CARDIAC ENZYMES

INTRODUCTION

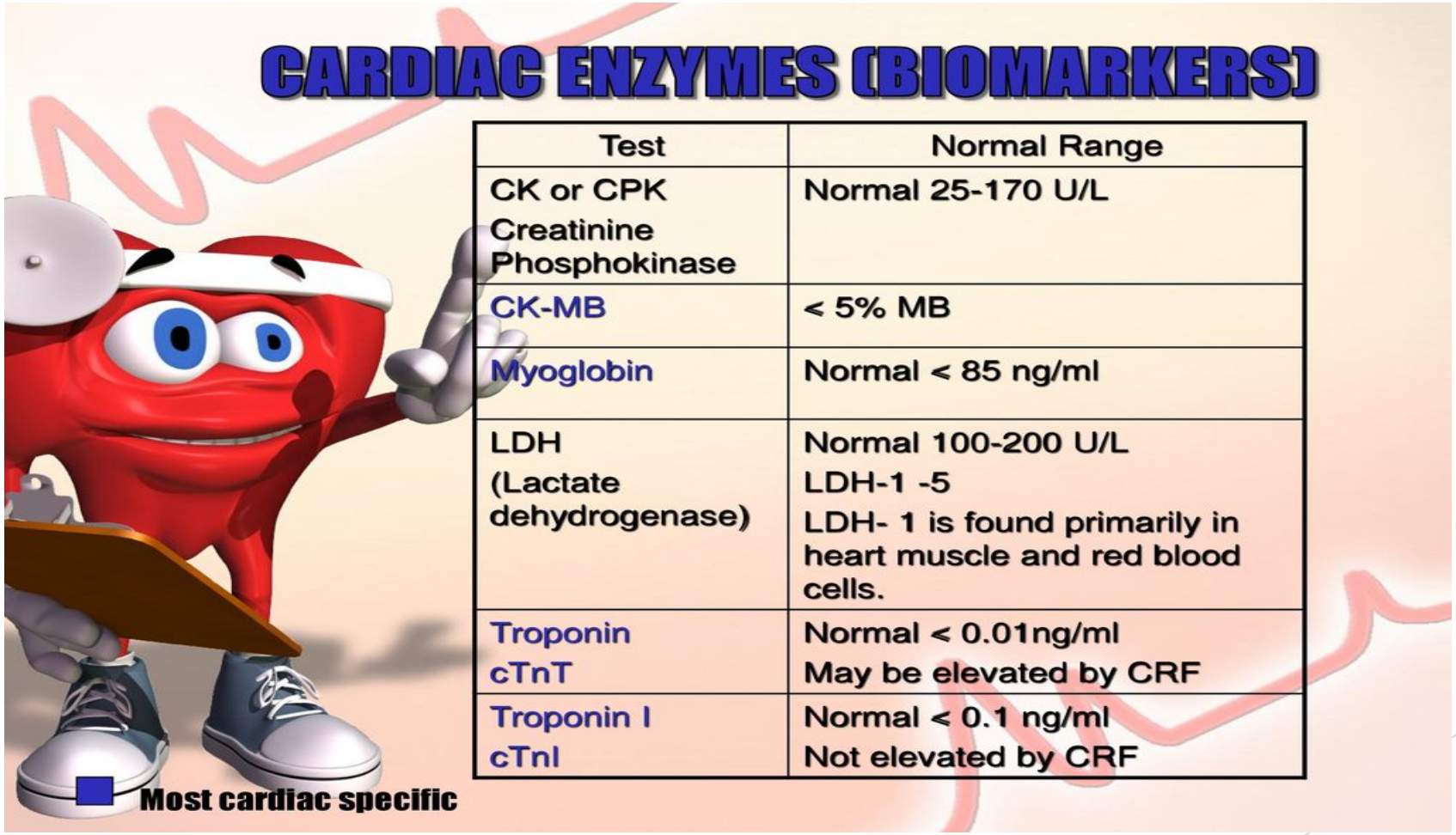
- Cardiac enzymes are the markers found in the blood.
- They are tested when Myocardial Infarction (MI) is suspected.
- The markers are normally present at all times, however, they are significantly elevated during a damage of the heart muscle.

