LIVER FUNCTION TESTS (6 marks)

Functions of liver:

① Metabolic functions
key site of metabolism of carbohydrates, proteins and lipids

1. Carbohydrate: glycogen metabolism
2. Protein ~~met~~ catabolism
3. Lipids: Ketogenesis, fatty acid synthesis and beta oxidation, cholesterol synthesis and catabolism.
4. Catabolism and anabolism of nucleic acids.

② ~~Secretory functions~~ Secretory fn.
1. Formation and secretion of bile in the intestine.
2. Conjugation of free bilirubin.
3. Excretory function: Serum bilirubin
4. Synthesis of specific proteins.
→ Albumin, coagulation factors.
→ To some extend α and β globulin.
5. Detoxification and protective function:
→ Drug metabolites, hormones.
6. Storage:
→ glycogen
→ Vitamins B_{12}, vitamin A DEK
7. Homeostasis: Blood glucose regulation

Classification of LFT

A. Classification based on laboratory finding.

Group I. (Test of hepatic excretory function)
- Serum - bilirubin
- Urine - bile pigments, bile salts, urobilinogen.

Group II. (Liver enzyme panel)
- Markers of hepatocellular injury (ALT, AST)
- Markers of cholestasis (ALP, GGT, NTP)

Group III (Test for synthetic function of liver)
- Total protein, serum.

B. Classification based on clinical aspects

Group I: Markers of liver dysfunction
Serum bilirubin.
Urine: Bile pigments, bile salts and UBG
Total protein, serum albumin globulin, A/G ratio.
Prothrombin time, blood ammonia

VB test → 4 mark

(A) Group IV (special tests)

Ceruloplasmin, Ferritin, α1 antitrypsin (AAT), Alpha fetoprotein (AFP)

Group V: Direct & Indirect markers of hepatic fibrosis

(i) Serum hyaluronic acid (SHA)

(ii) Procollagen type I carboxy terminal peptide (PICP)

(iii) Procollagen type III amino terminal peptide (PIIINP)

(iv) Matrix metalloproteinases (MMPs)

(v) Tissue inhibitors of MMPs (TIMPs).

(vi) Transforming growth factor beta 1 (TGF beta 1).

(B) Group II Markers of hepatocellular injury

AST, ALT.

Group III: Markers of cholestasis

ALP, GGT, NTP.

Based on Laboratory finding

A

Group 1.

Test based on excretory failure.

(a) Serum Bilirubin:

Normal serum bilirubin level varies from 0.2 to 0.8 mg/dl.

- Estimated by van den Bergh test.

reagent → .

→ when mixed with serum/

Group II

Test based on liver enzymes

a) Marker of Hepatocellular damage:

i) ALT (SGPT)

- Elevated in all liver disease
- Normal level = 10-35 IU/L.
- Acute hepatitis >1000 IU/L

ii) AST (SGOT):

- Elevated in all liver diseases.
- Not specific for liver, may be raise in alcoholic liver disease.
- Normal level → 8-35 IU/L

Moderate elevation (100-300 IU/L)

- Alcoholic hepatitis.
- Auto immune hepatitis.
- Wilson's disease.

Mild upto <100 IU/L.

- Fatty liver.
- chronic viral hepatitis

b) Markers of obstructive liver disease:

i) ALP:

- Normal level 40-125 IU/L.
- Not specific for liver disease.
- Mild elevation in hepatic cell damage.
- Very high levels seen in cholestasis.

ii) GGT:

Normal level 10-30 IU/L

Alcoholic liver disease

Intrahepatic cholestasis.

iii) 5'NTP

Normal level - 2-10 IU/L

Increased in hepatobiliary disease

More specific for obstructive liver disease.

Group III

Test based on synthetic function

① Serum Albumin:

Almost all plasma proteins are synthesized in liver except Immunoglobulin.

½ life of albumin = 20 day

S. Albumin is decreased in chronic liver disease

Normal serum level

Total protein = 6-8 g/dl

Albumin = 3.5-5 g/dl

Globulin = 2.5-5 g/dl

A/G ratio = 1.2:1 to 1.5:1

→ In chronic liver disease, albumin ↓, compensatory ↑ in globulin synthesis.

② Prothrombin time:

Synthesized in liver.

½ life → 6 hours ∴ indicates

present function of liver.

→ PT prolonged in acute liver failure and also in vit K deficiency.

→ Other proteins: haptoglobin, transthyretin, have short ½ life.

→ decreased in acute liver disease.

Group IV Special tests.

→ AFP (alpha feto protein), normal component of fetal blood. Raised in hepatocellular carcinoma. AFP is a tumour marker.

→ Glutathion-S-transferase is a very sensitive indicator of liver function.

→ Ceruloplasmin increased in active hepatitis, biliary cirrhosis, obstructive biliary disease.

→ Decreased in cirrhosis

B. Based on Clinical Aspects

Group1

- Markers of liver dysfunction- Bilirubin, Urine bile salts, bile pigments, UBG, total proteins, PT, NH_3

Group 2.

Markers of hepatocellular injury

AST, ACP.

Group 3

Markers of cholestasis.

ALP, GGT, NTP

Test based on metabolism

1. Plasma ammonia:
- conversion of ammonia to urea is decreased in liver failure.

Normal level ≤ 50 mg/dL

Increased in liver cirrhosis.

2. Other rare tests
- Galactose tolerance test - galactose selectively metabolised by liver.
- Bromsulphthalein test.