers, permitting true rapid whole-blood testing in the emergency department or in hospital chest-pain units. Rapid whole-blood cardiac-marker testing devices have also proven useful in centralized stat laboratories. In many cases, the analytical and clinical performance of these assays is equivalent or nearly equal to that of conventional central laboratory testing using automated immunoassay platforms.[3] The availability of rapid high-quality point-of-care tests for patients with cardiovascular disease can facilitate restructuring of conventional approaches to patients with ACS and heart failure,[4,5] and may have the potential to improve medical outcomes.

TROPONINS, CREATINE KINASE ISOENZYME CONTAINING M AND B SUBUNITS, AND MYOGLOBIN

Clinical Considerations

Each year, approximately 8 million Americans present with nontraumatic chest pain[1] suggestive of a possible ACS. ACS encompass a range of myocardial ischemia,

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including unstable angina, non–Q wave acute myocardial infarction (AMI), and Q wave AMI. Electrocardiographic findings may evolve over time during an AMI. Patients who present with ST elevation indicative of ischemia on ECG usually develop a Q wave AMI (**Fig. 1**). The minority develop a non–Q wave AMI. Other patients initially show no ST elevation. Most of these are eventually diagnosed with either unstable angina or a non–ST elevation AMI (NSTEMI).[6] The distinction between unstable angina and NSTEMI is based largely on the finding of elevated cardiac markers, which highlights the importance of rapid laboratory testing in the evaluation of ACS.

In patients with a typical clinical history and diagnostic ECG findings, the diagnosis and classification of ACS may be straightforward. For others, such a diagnosis and classification may be extremely challenging. Overdiagnosis of ACS leads to unnecessary hospitalization and expensive follow-up diagnostic procedures. Approximately 50% of patients admitted for the evaluation of chest pain are eventually found not to have had an ACS[1] and less than 30% of patients admitted to a coronary care unit rule in for an AMI.[7] Consequently the majority of patients admitted for ''rule out'' AMI do not have a myocardial infarction. This fact has prompted various attempts to develop rapid and reliable ''rule out'' AMI protocols to reduce unnecessary admissions. Many hospitals have implemented chest-pain observation units to focus resources on efficient rule-out pathways. Many hospital admissions can be avoided by not admitting low-risk patients for ''rule-out AMI'' protocols. On the other hand, underdiagnosis of AMI will inevitably result in ''missed AMI'' with potentially serious morbidity or mortality. Missed AMI has been reported to be the leading cause of lawsuits stemming from events in emergency department settings.[1,5,8]

The diagnostic criteria for AMI have evolved over the past decade. In the past, the World Health Organization defined AMI as a combination of two of following three criteria[2]:

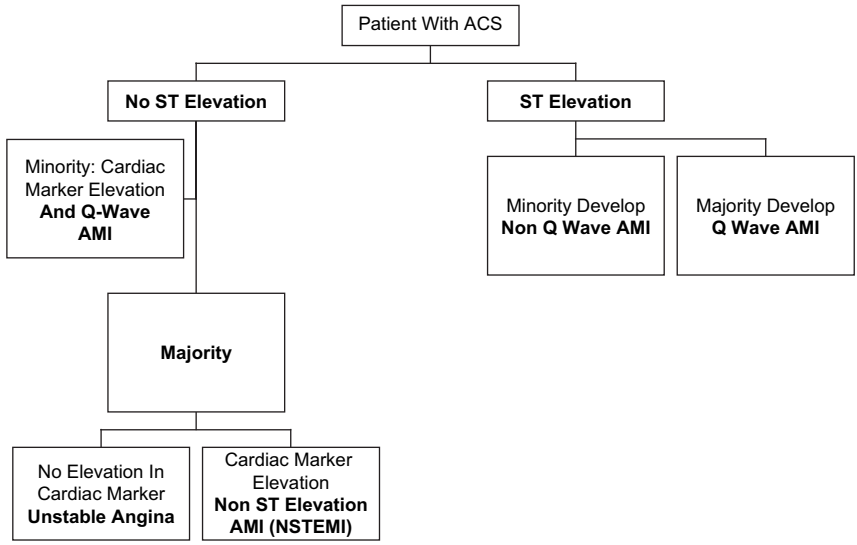

Fig. 1. Classification of ACS. (*Data from* Alpert J, Antman E, Apple F, et al. Myocardial infarction redefined. A consensus document of the joint European Society of Cardiology/American College of Cardiology Committee for the Redefinition of Myocardial Infarction. J Am Coll Cardiol 2000;36:959–69.)