- If Myocardial Infarction is suspected, enzyme markers are drawn several times usually six hours apart.
- These are few different enzymes and proteins whose levels are elevated hours after the initial heart damage.

Cardiac enzymes

- Cardiac enzymes — include
- creatine phosphokinase. CpK
- SGOT/AST
- lactate dehydrogenase, or LDH,
- myoglobin,
- troponin and

NORMAL RANGE



Blood collection

Centrifugation for serum separation

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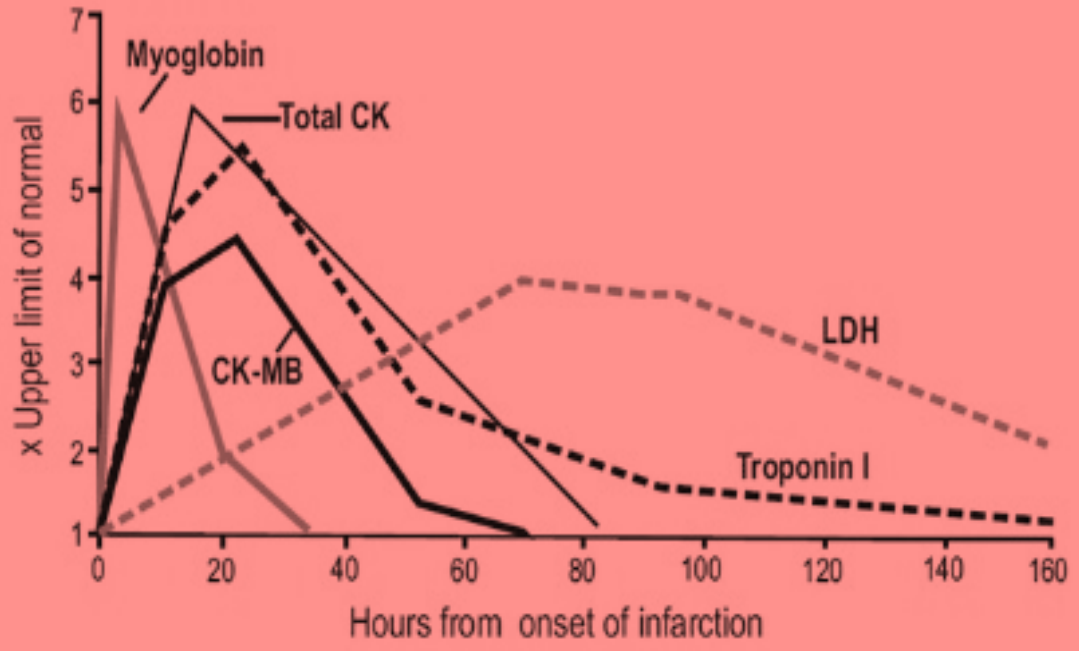
Protein Elevations in Serum after MI

Serum Protein	Time After Infarction: 1st Elevation (hours)	Time After Infarction: Peak Elevation (hours)	Duration of Elevation (days)
AST/SGOT	2-4	2-4	3(~2-3xnormal only)
LDH	2-4	6-9	1
CK	4-6	18-36	3(~2-3xnormal only)
CKMB	2-4	24	3(~2-3xnormal only)
Myoglobin	2-3	6-9	1
Troponin I & T	4-6	24-36	Depends on extent of damage(Trop I 7-10/ Trop T 10-14)


Myoglobin
Total CK
CK-MB
LDH
Troponin I
x Upper limit of normal
Hours from onset of infarction
0
20
40
60
80
100
120
140
160
1
2
3
4
5
6
7

CREATINE KINASE (CK)

- *CREATINE KINASE* (CK), also known as creatine phosphokinase (CPK), is an enzyme expressed predominantly in skeletal muscle, smooth muscle and the brain. The CK enzyme consists of two subunits, which can be either B (brain type) or M (muscle type), and hence three different isoenzymes:
- CK-MM, CK-BB and CK-MB.
- CK catalyzes the conversion of creatine to phosphocreatine, consuming adenosine triphosphate (ATP) and generating adenosine diphosphate (ADP) and the reverse reaction.
- CK is often determined routinely in emergency patients with chest pain and acute renal failure.
- Elevation of CK is an indication of damage to muscle and has been associated with injury, myocardial infarction, myositis, myocarditis, malignant hyperthermia and neuroleptic malignant syndrome, etc.

