INTRODUCTION

Clinical enzymology is the discipline that studies and tests enzyme activity in serum, plasma, urine, or other body fluids to help establish the diagnosis and prognosis of disease, and to screen for abnormal organ function.

DEFINITION

It is the study of the activity and properties of enzymes in specimens (usually of blood) taken from patients, as an aid to the diagnosis and understanding of disease.

PROPERITIES

- Enzymes affect the rate of biochemical reaction and not the direction. Most of the enzymes have a high turnover number. Turnover number of an enzyme is the number of molecules of a substance that is acted upon by an enzyme per minute. High turnover number of enzymes increases the efficiency of the reaction.
- Enzymes are specific in action.

- Enzymes are complex macromolecules with high molecular weight.
- They catalyze biochemical reactions in a cell. They help in the breakdown of large molecules into smaller molecules or bring together two smaller molecules to form a larger molecule.
- Enzymes do not start a reaction. However, they help in accelerating it.

- Enzymatic activity decreases with increase in temperature.
- They show maximum activity at an optimum pH of 6 – 8.
- The velocity of enzyme increases with an increase in substrate concentration and then, ultimately reaches maximum velocity.

Enzymes of diagnostic importance in Liver Diseases

- Liver function tests are blood tests used to help find the cause of your symptoms and monitor liver disease or damage. The tests measure the levels of certain enzymes and proteins in your blood.
- Some of these tests measure how well the liver is performing its regular functions of producing protein and clearing bilirubin, a blood waste product. Other liver function tests measure enzymes that liver cells release in response to damage or disease.

Liver function tests can be used to:

- Screen for liver infections, such as hepatitis.
- Monitor a disease, such as viral or alcoholic hepatitis, and determine how well a treatment is working.
- Look for signs of serious disease, particularly scarring of the liver, called cirrhosis.
- Monitor possible side effects of medicines.

Liver function tests check the levels of certain enzymes and proteins in your blood. Levels that are higher or lower than usual can mean liver problems. The pattern and degree of elevation of these tests along with the overall clinical picture can provide hints to the underlying cause of these problems.

ALANININE TRANSAMINASE

ALT is an enzyme found in the liver that helps convert proteins into energy for the liver cells. When the liver is damaged, ALT is released into the bloodstream and levels increase. This test is sometimes referred to as SGPT.

ASPARTATE TRANSAMINASE

AST is an enzyme that helps the body break down amino acids. Like ALT, AST is usually present in blood at low levels. An increase in AST levels may mean liver damage, liver disease or muscle damage. This test is sometimes referred to as SGOT.

ALKALINE PHOSPHATASE

ALP is an enzyme found in the liver and bone and is important for breaking down proteins. Higher-than-usual levels of ALP may mean liver damage or disease, such as a blocked bile duct, or certain bone diseases, as this enzyme is also present in bones.

ALBUMIN AND TOTAL PROTEIN

Albumin is one of several proteins made in the liver. Your body needs these proteins to fight infections and to perform other functions. Lower-than-usual levels of albumin and total protein may mean liver damage or disease. These low levels also can be seen in other gastrointestinal and kidney-related conditions.

BILIRUBIN

Bilirubin is a substance produced during the breakdown of red blood cells. Bilirubin passes through the liver and is excreted in stool. Higher levels of bilirubin might mean liver damage or disease. At times, conditions such as a blockage of the liver ducts or certain types of anemia also can lead to elevated bilirubin.

GAMMA GLUTAMYLTRANSFERASE

- Gamma-glutamyltransferase (GGT). GGT is an enzyme in the blood. Higher-than-usual levels may mean liver or bile duct damage. This test is nonspecific and may be elevated in conditions other than liver disease.

L-LACTATE DEHYDROGENASE

L-lactate dehydrogenase (LD). LD is an enzyme found in the liver. Higher levels may mean liver damage. However, other conditions also may cause higher levels of LD.

