

## Lecture-12

### Enzymes of diagnostic values

Enzyme diagnostics is one of the branches of enzymology. It has two main directions:

- 1) Use of enzymes as reagents for determination of normal and pathological components in serum, urine, gastric juice etc.
- 2) Determination of enzyme activity in biological material with a diagnostic purpose.

Serum enzymes are divided into 3 groups:

1. **Cellular enzymes** enter the blood from different organs. Their activity in serum depends on enzyme content in organs, molecular weight, intracellular localization, rate of elimination. Cellular enzymes are divided into non-specific and organ specific.
2. **Secretory enzymes** are synthesized by cells, enter the bloodstream and fulfil their specific functions in the circulatory system. These are enzymes of coagulation system and fibrinolysis, choline esterase etc.
3. **Excretory enzymes** are synthesized by glands of GIT and enter the blood (amylase, lipase).

Enzymes synthesis, functioning and breakdown take place continuously and simultaneously; providing their given concentration and activity. Enzymes are localized in different cellular compartments (cytoplasm, lysosomes, cellular membrane, mitochondrions). That is why increased activity of certain enzymes can indicate the degree of severity of cellular damage. Here, we have provided information about enzymes which are most frequently used in clinical practice for diagnosis, prognosis and therapy monitoring of different pathologies. Their determination in blood serum has high clinical significance.

#### **Transaminases**

- These are enzymes involved in the transfer of amino from an amino acid to a keto acid.
- Two aminotransferases are in use in diagnostic enzymology. They are:

Aspartate Amino Transaminase (AST) and Alanine Amino Transaminase (ALT).

#### **Aspartate Transaminase: (SGOT/GOT):**

(Also known as Serum Glutamate Oxaloacetate Transaminase)

- Both the enzymes are widely distributed in the body tissues such as heart, liver, skeletal muscle, kidney and erythrocytes.
- Damage to any of these tissues may increase plasma AST level.
- Causes of rise in plasma AST
- In vitro hemolysis.

- Circulatory failure with shock and hypoxia.
- Myocardial infarction.
- Acute viral or toxic hepatitis.
- Cirrhosis.
- Cholestatic jaundice.
- Skeletal muscle disease.
- Severe hemolytic anemia.
- After surgery.
- ALT is increased in hepatocellular injury in dog and cat. It is not useful in evaluating chronic liver disease.
- ALT may also be elevated in corticosteroid treatment. This enzyme is not useful in evaluating hepatic disease in horse, cow, sheep, goat and pig.
- Elevation of AST is more specific than that of ALT in evaluating hepatic disorders in large animals.

***Alanine Transaminase*** Also known as Alanine

transaminase (**ALT**) or **Serum Glutamate Pyruvate Transaminase (SGPT/GPT)**

- In most conditions where AST is elevated there is a concurrent smaller raise in ALT.
- In hepatitis plasma levels of ALT may exceed those of AST.

### **Alkaline Phosphatase**

Alkaline Phosphatase are a group of enzymes which hydrolyze phosphates at high pH. This enzyme is present in high concentrations in liver, bone (osteoblast) placenta and intestinal epithelium.

Each of these tissues contains specific isoenzymes of ALP.

In general serum alkaline phosphatase activity is increased in bone and liver diseases.

- Bone Diseases
  - Osteomalacia and Rickets.
  - Paget's disease of bone.
  - Carcinoma in bone.
- Liver Diseases
  - Intra and extra hepatic cholestasis.
  - In lesions and tumour.

### **Acid Phosphatase (ACP)**

- This enzyme is present in high concentrations in the prostate gland, liver, rbc, platelets and bone.
- And it is elevated in the plasma of some patients with prostatic cancer.

### **Lactate Dehydrogenase (LDH)**

- This enzyme catalyses the reversible interconversion of lactate and pyruvate.
- This enzyme is present in all cells of the body.
- Serum LDH is increased in liver, heart, skeletal muscle and kidney diseases and also in hepatopoietic and neoplastic disease.
- A better evaluation of the cause of an elevation of LDH can be ascertained by evaluating the isoenzymes separately.
- All LDH isoenzymes are found in varying concentrations in all the tissues.
- There are five well defined LDH isoenzymes.
- This enzyme exists in the body as a Tetramer.
- Two monomers H and M can combine in various proportions.
- Predominant elevation of LD1 and LD2 occurs after myocardial infarction.
- Predominant elevation of LD2 and LD3 occurs in acute leukemia.
- Elevation of LD5 occurs after damage to the liver or skeletal muscle.
- The means of identification of these isoenzymes is usually by serum electrophoresis.

### **Creatine Kinase**

- Creatine kinase consists of two protein sub units (dimer) M and B, which combine to form three isoenzymes(BB, MM and MB).
- BB is confined to the brain.
- Most of the CK normally present in the plasma is the MM, which comes from skeletal muscle.
- An increase is seen with the skeletal muscle damage. Cardiac muscle contains MB type isoenzyme.
- A raised CK-MB is a characteristic of myocardial infarction.

### **Gamma Glutamyl Transferase (GGT)**

- This enzyme is present in high concentration in the liver, kidney and pancreas.
- Very high plasma activity is due to:

- Alcoholic hepatitis.
- Induction by anticonvulsant drugs.
- Cholestatic liver disorders.
- GGT is sensitive than ALP for the deduction of cholestatic disease in horse, cattle, sheep and pig.
- GGT appears in serum as a result of increased synthesis rather than as a result of leakage from the cells.
- In acute hepatic injury ALT and AST are generally elevated and ALP may be normal.
- In chronic disease with cholestasis, ALP and GGT are elevated and ALT AST may be normal or slightly increased.

### **Amylase**

- Amylase breaks down starch and glycogen to maltose.
- It is present at high concentrations in pancreatic juice and in saliva.
- The plasma activity of this enzyme is very high in acute pancreatitis.

### **Lipase**

- It is found in the pancreas.
- Increased amounts of this enzyme indicates disease and inflammation of the pancreas.
- Lipase is not present in saliva so this test is more useful in the identification of pancreatic disorders.