LIVER

FUNCTION TESTS

Dr.Mohan kumar.S,1st year, Dept of Conservative Dentistry and Endodontics.

- The liver has a wide range of functions, including detoxification of various metabolites, protein synthesis, and production of biochemicals necessary for digestion. The liver is necessary for survival, and there is currently no way to compensate for the absence of liver function in the long term.

LIVER FUNCTION TEST

USED TO

- Detect presence of liver disease
- Distinguish among different types of liver disaease.
- Gauge the extent of known liver damage
- Follow the response of treatment

Tests based on detoxification & excretory functions

- Serum bilirubin
- Urine bilirubin
- Blood ammonia
- Serum enzymes : AST, ALT, GGT, 5'Nucleotidase,ALP

Tests that measure Biosynthetic function of liver

- Serum Albumin
- Serum Globulins
- PT ,INR

Serum Bilirubin

- A break down product of porphyrin ring of heme – containing proteins , found in blood in 2 fractions – conj/unconj
- Conjugated : water soluble , so excreted by kidneys
- Unconjugated : insoluble in water , bound to albumin in blood
- About 300 mg of bilirubin is formed per day

Serum Bilirubin

- Normal total serum bilirubin: 0.3 – 1.3 mg/dl
- Direct/conjugated bilirubin: 0.1 – 0.4 mg/dl
- Indirect/unconjugated bilirubin: 0.2 – 0.9mg/dl

- Measured by Van Den Bergh method
- Bilirubin reacts with diazo reagent to produce coloured azo pigment . At pH 5 – pigment purple .

Serum Bilirubin

- Plasma bilirubin exceeds 1mg/dl – hyperbilirubinemia
- B/w 1-2 mg/dl – latent jaundice
- >2 mg/dl – yellowish discolouration of sclera, conjunctiva, skin , mucous memberane resulting in jaundice.

- Bilirubin is taken up into hepatocytes , *conjugated* (modified to make it water-soluble) by UDP-glucuronyl-transferase, and secreted into the bile by CMOAT (MRP2), which is excreted into the intestine.

- In the intestine, conjugated bilirubin may be (1) metabolized by colonic bacteria, (2) eliminated, (3) reabsorbed. Metabolism of bilirubin into urobilinogen followed by reabsorption of urobilinogen accounts for the yellow color of urine as we urinate a downstream product of urobilinogen. Further metabolism of urobilinogen into stercobilin while in the bowels accounts for the brown color of stool.

- Increased total bilirubin (TBIL) causes jaundice, and can indicate a number of problems:
- 1. **Prehepatic**: Increased bilirubin *production*. This can be due to a number of causes, including hemolytic anemias and internal hemorrhage.
- 2. **Hepatic**: Problems with the liver, which are reflected as deficiencies in bilirubin *metabolism* (e.g., reduced hepatocyte uptake, impaired conjugation of bilirubin, and reduced hepatocyte secretion of bilirubin). Some examples would be cirrhosis and viral hepatitis.
- 3. **Posthepatic**: Obstruction of the bile ducts, reflected as deficiencies in bilirubin *excretion*. (Obstruction can be located either within the liver or in the bile duct)

- Direct bilirubin (conjugated bilirubin)
- Reference range0.1–0.4 mg/dLThe diagnosis is narrowed down further by looking at the levels of direct bilirubin.
- If direct (i.e. conjugated) bilirubin is normal, then the problem is an excess of unconjugated bilirubin (indirect bilirubin), and the location of the problem is upstream of bilirubin conjugation in the liver. Hemolysis, viral hepatitis, or cirrhosis can be suspected.
- If direct bilirubin is elevated, then the liver is conjugating bilirubin normally, but is not able to excrete it. Bile duct obstruction by gallstones or cancer should be suspected.

High Bilirubin in neonates

- Neonates are especially vulnerable to bilirubin levels due to an immature blood-brain barrier that predisposed them to kernicterus / bilirubin encephalopathy which can result in permanent neurological damage. Neonates also have a low amount of functional UDP-glucuronyl-transferase and can have elevated unconjugated bilirubin since conjugated is limited.

