اختبارات وظائف الكبد

Liver Function Tests

(LFTs)

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Outline

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The liver

The liver is a major organ only found in vertebrates which performs many essential biological functions such as detoxification of the organism, and the synthesis of proteins and biochemical necessary for digestion and growth. In humans, it is located in the right upper quadrant of the abdomen, below the diaphragm. Its other roles in metabolism include the regulation of glycogen storage, decomposition of red blood cells, and the production of hormones.

The various functions of the liver are carried out by the liver cells or hepatocytes. The liver is thought to be responsible for up to 500 separate functions, usually in combination with other systems and organs. Currently, no artificial organ or device is capable of reproducing all the functions of the liver. Some functions can be carried out by liver dialysis, an experimental treatment for liver failure. The liver also accounts for about 20% of resting total body oxygen consumption.

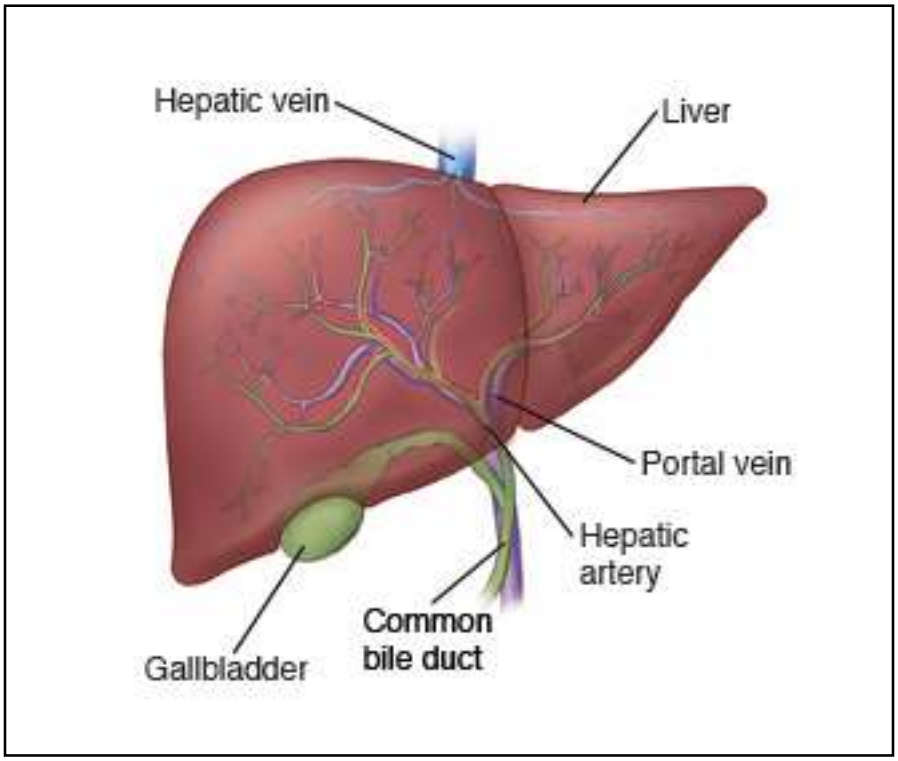

Figure (1): The liver

Major Metabolic functions of the Liver

1- Synthetic Function: which includes plasma protein (Albumin, Globulins), Cholesterol, Triglycerides and Lipoproteins.

2- Detoxification and excretion: involves removal Ammonia to urea (Urea Cycle), Bilirubin, Cholesterol, Drug metabolites.

3- Storage Function: Which includes Vitamins A, D, E, K and B_{12}

4- production of bile salts: this helps in digestion.

Some example of liver dysfunction

There are some diseases that cause liver dysfunction:

1- Hepatocellular Disease

2- Cholestasis (obstruction of bile flow)

3- Cirrhosis

4- Hepatitis

5- Jaundice

6- Liver cancer

7- Steatosis (fatty liver)

8- Genetic Disorders (Hemochromatosis)

Classification of LFTs

Group I: Markers of liver dysfunction which includes:

- Serum bilirubin: total and conjugated
- Urine: bile salts and urobilinogen
- Total protein, serum albumin and albumin/ globulin ratio
- Prothrombin Time

Group II: Markers of hepatocellular injury which includes:

▪ Alanine aminotransferase (ALT)

▪ Aspartate aminotransferase (AST)

Group III: Markers of cholestasis which involves:

▪ Alkaline phosphatase (ALP)

▪ γ-glutamyltransferase (GGT)

Limitations of LFTs

1- Normal LFTs values do not always indicate absence of liver disease where liver has very large reserve capacity.

2- Diagnosis should be based on clinical examination because asymptomatic people may have abnormal LFT results.

Common liver chemistry tests

1- Bilirubin: A byproduct of red blood cell breakdown. It is the yellowish pigment observed in jaundice. High bilirubin levels are observed in gallstones, acute and chronic hepatitis.

