# ORIGINAL RESEARCH PAPER

## Cardiology

### THE ROLE OF CARDIAC MARKERS IN ACUTE CORONARY SYNDROMES

**KEY WORDS:** Cardiac enzymes, Troponin, CK-MB

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**ABSTRACT**

Management of Acute Coronary Syndromes requires early and reliable diagnosis. Various diagnostic serological markers are available for quick testing. This article covers the essential information for correct interpretation and use of these biomarkers.

## Introduction

Acute Coronary Syndrome is a broad term used to denote the group of clinical presentations compatible with acute coronary ischemia; that is, insufficient blood supply to cardiac muscle which may be secondary to coronary artery disease or other associated conditions. Patients usually present with acute onset of angina or aggravation of pre-existing chronic stable angina. The varied clinical syndromes are classified on basis of pathophysiology and ECG and laboratory findings .

## Pathophysiology

ACS is due to acute or sub-acute reduction or stoppage of blood flow distally in a coronary artery territory. At the endothelial luminal level, there is rupture of an atherosclerotic plaque leading to formation of thrombus. This may be associated with vasoconstriction, inflammation and distal embolisation.

Plaque formation starts early in life and remain dormant for a long time. Plaques that are vulnerable to rupture are characterized by a large lipid core, thin fibrous cap, high macrophage density, disorganized collagen and high tissue factor concentration. Active rupture is likely related to secretion of proteolytic enzymes by the macrophages while passive rupture is related to physical forces at the weakest point of the fibrous cap. Plaque erosion may also occur and lead to the intra-arterial thrombus formation. Inflammation in the form of macrophage infiltration is demonstrated consistently in pathological studies. In addition, activated T-cells are also seen at site of plaque rupture.

Thrombosis is formed at the site of plaque rupture or erosion. This is platelet-rich and rapidly leads to total or near-total occlusion of the lumen. Spontaneous fragmentation or thrombolysis may explain transient symptoms in some patients where the small fragments are embolised into the smaller branches and arterioles. Also, the platelet rich thrombus can release vasoconstrictor chemicals such as serotonin and thromboxane A2 that induce vasoconstriction at site of plaque rupture.

Pathological changes in the myocardium supplied by the occluded artery occur depending on the duration of ischemia. Varying degree of necrosis is seen. Following ischemic injury, there is release of structural proteins into the blood and increase in levels of specific enzymes. These are extremely sensitive and specific to the myocardium and their presence in blood signifies myocardial injury of varying degree. Hence they are useful in diagnosis and prognostication of such patients especially when there are non-specific changes or no changes in ECG. Even micro-infarcts can be detected by the presence of these markers.

The various cardiac markers in use currently are:-
Troponins, CKMB, Myoglobin, BNP

## TROPONINS

Cardiac Troponins are structural proteins of the cardiac muscle which are actively involved in contraction and relaxation of the myocardium, along with tropomyosin, myosin and actin. There are 3 sub-units: TnI, TnT and TnC. They are normally not present in the peripheral blood and therefore their detection is virtually diagnostic of myocardial damage. However, it may take up to 6 hours after the onset of myocardial injury for them to rise to detectable levels. Thereafter they remain elevated for 10 to 14 days. The magnitude of rise of the troponins directly co-relates with the amount of myocardial damage and hence has an important prognostic value. Even small increase in the serum levels is associated with substantial increase in morbidity and mortality. Newer assays can detect levels as low as 0.1ng/ml.

## CREATINE KINASE

This enzyme is found in a variety of tissues such as skeletal muscles, diaphragm, small intestine, tongue etc in addition to the heart. The heart specifically has the MM and the MB isozymes. The latter i.e. the CK-MB fraction is the one which is useful in management of acute coronary syndromes. Following ischemic myocardial injury, CK-MB levels typically rise 4 – 6 hours after the onset of chest pain, peak at 12 – 24 hours and return to baseline levels within 36 – 48 hours. Serial measurements should be obtained every 6 – 8 hours till peak values are determined. Skeletal muscle injury, trauma may also be responsible for elevated CK-MB levels.

## MYOGLOBIN

This is not cardiac specific, but may be detected as early as 2 hours after myocardial necrosis starts. Hence it has a high negative predictive value when blood samples are taken in 4 – 8 hours after onset. The results should be supplemented with other more specific cardiac biomarkers.

## BNP

Levels of natriuretic peptide ( brain natriuretic peptide [BNP] and N-terminal pro-BNP) rise in response to the degree of ventricular distension following myocardial damage. Higher levels co-relate with higher risk and identify patients who will benefit from more aggressive therapy.

## CRP

C-reactive protein levels are elevated following myocardial damage, as a marker of inflammation and persistently elevated levels are associated with greater incidence of complications in future.

Newer or emerging biomarkers such as Growth differentiation factor-15, heart-type fatty acid-binding protein, myeloperoxidase etc are not routinely used.

## CONCLUSION

Standard practice in ICU today, in management of acute onset chest pain includes judicious use of cardiac biomarkers in addition to clinical profile and other measures such as serial ECG. Particularly in patients with atypical symptoms and inconclusive or non-diagnostic ECG, specific biomarkers such as TnT and TnI (or CK-MB if these are not available) are most useful to diagnose, prognosticate and guide therapy.

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