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Liver Function Tests

Liver function tests

- Liver function tests (LFTs) are a group of blood tests that are used to assess the health and function of the liver.
- The liver is a vital organ responsible for numerous metabolic and detoxification processes in the body.
- Liver perform several diversified functions enumerated below:

1. **Metabolic function:** Liver is the key organ and the principal site where the metabolism of carbohydrate, lipids, protein, minerals and vitamins take place.
2. **Secretory function:** Liver is responsible for the formation and secretion of bile in the intestine. Bile pigment bilirubin formed from heme catabolism is conjugated in liver cells and secreted in the bile. Cholesterol and bile salts are also secreted in the bile into the intestine.
3. **Excretory function:** Exogenous dye BSP (bromosulphthalein) and Rose Bengal dye are excreted through liver cells.
4. **Detoxification and Protective function:** Ammonia is detoxified to urea. Liver cells can detoxified drugs, hormones and convert them into less toxic substances for excretion. Kuffer cells of liver perform phagocytosis to eliminate foreign compounds.
5. **Storage function:** Liver stored glycogen, trace mineral iron and vitamin A, D and B12.
6. **Hematological function:** Liver participates in the formation of blood particularly in the embryo (adults in some abnormal states), synthesis of plasma proteins and blood clotting factors and destruction of erythrocytes.

Standard liver function tests (SLFTs):

Standard Liver Function Tests (LFTs) will help to detect the abnormalities and extent of liver damage.

Classification of LFTs:

Classification is based on the specific functions of the liver involved.

1. Tests based on metabolism:

a. Carbohydrate metabolism:

- Galactose tolerance test
- Fructose tolerance test

b. Lipid metabolism:

- Serum cholesterol: Free and esterified form of cholesterol estimation and their ratio
- Estimation of fecal fats

c. Protein metabolism:

- Estimation of total protein, Albumin, Globulin and A/G ratio
- Determination of prothrombin time

- Flocculation tests: Thymol turbidity test, Zinc sulfate test, Colloidal gold test, Cephalin cholesterol flocculation test, Formal gap test.
- Amino acids in urine

2. <u>Tests based on detoxification and protective functions of liver:</u>

a. Conversion of ammonia to urea:

- Estimation of blood urea
- Estimation of blood ammonia

b. Formation of bilirubin diglucuronate:

- Estimation of serum bilirubin (Direct and Indirect)
- Icteric index
- VD Bergh reaction
- Urinary estimation of bilirubin and uribilinogen

c. Hippuric test

3. <u>Tests based on excretory functions:</u>

- Bromosulfthalein (BSP) test
- Rose Bengal test

4. <u>Tests based on storage functions of liver:</u>

a. Glycogen estimation
b. Lipid estimation
c. Estimation of vitamin A, D, B12
d. Estimation of serum iron and serum iron binding capacity

5. <u>Tests based on serum enzymes derived from liver:</u> Determination of

- Transaminases
- Alkaline phosphatases
- S- nucleotidase
- ϒ-glutamyl trans peptidase

6. <u>Cellular structural studies:</u>

- Liver biopsy

The typical components of liver function tests include:

1. <u>Alanine aminotransferase (ALT):</u>

- This enzyme is found mainly in the liver cells.
- Elevated levels of ALT in the blood may indicate liver damage or disease.
- It plays a crucial role in the conversion of alanine, an amino acid, into pyruvate.
- ALT is released into the bloodstream when there is liver cell damage or inflammation.

- Therefore, measuring ALT levels in the blood is a common way to assess liver health and function.

2. Aspartate aminotransferase (AST):

- It is another enzyme that plays a crucial role in various metabolic processes, and it is found in high concentrations in the liver, heart, muscles, kidneys, and brain.
- AST is released into the bloodstream when there is damage to cells containing this enzyme, particularly liver and heart cells.
- The primary function of AST is to catalyze the conversion of aspartate, an amino acid, to oxaloacetate.
- In the context of liver function tests (LFTs), AST is often measured alongside ALT to provide a more comprehensive assessment of liver health.

3. Alkaline phosphatase (ALP):

- It is an enzyme found in various tissues throughout the body, with higher concentrations in the liver, bones, bile ducts, and the placenta during pregnancy.
- ALP plays a role in several physiological processes, including the breakdown of proteins and the transport of compounds across cell membranes.

4. Total bilirubin:

- Bilirubin is a yellowish pigment produced during the breakdown of red blood cells.
- Elevated levels of bilirubin in the blood may indicate liver dysfunction or problems with the bile ducts.
- Albumin is a protein produced by the liver, and it helps maintain blood volume and pressure.
- Abnormal levels may be indicative of liver disease.

5. Total protein:

- This measures the total amount of proteins in the blood, including albumin and other proteins.
- Changes in total protein levels can be associated with liver and kidney diseases.

Liver Biopsy:

- Histopathological studies of liver biopsy reveal various pathological states of liver cells.
- Indications for Liver biopsy are fibrosis or neoplasms of liver, in metabolic diseases, arsenic poisoning selenium poisoning and for estimation of Vitamin A, Vitamin E, Cu, Zn, Liver glycogen.
- Biopsy is contraindicated in liver abscess.

❖ **Serum bilirubin levels**
- Normal Range: 0.2-0.8 mg/dL
- Unconjugated (indirect): 0.2-0.7 mg/dL
- Jaundice: above 2 mg/dL

❖ **Serum Albumin level**
- Normal Range: 3.5-5 g/dL

❖ **Serum Globulin level:**
- Normal Range: 2.5-3.5 g/dL

❖ **Serum AST levels:**
- Normal Range: 8-20 U/L

❖ **Serum ALT levels:**
- Normal Range:
- Male: 13-35 U/L
- Female: 10-30 U/L

❖ **Serum ALP levels**
- Normal Range: 40-125 U/L

❖ **Serum γ-glutamyltransferase levels GGT:**
- Normal Range: 10-30 U/L

Prothrombin Time (PT):
- Prothrombin Time (PT) is a blood test that measures the time it takes for plasma to clot. It is one of the tests used to assess the blood's ability to form a clot properly.
- PT is often used to monitor the effectiveness of anticoagulant medications such as warfarin and to evaluate liver function.
- During the test, a sample of blood is taken, and the plasma is separated from the blood cells. The plasma is then mixed with a substance that initiates the clotting process. The time it takes for the clot to form is measured in seconds, and the result is compared to a standard range.
- It's synthesized by the liver, a marker of liver function and vitamin K status.
- As for the result of the prothrombin time, a result of 1.1 or less is considered normal in healthy people.