Serum bilirubin levels

■ Normal Range

▪ 0.2-0.8 mg/dL

■ Unconjugated (indirect):

▪ 0.2-0.7 mg/dL

■ Jaundice

▪ above 2 mg/dL

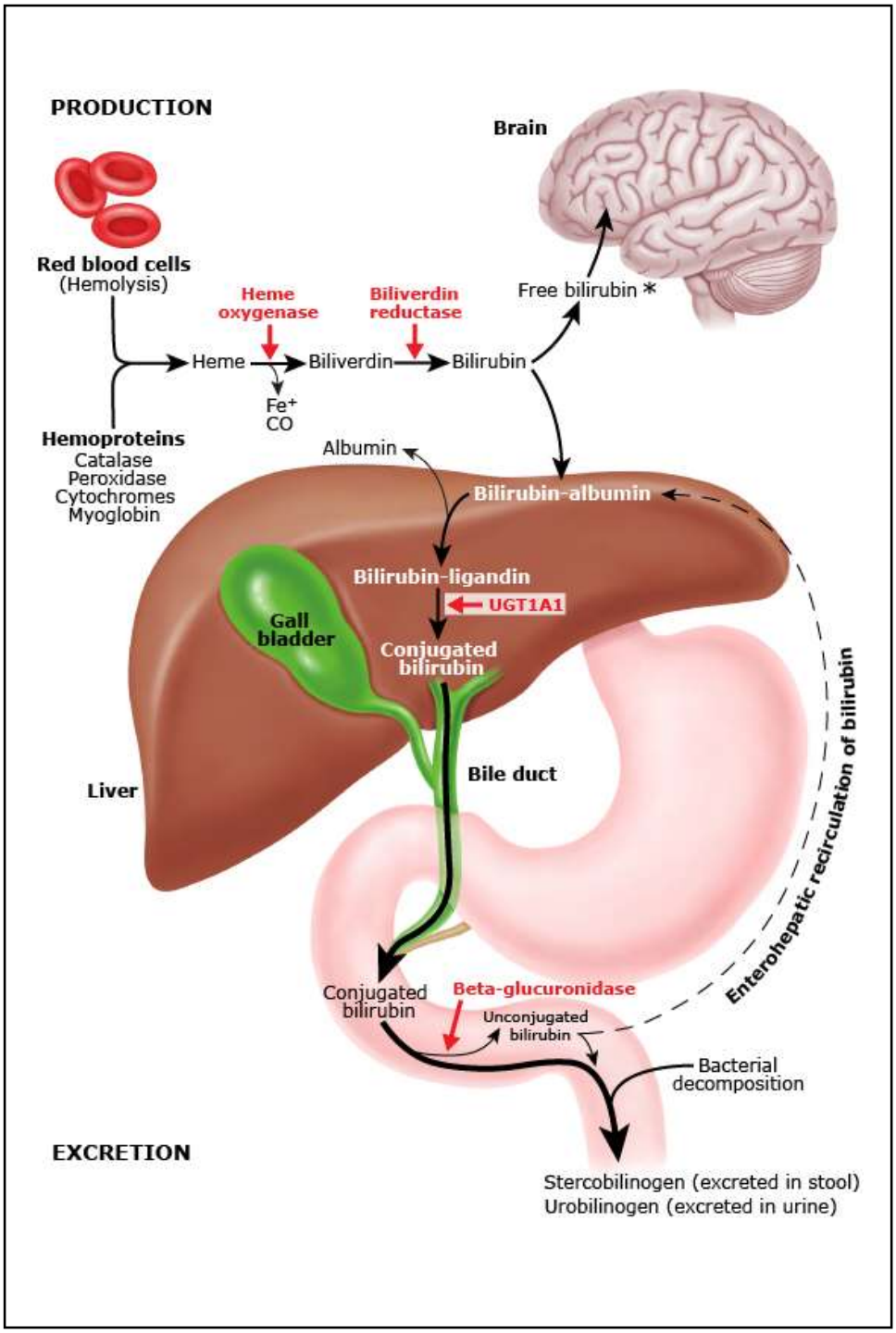

Figure (2): metabolism of Bilirubin

2- Serum Albumin: The most abundant protein synthesized by the liver. Synthesis depends on the extent of functioning liver cell mass. Its levels decrease in all chronic liver disease.

Serum Albumin level

■ Normal Range

▪ 3.5-5 g/dL

3- Serum Globulin: They constitute immunoglobulins (antibodies). α and β-globulins mainly synthesized by the liver. High serum $^{\gamma}$- globulins are observed in chronic hepatitis and cirrhosis.

Serum Globulin level:

■ Normal Range

▪ 2.5-3.5 g/dL

4- Prothrombin Time (PT): its synthesized by the liver, a marker of liver function and vitamin K status. Prothrombin time is most commonly measured using blood plasma. As for the result of the prothrombin time, a result of 1.1 or less is considered normal in healthy people.

5- Aspartate aminotransferase (AST): A marker of hepatocellular damage. High serum levels are observed in chronic hepatitis, cirrhosis and liver cancer.

Serum AST levels:

■ Normal Range

▪ 8-20 U/L

6- Alanine aminotransferase (ALT): A marker is more liver-specific than AST. High serum levels in acute hepatitis (300-1000 U/L). Moderate elevation in alcoholic hepatitis (100-300 U/L). Minor elevation in cirrhosis, hepatitis C and non-alcoholic steatohepatitis (NASH) (50-100 U/L).

Serum ALT levels:

■ Normal Range

▪ Male: 13-35 U/L

▪ Female: 10-30 U/L

7- Alkaline phosphatase (ALP): A marker of cholestasis and non-specific marker of liver disease. Its produced by bone osteoblasts (for bone calcification). Its present on hepatocyte membrane. Moderate elevation observed in infective hepatitis, alcoholic hepatitis and hepatocellular carcinoma.

Serum ALP levels

■ Normal Range

▪ 40-125 U/L

8- γ-glutamyltransferase (GGT): Used for glutathione synthesis. Moderate elevation observed in infective hepatitis and prostate cancer. GGT is increased in alcoholics despite normal liver function tests.

Serum GGT levels:

■ Normal Range

▪ 10-30 U/L

Homework

1- What is the difference between liver function assessment tests and liver injury diagnostic tests?

2- What is Urobilinogen?

3- What is Glucuronic acid?

4- What is Albumin to Globulin ratio (A/G)?

References

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