

Universal Definition of Myocardial Infarction for the 21st Century

Definition of a concept or an object enables effective human communication concerning the defined entity. The history of medicine is full of examples where inaccurate or poorly understood definitions of clinical terms have led to confusion and inaccuracies both in investigation and daily clinical practice. Accurate, clear, and easily interpreted definitions of a disease entity are essential if physicians are to communicate amongst themselves or with patients. In clinical trials, standardized, universally employed definitions of disease entities are required if these trials are to be compared and correctly interpreted.

Myocardial infarction (MI) is a clinical diagnosis that is based on certain clinical events combined with specific laboratory tests. When both are present, a diagnosis of MI is established. Unfortunately, clinicians and clinical scientists have often defined MI in different ways, thereby leading to confusion both in daily practice and in clinical investigation. In an attempt to alleviate some of this confusion and arrive at an internationally agreed upon definition of MI, the European Society of Cardiology (ESC) and the American College of Cardiology (ACC) completed a consensus process in 2000 that sought to define MI in a universally acceptable manner. The consensus process led to a document that was published simultaneously in the European Heart Journal and the Journal of the American College of Cardiology (1).

Central to this original global definition of MI was the use of the highly sensitive and specific biomarker, troponin, in the identification of ischemic myocardial necrosis. Clinical identifiers such as an appropriate history and typical ischemic ECG changes were also a required part of the definition. Since the publication of this report, a number of scientific reports have detailed new information that directly relates to certain aspects of the suggested global definition. It was therefore agreed that the ESC/ACC 2000 MI-definition would need revision. Consequently, a task force was constituted with members coming from various parts of the world. This global task force was successful in its efforts and the newly redefined universal definition for MI was published simultaneously in the European Heart Journal, Circulation, and the Journal of the American College of Cardiology in 2007 (2).

Based on scientific advances, new concepts were added to the revised definition, while, at the same time, retaining or expanding a number of features of the ESC/ACC 2000 MI-definition. The new definition is still based on a patient history involving an appropriate clinical syndrome with chest discomfort or its equivalent together with ischemic ECG changes and a rise in blood troponin values. Troponin assays must be carefully done and shown to be highly reproducible. The 99 percentile of the

upper reference limit (URL) of normal for blood measurement of troponin should be exceeded in order for the clinician to diagnose an acute MI. In the revised definition, however, there are new ways for the clinical scenario to lead to the diagnosis of acute or remote MI. For example, a patient who arrives at a hospital or clinic and reports classic symptoms of MI together with an ECG that demonstrates ST segment elevation or left bundle branch block as well as angiographic or autopsy evidence of an occluded coronary artery is labeled as having had an MI even if the patient dies before blood troponin levels can become elevated.

Additionally, MI can be diagnosed when a non-invasive imaging test demonstrates a ventricular wall motion abnormality together with a characteristic elevation of troponin values, even though appropriate symptoms or ECG changes are absent. A healed or remote MI may also be detected by imaging studies if definite myocardial scarring can be identified in a patient with coronary artery disease.

One controversial area of the original definition of MI was the scenario involving elevated blood troponin levels following percutaneous coronary interventions (PCI). In a similar fashion, the original document offered no criteria for diagnosing a MI following coronary bypass surgery (CABG). The revised definition offers a consensus recommendation for both of these situations. In the case of PCI, the troponin values should exceed three times the 99 percentile URL before a MI is diagnosed. In the case of CABG, the troponin level must exceed five times the 99 percentile URL. Elevated troponin values below these consensus levels are termed procedurally related myocardial injury, but are not labeled as MI. It should be emphasized that the definitions for these procedurally related infarcts are the result of consensus among task force members based on the best available scientific information at the time that the document was written.

One of the goals of good clinical practice is to reach a definitive and specific diagnosis, which is supported by current scientific knowledge. The approach to the definition of MI meets this goal. Thus, the current diagnosis of acute MI is a clinical diagnosis based on patient symptoms, ECG changes, and highly sensitive biochemical markers, as well as information gleaned from various imaging techniques. However, it is important to characterize the extent of the infarct as well as residual LV function and the severity of coronary artery disease rather than merely making a diagnosis of myocardial infarction. The information conveyed about the patient's prognosis and ability to work requires more than just the mere statement that the patient has suffered an infarct. The multiple other factors just mentioned are also required so that appropriate social, family, and employment decisions can be made. A number of risk scores have been developed predicting post infarction prognosis.

The change in the definition of MI will have a substantial impact on the identification, prevention, and treatment of cardiovascular disease throughout the world. Cultural, financial, structural and

organisational problems in the different countries of the world regarding diagnosis and therapy of acute MI will require on-going investigation. It is essential that the gap between therapeutic and diagnostic advances be addressed in this expanding area of cardiovascular disease.

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References

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2. Thygesen K, Alpert JS, White HD: joint ESC/ACCF/AHA/WHF Task Force for the Redefinition of Myocardial Infarction. Universal definition of myocardial infarction. *Eur Heart J* 2007;28: 2525-2538; *Circulation* 2007;116: 2634-2653; *J Am Coll Cardiol* 2007;50:2173-2195.