PROTHROMBIN TIME

- **Prothrombin time (PT).** PT is the time it takes your blood to clot. Increased PT may mean liver damage. However, it also can be higher if you're taking certain blood-thinning drugs, such as warfarin

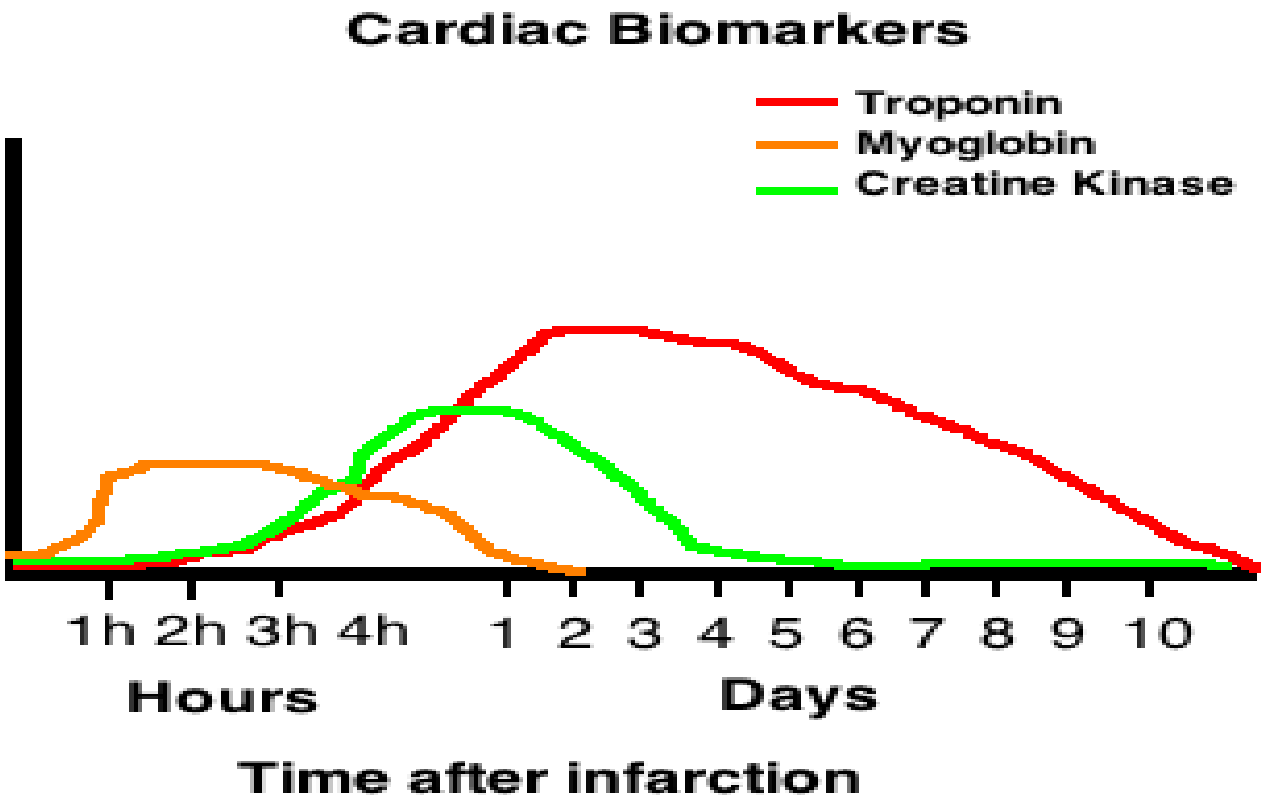
MYOCARDIAL INFARCTION

. Myocardial infarction (MI), colloquially known as "heart attack," is caused by decreased or complete cessation of blood flow to a portion of the myocardium.

CREATINE KINASE

Creatine kinase (a.k.a. creatine phosphokinase or CPK) is a muscle enzyme which exists as isoenzymes. The MB type is specific to myocardial cells while MM and BB are specific to skeletal muscle and brain tissue respectively.

The CK level will increase approximately 3-4 hours after a myocardial infarction and stays elevated for 3-4 days. This makes it useful for the detection of re-infarction in the 4-10 day time window after the initial insult since troponin remains elevated for 10 days making it less useful for this purpose.


Cardiac Biomarkers
Troponin
Myoglobin
Creatine Kinase
1h 2h 3h 4h 1 2 3 4 5 6 7 8 9 10
Hours
Days
Time after infarction

CARDIAC TROPINS

A troponin test measures the levels of troponin T or troponin I proteins in the blood. These proteins are released when the heart muscle has been damaged, such as occurs with a heart attack. The more damage there is to the heart, the greater the amount of troponin T and I there will be in the blood.

