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Enzymes

ISOENZYME

- Isoenzymes are multiple forms of the same enzyme **that differ in (amino acid sequence but catalyze the same chemical reaction).**

- The different isoenzyme reflect different tissues responsible on there productions.

- For example in Creatine kinase (CK) :

1) Increase in isoenzyme **CK-MM** which produced from muscle indicate skeletal **muscles damage**.
2) Increase in isoenzyme **CK-MB** which present in the heart indicates **heart disease**.
3) Increase in isoenzyme **CK –BB** present in the brain so its increase in **brain damage**

Creatine Kinase (CK)

• Creatine kinase isoenzymes are dimer that are made up of two types of polypeptide chains, which may be either M (muscle) type or B (brain) type, generating three isoenzymes (Table 6.8).

– CK -(BB) : It is present in the brain so its increase in brain damage

– CK -(MB) : Cardiac tissue is the only tissue which has the mixed MB isoenzyme so its increases in myocardial infarction

– CK -(MM) : It is present in skeletal muscle so its increase in myopathys.

Clinical Diagnostic Use of Enzymes

- Enzymes are known as marker of cellular damage and their measurement in plasma is used in the investigation of diseases of liver, heart, skeletal muscle… etc.

Enzyme Assay in Myocardial Infarction

- The enzymes' assay, which are most helpful in the diagnosis of

Table 6.10: Enzymes in diagnosis of myocardial infarction and time course of plasma enzyme activity changes after myocardial infarction

Enzyme	*Abnormal activity detectable (hours)*	*Time for maximum rise (hours)*	*Time for return to normal (Days)*
CK_2 (MB-isoenzyme)	3-10	12-24	2-3
AST	6-12	24-48	4-6
LDH (heart specific)	8-16	48-72	7-12

Enzyme Assay in Myocardial Infarction

- The enzymes like **CKMB, LDH1 and AST** are included under the group cardiac enzymes. Estimation of these, help in the diagnosis, assessment and prognosis of the heart diseases.
- **1- CKMB:** Following myocardial infarction **the 1st enzyme to increase is CKMB.** Immediately after the heart attack CKMB levels in serum, start increasing and after reaching the peak level CKMB decreases and reaches the normal level by 3rd day.
- **2-AST:** AST levels in plasma increase after 6 to 8 hours of chest pain and then return to normal by 5th day.
- **3-LDH 1**: Total LDH and LDH 1 begin to increase 8 to 12 hours after the chest pain. It continues to increase and then slowly comes to normal by about 7th day.

Cardiac Troponin

- Recently these cardiac enzymes had been less used in diagnosis of myocardial infraction and depend more on **cardiac troponin** because it **is cardiac troponin is more sensitive and specific test to detect myocardial infarction** than these enzymes.

- Troponin characterized by early elevation after **4 hours from onset of chest pain and continues to be elevated to about 10 days**

- Elevated **troponin** with presence of suggested **clinical symptoms** or **ECG** abnormalities can **make the diagnosis of myocardial infarction**.

Liver Function Tests

Liver function tests includes several enzymes measurements in addition to measurements of bilurbin to assess jaundice and albumin to assess protein synthesis in the liver

1) Alanine transaminase (ALT)

- Alanine transaminase was known formerly as glutamate pyruvate transaminase (GPT) it is mainly specific to liver
- ALT level is elevated in liver diseases as viral hepatitis, alcoholism and fatty liver.

2)Aspartate transaminase (AST)

- It was known formerly as glutamate oxaloacetate transminase (GOT).
- it is less specific enzyme because it present in different tissues such as **liver, heart**, skeletal muscles, lungs and kidney.
- Increased AST level occurs after myocardial infarction.
- It is moderately elevated in **liver disease** together with ALT usually

3) Alkaline phosphatase (ALP)

- ALP hydrolyzes organic phosphate at alkaline ph. Presented in many tissues but mainly in bone and **liver biliary tract**
- Normal serum level for adults is 140 IU/L.
- It is elevated in certain **bone** and **liver** disease.
- Very high levels may be noticed in obstructive jaundice, bone diseases such as rickets, osteomalacia and other bone diseases .

4) Gamma Glutamyl Transferase (GGT)

- Liver and bile duct are the main sources of plasma gamma glutamyl transferase (GGT)
- Clinical significance—GGT levels in serum are increased in:
  - Obstructive jaundice : support diagnosis when ALP elevated
  - used in cases of Alcohol addiction.
  - Drug induction as antiepileptic drugs

Thank you