



MLS 418: CLINICAL CHEMISTRY LABORATORY

PRELIM WEEK 4 – LESSON 4

ALP and ACP

→ catalyzes a reaction that involves phosphates

ALKALINE PHOSPHATASE (ALP)

- E.C. 3.1.3.1: Orthophosphoric Monoester Phosphohydrolase (Alkaline Optimum)
- A nonspecific enzyme because it is capable of reacting to many different substrates



- The substrate, phosphomonoester is being hydrolyzed to produce an alcohol and a phosphate ion
- Reaction happens in an alkaline environment
- ALP optimum pH: 9-10

ALP activators

- Co^{2+}
- Mg^{2+}
- Mn^{2+}
- Zn^{2+} - some sources described zinc as a component of ALP

ALP inhibitors

- Phosphate
- Borate
- Oxalate
- Cyanide

ALP Tissue sources

- Present on cell surfaces in most tissues
 - Intestine
 - Liver
 - Sinusoidal and bile canalicular membranes
 - ALP levels of a healthy patient really originates from the liver and the rest are from the bone
 - Bone
 - Osteoblasts
 - Spleen
 - Placenta
 - Kidney

Why is it better to perform isoenzyme analysis compared to just measuring the ALP level alone?

1. To pinpoint the highest possible source of the elevated ALP level
2. The diagnosis of the physician is only playing around either the liver or bone
3. To ascertain any modifications in the activity of our osteoblast esp in patients who have established bone disorders

Different criteria in differentiating isoenzymes

1. Electrophoresis – use of electrophoretic mobility
2. Stability to denaturation by heat or chemicals
3. Response to presence of selected inhibitors
4. Affinity to lectins
5. Immunochemical characteristics

ALP Isoenzymes (electrophoresis)

- Liver ALP – migrates the fastest; pumupunta sa anode
- Bone ALP
- Placental ALP
- Intestinal ALP

Problem with this method: there are times that the bands of liver ALP and bone ALP will overlap

How to solve this?

- Perform another method; do not lie alone on the results of electrophoresis
- Before performing another electrophoresis, add neuraminidase to your serum. Mix and let it stand for 15 mins at 37°C.
- **Purpose of neuraminidase:** destroy the sialic acid that is present in the bone ALP, and once it is destroyed = result to slower mobility of the bone ALP

2 Fractions of Liver ALP

- Major liver fraction
 - Hepatobiliary conditions
- Fast liver fraction (α liver)
 - metastatic carcinoma of the liver
 - other hepatobiliary diseases
 - valuable indicator of obstructive liver disease...
 - migrates faster than the major liver fraction

Bone ALP

- Attached to the cell surface of the osteoblasts
- Increases due to osteoblastic activity
- Normally elevated
 - children during periods of growth
 - adults older than age 50
- four isoforms (B/L, B1, B2, B1x)
 - B/L, B1 and B2 - seen among healthy individuals
 - B1x – seen only in serum of dialysis patients.

Why? Remember that bone ALP is present when there is osteoblastic activity. Whenever there is osteoblastic activity, there is also a mineralization process in the body. Once you have this physiologic activities, only expected are the first 3 isoforms. However, if you have chronic kidney disease the regulation of electrolytes will be affected. Imbalance of electrolyte level can affect the mineralization process = Bone mineral disease. The body will still try to do its function → increase its osteoblastic activity = ↑ bone ALP (B1x)

Intestinal ALP

- Presence depends on the blood group and secretor status of the individual (more likely "B" and "O")
 - Secretor status – more on genetic makeup of the individual. H and SE genes (?)
 - Increases after consumption of fatty meal
- Found in intestinal epithelial cells
- Patient must be fasting
- Bound by erythrocytes of "A" group – because our sample is serum, and this is separated from erythrocytes = we cannot measure intestinal ALP of blood type A
- Diseases of the digestive tract and cirrhosis
- Chronic hemodialysis

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