WHY THE TEST IS PERFORMED

The most common reason to perform this test is to see if a heart attack has occurred. Your health care provider will order this test if you have chest pain or other signs of a heart attack. The test is usually repeated two more times over the next 6 to 24 hours.

- The troponin test may also be done to help detect and evaluate other causes of heart injury.
- The test may be done along with other cardiac marker tests, such as CPK isoenzymes or myoglobin.

NORMAL RESULT

- Cardiac troponin levels are normally so low they cannot be detected with most blood tests.
- Having normal troponin levels 12 hours after chest pain has started means a heart attack is unlikely.

ABNORMAL RESULTS

- Even a slight increase in the troponin level will often mean there has been some damage to the heart. Very high levels of troponin are a sign that a heart attack has occurred.
- Most patients who have had a heart attack have increased troponin levels within 6 hours. After 12 hours, almost everyone who has had a heart attack will have raised levels.

Troponin levels may remain high for 1 to 2 weeks after a heart attack.

Increased troponin levels may also be due to:

- Abnormally fast heartbeat
- High blood pressure in lung arteries (pulmonary hypertension)
- Blockage of a lung artery by a blood clot, fat, or tumor cells (pulmonary embolus)
- Congestive heart failure
- Coronary artery spasm

- Inflammation of the heart muscle usually due to a virus (myocarditis)
- Prolonged exercise (for example, due to marathons or triathlons)
- Trauma that injures the heart, such as a car accident
- Weakening of the heart muscle (cardiomyopathy)
- Long-term kidney disease

- Increased troponin levels may also result from certain medical procedures such as:
- Cardiac angioplasty/stenting
- Heart defibrillation or electrical cardioversion (purposeful shocking of the heart by medical personnel to correct an abnormal heart rhythm)
- Open heart surgery
- Radiofrequency ablation of the heart

MUSCLE DISEASES-ALDOSE

- Aldolase is an enzyme found mainly in the skeletal muscles, brain, and liver. This enzyme helps the body break down sugars to produce energy. When cells containing the enzyme are damaged, aldolase is released into the bloodstream.

High levels of aldolase in the blood can be a sign of muscle or organ damage. A blood test to check aldolase levels may be ordered when muscle or liver damage is suspected. Aldolase testing may also be used to monitor patients having treatment for diseases that affect the muscles.

PURPOSE

- The purpose of aldolase testing is to diagnose and monitor certain conditions that damage the skeletal muscles and organs.
- Aldolase testing may reveal muscle or organ damage that has occurred due to injury or a condition that affects the muscles or organs.

- As a diagnostic test, aldolase testing is used with other muscle enzyme tests to help diagnose muscle diseases like muscular dystrophy, polymyositis, and dermatomyositis.
- Aldolase testing can also help doctors understand the cause of certain muscle disorders.

Many disorders of the muscles originate in the nervous system and cause muscle weakness or pain. Measuring aldolase can help doctors learn whether the source of these muscle problems originates in the nervous system or in the tissues of the muscles themselves.

Aldolase testing may also be used to monitor patients who are being treated for muscle diseases. Aldolase levels can provide information about how well a patient is responding to treatment and whether their condition is improving or worsening.

BONE DISEASE-ALP

- Alkaline phosphatase (ALP) is mainly found in your liver and bones.

ALP Blood Test

- An alkaline phosphatase (ALP) test measures the amount of this enzyme in your blood to help diagnose certain health problems. If you show signs of liver disease or a bone disorder, your doctor may order an ALP test.

PROSTATE CANCER - PSA

Prostate-specific antigen, or PSA, is a protein produced by normal, as well as malignant, cells of the prostate gland. The PSA test measures the level of PSA in the blood.

RESULT

There is no specific normal or abnormal level of PSA in the blood. In the past, PSA levels of 4.0 ng/mL and lower were considered normal. However, some individuals with PSA levels below 4.0 ng/mL have prostate cancer and many with higher PSA levels between 4 and 10 ng/mL do not have prostate cancer (1).

PROSTATE CANCER-ACP

In adults and elderly persons, the normal findings for acid phosphatase are 0.13-0.63 U/L (Roy, Brower, Hayden; 37°C) or 2.2-10.5 U/L (SI units). Normal findings in children are 8.6-12.6 U/mL (30°C), while normal findings in newborns are 10.4-16.4 U/mL


Thank
You