PRINCIPLE OF EXPERIMENT

- BioAssay Systems EnzyChrom™ Creatine Kinase Assay Kit is based on enzyme coupled reactions in which creatine phosphate and ADP is converted to creatine and ATP by CK, the generated ATP is used to phosphorylate glucose by hexokinase to generate glucose-6-phosphate, which is then oxidized by NADP in the presence of glucose-6-phosphate dehydrogenase. The produced NADPH, measured at 340 nm, is proportionate to the CK activity in the sample

Aspartate Aminotransferase (AST)

- Aspartate Aminotransferase (AST), formerly called serum glutamate-oxaloacetate transaminase (SGOT), is a pyridoxal phosphate (PLP)-dependent enzyme that catalyzes the conversion of aspartate and α-ketoglutarate to oxaloacetate and glutamate. Similar to Alanine Aminotransferase (ALT), AST levels in blood are commonly used as a marker for liver function. However, AST has a broader tissue distribution than ALT and perturbations in AST levels can occur in response to diseases or injuries in multiple tissues including skeletal and heart.

PRINCIPLE OF EXPERIMENT

- The Aspartate Aminotransferase Activity Assay kit provides a simple and direct procedure for measuring AST activity in a variety of samples.
- In this kit, the transfer of an amino group from aspartate to α-ketoglutarate results in the generation of glutamate, resulting in the production of a colorimetric (450 nm) product proportional to the AST enzymatic activity present.
- One unit of AST is the amount of enzyme that will generate 1.0 µmole of glutamate per minute at pH 8.0 at 37 °C.

Lactate dehydrogenase (LDH)

- Lactate dehydrogenase (LDH) is an oxidoreductase enzyme that catalyses the interconversion of pyruvate and lactate. Cells release LDH into the bloodstream after tissue damage or red blood cell hemolysis. Since LDH is a fairly stable enzyme, it has been widely used to evaluate the presence of damage and toxicity of tissue and cells. LDH is also elevated in certain pathological conditions such as cancer. Quantification of LDH has a broad range of applications.

PRINCIPLE OF EXPERIMENT

- In this kit, LDH reduces NAD to NADH, which is specifically detected by colorimetric (450 nm) assay. The LDH Activity Assay kit quantifies LDH activity in variety of biological samples. The assay is quick, convenient, and sensitive

Myoglobin

- Myoglobin is a relatively small, 17.8 kDa, heme protein that is abundant in the cytoplasm of cardiac and skeletal muscle cells. The main function of myoglobin is to transport oxygen within muscle cells, and it constitutes approximately 2% of muscle protein in both skeletal and cardiac muscles.
- Of the biomarkers routinely collected from patients suspected or diagnosed with CVD, myoglobin is generally accepted as one of the earliest to appear during the development of the disease. Elevated levels following an AMI appear in the circulation after 0.5–2 hours. Since myoglobin is only released as a result of tissue necrosis, it is a poor biomarker of acute cardiac ischemia.

Troponins I and T

- The troponin protein complex consists of 3 subunits, the C (TnC) subunit which is the calcium binding component, the I (TnI) which maintains the structural position of the troponin-tropomyosin complex, and the T (TnT) which is the tropomyosin binding subunit.
- All are located on the thin filament of both skeletal and myocardial myocytes of heart.
- Interestingly, both TnT and TnI sub-units have distinct isoforms for each muscle type, hence there is a specific cardiac isoform.
- Cardiac troponins T and I (cTnT and cTnI) are now recognized as the most tissue-specific biomarkers related to cardiac damage and have been included as a diagnostic criterion for several cardiac-related pathologies.

MICROLAB 300

SELECTRA

ARCHETIC