Urine Bilirubin

- The conjugated bilirubin being water soluble is excreted in urine.
- This s contrast to unconjugated bilrirubin which is not excreted
- Biluribin in urine can be detected by fouchets test or gmelins test.

Serum Enzymes – reflect damage to hepatocytes

- Aminotransferases (AST,ALT) – sensitive indicators of liver cell injury
- Helpful in recognizing hepatocellular diseasess such as hepatitis.

Aspartate Aminotransferase (SGOT) *Reference range6-40 IU/L*

- Aspartate transaminase (AST) also called serum glutamic oxaloacetic transaminase (SGOT) or aspartate aminotransferase (ASAT) is similar to ALT in that it is another enzyme associated with liver parenchymal cells.
- It is raised in acute liver damage, but is also present in red blood cells, and cardiac and skeletal muscle and is therefore not specific to the liver.
- The ratio of AST to ALT is sometimes useful in differentiating between causes of liver damage.[6][7] Elevated AST levels are not specific for liver damage, and AST has also been used as a cardiac marker

Alanine Aminotransferase(SGPT)

- Normal : 7 – 41 U/L
- ALT found primarily in liver.
- Upto 300U/L – nonspecific , any type of liver disorder(cirrhosis /malignancy)
- >1000U/L – extensive hepatocellular damage (viral hepatitis, ischemic liver injury , toxin /drug induced liver injury)
- Acute hepatocellular diseases – ALT >AST

Serum Enzymes – that reflect cholestasis

3 enzymes

- Alkaline Phosphatase
- 5'Nucleotidase
- Gamma glutamyl transpeptidase

Alkaline Phosphatase

- Normal :40 – 125 U/L
- **Alpha -1 ALP** – epithelial cells of biliary canaliculi , increased in obs.jaundice.
- Alpha-2 heat labile ALP – hepatic cells , increased in hepatitis
- Alpha -2 heat stable ALP – placental origin, normal pregnancy
- Pre Beta ALP – bone origin , increased in bone diseases
- Gamma ALP – Intestinal cells, increased in Ulcerative colitis.

Alkaline Phosphatase

- Elevation of liver derived ALP – not totally specific for cholestasis .
- < 3 fold rise can be seen in many types of liver ds (infective, alcoholic hepatitis)
- >4 times – cholestatic liver diseases, infiltrative liver diseases, bone diseases with rapid bone turnover .

- Isolated rise of ALP – hodgkins lymphoma,
  diabetes
  hyperthyrodism
  amyloidosis
  inf.bowel diseases
- Not helpful in diff b/w intrahep & extrahep cholestasis

5'Nucleotidase

- Normal :2 – 10 U/L
- Moderate elevated – hepatitis
- Highly elevated – biliary obstruction
- Unlike ALP , the level is unrelated with osteoblastic activity ie.. Unaffected by bone diseases.

Gamma glutamyl transpeptidase

- Used in body for synthesis of glutathione
- Seen in liver, kidney, pancreas, intestinal cells, prostate
- Normal : 9 – 58 U/L

GGT

- Rised even when other LFT are normal in alcohalics.
- GGT falls rapidly within few days after abstinence.
- Mod rise – infective hepatitis, prostate Cancer
- High rise – alcoholism,

  obstructive jaundice,

  neoplasms of liver

Tests that measure Biosynthetic function of liver – Serum Albumin

- Produced by hepatocytes
- Normal : 3.5 – 5 g/dl
- Long half life :18 -20 days
- Because of slow turnover Serum Albumin not a good indicator of acute/mild hepatic dysfunction.

Serum Globulins

- Normal : 2 – 3.5 g/dl
- > 4 g/dl - CLD
- Gamma globulins – B lymphocytes
- Alpha , beta globulins – hepatocytes
- Increased gamma globulins – CLD

Gamma globulins

- IgG – Auto immune hepatitis
- IgM – Primary biliary cirrhosis
- Ig A – Alcoholic liver ds

Prothrombin Time ,INR

- Normal : 11.5 – 12.5 sec
- Prolongation of PT by 2 sec / more – Abnormal
- PT – factors I,V, VII, X

➢ PT prolonged – hepatitis, cirrhosis, vit K deficiency(obsyructive jaundice, fat malabsorption)


Have a break have a KitKat