

# A new global definition of myocardial infarction for the 21st century

## Nowa światowa definicja zawału serca na XXI wiek

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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 is a clinical diagnosis that is based on certain clinical events combined with specific laboratory tests. When both are present, a diagnosis of myocardial infarction is established. Unfortunately, clinicians and clinical scientists have often defined myocardial infarction 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 myocardial infarction, the European Society of Cardiology and the American College of Cardiology completed a consensus process in 2000 that sought to define myocardial infarction in a universally acceptable manner [1]. 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*.

Central to this original global definition of myocardial infarction 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 decided three years ago that the original global definition of myocardial infarction would need revision. Consequently, a task force was constituted with members coming from Europe, North and South America, Asia, and the Middle East. This task force was successful in its efforts and the newly redefined global definition for myocardial infarction was published simultaneously in the *European Heart Journal*, *Circulation*, and the *Journal of the American College of Cardiology* in October, 2007 [2].

Several new features were added to the revised definition based on scientific advances of the last seven years. Nevertheless, a number of features of the first definition were retained or were amplified. The essential features of the revised definition are as follows. 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% upper limit of normal for blood determination of troponin should be exceeded in order for the clinician to diagnose an acute myocardial infarction. In the revised definition, however, there are new ways for the clinical scenario to lead to the diagnosis of acute or remote myocardial infarction. For example, a patient who arrives at a hospital or clinic and reports classic symptoms of myocardial infarction 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 a myocardial infarction even if the patient dies before blood troponin levels can become elevated (usually less than 4–6 hours after the onset of chest discomfort).

Additionally, myocardial infarction can be diagnosed when a non-invasive imaging test demonstrates a ventricular wall motion abnormality and an elevated blood troponin value is also documented, even though appropriate symptoms or ECG changes are absent. A healed or remote myocardial infarction 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 myocardial infarction was the scenario involving elevated blood troponin levels following percutaneous coronary interven-

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tions (PCI). In a similar fashion, the original document offered no criteria for diagnosing a myocardial infarction following coronary bypass surgery. The revised definition offers a consensus recommendation for both of these situations. In the case of PCI, the blood troponin level should exceed three times the upper limit of normal before a myocardial infarction is diagnosed. In the case of coronary arterial surgery, the troponin level must exceed five times the upper limit of normal. Elevated troponin levels below these consensus levels are termed procedurally related myocardial injury but are not labeled as myocardial infarction. 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. It is likely that future investigation will result in revision of these recommended levels of troponin elevation needed to label a patient as having had a myocardial infarct following a coronary arterial procedure.

There are a number of social and epidemiological implications implied by the revised definition. Similar implications were noted following the publication of the original document. Since the new definition of myocardial infarction involves the use of more sensitive and specific biomarkers of myocardial necrosis than had been used in the past, the incidence and prevalence of myocardial infarction will be increased at the expense of the diagnosis category, unstable angina. This could create considerable consternation for students of epidemiology. Indeed, it will be difficult to compare current and future public health statistics dealing with myocardial infarction with data from earlier eras. Therefore, it is essential that a number of clinical centers continue to measure the new biomarkers as well as traditional enzymes and older definitions of myocardial infarction so as to ascertain the magnitude of change engendered by the use of the new biomarkers.

Changing the criteria for diagnosing myocardial infarction will also have important effects on individual patients and on society in general. For example, a patient who formerly would have been told that he or she had had an episode of unstable angina might now be told that they had suffered a myocardial infarct, albeit a small one. Public health statistics, insurance calculations, disability applications, and so on, will be affected. Educational efforts for physicians, public health statisticians, clinical scientists, and the general public must be organized in order to inform all concerned groups about the new definition of myocardial infarction and its implications.

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