Cardiac Markers Following Cardiac Surgery and Percutaneous Coronary Intervention

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KEYWORDS

• Laboratory medicine • Cardiac markers • Biomarkers • Troponin • CK-MB • Cardiac surgery • PCI • CABG

KEY POINTS

- Differentiation between perioperative myocardial injury and acute myocardial infarction (MI) is challenging.
- The current cardiac biomarker thresholds for MIs after cardiac procedures are largely arbitrary and, more importantly, lack therapeutic implications.
- Measurement of cardiac marker concentrations after percutaneous coronary intervention and cardiac surgery should currently be used as a marker of baseline risk, atherosclerosis burden, and procedural complexity rather than a conclusive marker to diagnose acute MI.
- Clinical scrutiny remains of the essence in the evaluation of patients with a clinical suspicion of a postprocedural MI.

INTRODUCTION

Myocardial injury leads to disruption of the normal cardiac myocyte membrane integrity and loss of intracellular content into the extracellular space. As a result, elevated levels of cytosolic and structural proteins, such as MB-creatine kinase (CK-MB) and cardiac troponin (cTn), can be detected in blood serum.[1] Both biomarkers are highly specific for myocardial injury and have, therefore, been granted a central role in the diagnosis of acute myocardial infarction (MI).[2]

However, varying concentrations of cTn and CK-MB can also be found in patients with skeletal muscle damage, heart failure, renal insufficiency, arrhythmias, pulmonary embolism, and in those undergoing cardiac surgery or a percutaneous coronary intervention (PCI).[1,3] The interpretation of cardiac biomarkers is especially complex after

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interventional cardiac procedures because both procedure-related myocardial necrosis and periprocedural MI may cause a (sizable) elevation of serum concentrations. High rates of electrocardiogram (ECG) abnormalities and the absence of clinical symptoms (resulting from use of strong analgesics) in the postinterventional period challenge adequate differentiation even more.[1,2]

In this article, the authors discuss both the diagnostic and prognostic value of cardiac biomarkers after cardiac procedures and analyze the scientific background of the current recommendations. In addition, an overview of the latest MI definitions will be provided.

TYPE 4 AND 5 MI

The interest in cardiac markers after cardiac procedures has strongly increased over the last 3 decades (Fig. 1), which led to multiple modifications of the definition of PCI- and cardiac surgery–related MI.[2]

The classic definition of MI was composed in 1979 by the World Health Organization and consisted of 2 or 3 of the following components: typical symptoms (ie, angina), an increase in cardiac enzymes, and a typical ECG pattern involving the development of Q waves. Definite MI was defined as the presence of unequivocal ECG changes and/or unequivocal enzyme changes, whereas angina was not an absolute necessity for a MI.[4] Notably, the interpretation of cardiac enzyme changes was troublesome at that time because of three factors. First, different assays were used to detect CK and CK-MB serum concentrations (ie, CK-MB was measured both by immune assay and mass). Second, serum CK-MB concentrations were influenced by surgery or trauma because of the expression of CK-MB in skeletal muscle.[5,6] Third, the introduction of cTn in the early 1980s led to conflicting thoughts on biomarker superiority.

2000 Universal Definition of MI

The pressing call of clinicians and researchers for a universal definition of MI compelled the formation of a consensus document in 2000 (Table 1). This document ushered in a new era of MI diagnostics by centralizing cardiac biomarkers.[7] Acute MI was redefined as a typical increase and/or decrease of cardiac biomarkers combined with at least one of the following: (1) ischemic symptoms, (2) development of pathologic Q waves on the ECG, (3) ECG changes indicating ischemia (ST segment elevation or depression), or (4) coronary artery intervention (eg, coronary angioplasty). Furthermore, in the appropriate

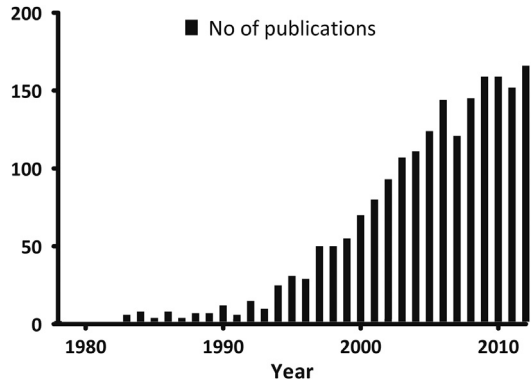

Fig. 1. Numbers of articles regarding cardiac biomarkers and cardiac surgery or PCI in MEDLINE database.