Cardiac Markers

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Outline

- Definition
- Timeline of cardiac markers
- Acute Myocardial infarction
- Ideal biomarkers
- Biochemistry of Cardiac markers
- Biomarkers of ischemia and necrosis
- Kinetics of cardiac markers

Definition

Laboratory tests useful for detecting AMI or minor myocardial injury
They are most useful in patients have no diagnostic ECG tracing

- Located in myocardium
- Release after cardiac damage
- Can be measured in blood

Most cardiac markers myocardial protein differ in

- Location within the myocyte
- Release kinetics after damage
- Clearance from the circulation

Uses

- Ruling out MI require test with high diagnostic specificity
- Ruling in MI require test with high diagnositic sensitivity

Biochemistry Of Cardiac Markers

- Cardiac troponins
- CK MB isoenyzmes and isoforms
- Myoglobin
- Cardiac enzymes
- Others
- Ischemia modified albumin
- Myeloperoxidase
- C reactive protein
- Brain natriuretic peptide

Troponins

Are regulatory proteins in myofibril. They are complex of three protein subunit
Troponin C (calcium binding components)
Troponin I (inhibitory component)
Troponin T (tropomyosin – binding components)

Tissue specificity of Troponins

Are these subunit are present in both human heart and skeletal muscle
Troponin is localized primarily in the myofibrils (94% - 97%) with smaller cytoplasmic components (3% - 6%)
Cardiac troponins subunits I and T have different amino acid sequences encoded by different genes
With additional postranslation 31 amino acid for cardiac troponin I make it unique cardiac specific
Cardiac troponin T also encoded by different gene from skeletal muscle with additional 11 amino acid terminal residue make it cardiac specific
(although expression of cardiac troponin isoform had been found in skeletal muscle in disease state such as muscular dystrophy, polymyositis, and end stage renal disease)

Cardiac troponin in the circulation present in different form
T-I-C ternary complex
I-C binary complex
Free I

In addition, multiple modification of these form by reduction, phosphorylation and degradation of N and C terminal

Myoglobin

Is an oxygen binding protein of cardiac and skeletal muscle with molecular mass of 17800 Da
Low molecular weight protein with cytoplasmic localization account for its early release in the circulation following muscle (heart and skeletal) injury

Kinetics of Cardiac Markers

MARKER	DETECTION	PEAK	DISAPPEARANCE
Myoglobin	**1 – 4 h**	**6 – 7 h**	**24 h**
CK-MB mass	**3 – 12 h**	**12 – 18 h**	**2 – 3 days**
Total CK	**4 – 8 h**	**12 – 30 h**	**3 – 4 days**
cTnT	**4 – 12 h**	**12 – 48 h**	**5 – 15 days**
cTnI	**4 – 12 h**	**12 – 24 h**	**5 – 7 days**

These values represent averages.