Cardiac Biomarkers

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Introduction

Plasma contains many functional enzymes, which are actively secreted in plasma, but there

are a few non functional enzymes, which are coming out from cells of various tissues due to normal wear and tear.
Their normal levels in blood are very low; but are

drastically increased during cell death or disease.

Therefore assay of these enzymes are very useful in diagnosis of disease.

Cardiac Biomarkers

A biomarker is a clinical laboratory

test which is useful in detecting dysfunction of an organ.

The cardiac biomarkers are used to:

Detect myocardial ischemia at the earliest
Monitor the progression of the condition
Predict the risk in cardiac dysfunction (Congestive cardiac failure)

Indication for the use of Cardiac markers:

Acute chest pain
Unstable angina

Suspicious ECG
History of myocardial infarction
Following surgical coronary revascularization
Patients with hypotension and dyspnea.

CRITERIA FOR *IDEAL MARKERS* FOR MYOCARDIAL INFARCTION

1- Specific: To myocardial muscle cells *(no false positive).*

2- Sensitive: - Rapid release on onset of attack (diagnose early cases)

- So, can detect minor damage

- No miss of positive cases *(no false negative).*

3- Prognostic: Relation between

plasma level &
extent of damage.

4- Persists Longer:
So, can diagnose
delayed admission.

6- Reliable:
Procedure depends

on evidenced principle.

5- Simple, Inexpensive: - Can be performed anywhere by low costs

- no need for highly qualified personnel.

7- Quick: Low Turnaround Time. Commonly used cardiac biomarker Creatine kinase Cardiac troponin

Brain natriuretic peptide

Myoglobin

Lactate dehydrogenase

Aspartate transaminase

Creatine Kinase (CK)

Total CK (sum of CK-MM, CK-MB & CK-BB)

Non specific to cardiac tissue (available in skeletal muscles.)

CK-MB (*CK-2*) activity more specific than total CK.

BUT: less specific than Troponin I.

Appears in blood : within 4-6 hours of onset of attack

Peak : 12 - 24 hours

Returns to normal: within 2 - 3 days (no long stay in blood)

Advantages: - useful for early diagnosis of MI
- Useful for diagnosis reinfarction

Disadvantages: Not used for delayed admission (more than 2 days)
Not 100% specific (elevated in sk.Ms damage)

Reference Range: Total CK: 10 – 50 IU/L

Cardiac Troponins

Protein complex located on the thin filament of striated cardiac muscles

consists of 3 subunits: cTn T, cTnI & cTn C with different structures & functions

Cardiac troponins (cTn) are different from skeletal muscle troponins

So, more specific for MI diagnosis

cTnI & cTnT are used are **biomarkers for MI diagnosis**

cTnI:

100 % cardiac specific

With **greater sensitivity** for diagnosing minor damage of MI

Appears in blood within 6 hours after onset of infarction

peak: around 24 hours

Disappears from blood **after about one week** (stays longer)

So, useful for diagnosis of **delayed admission cases**

Prognostic marker (relation between level in blood & extent of cardiac damage)

Reference range: <0.01ng/ml

Brain Natriuretic peptide

Patients with congestive heart failure have high levels of plasma BNP. The concentration correlates with the extent of ventricular dysfuction.

High concentration of BNP predicts poor long term survival.
In breathlessness, BNP test helps in the differentiation of the cause as heart failure or COPD.
Normal levels: <400ng/L

Myoglobin

Cytosolic protein

not specific for cardiac tissue (also in sk.ms. & renal tissue)

appears in blood **EARLIER** than other

markers (within 1-4 hours)

So, it has high sensitivity

Returns to normal in 24 hours

So, **not for delayed admission** cases (after one day of onset of attack).

Myoglobin is an important negative marker for MI.

Lactate Dehydrogenase (LDH)
LDH consist of 5 isoenzyme forms.

In MI, total LDH activity is increased, while LDH1 isoenzyme is increased 4-5 times more.
The magnitude of the peak value will be roughly proportional to the

size of the myocardial infarct. Normally LDH 2 concentration in blood is greater than LDH1, but this pattern is reversed in MI, this is called flipped pattern.

LDH has only limited value because of its nonspecific nature. Reference range: 50 – 200 IU/L

Aspartate Transaminase (AST) Also called as SGOT

It rises sharply after CK-MB and reaches peak within 48hrs of Myocardial infarction.
It is found in cytosol and mitochondria, hence appears late.
It takes 4 – 5 days to return to normal.

Reference range: 4-45 IU/L

Timings of Cardiac Biomarkers

Thank you