

Diseases of the liver

☒ Introduction

The liver has many functions, these functions are:-

- The detoxification and excretion of many toxic substances, including photodynamic agents (drugs or toxins) of the blood stream.
- The maintenance of normal blood glucose levels by providing the source as glycogen (regulation of blood-sugar levels).
- Maintenance of blood protein and cholesterol levels.
- The formation and excretion of bile salts (that helps to metabolize fats) and the excretion of bile pigments.
- The formation of prothrombin.
- Production and maintenance of normal blood-clotting factors.

The basic disease processes are divided into:-

- Infection
- Inflammation
- Toxicity
- Cancer
- Metabolic disease
- Congenital diseases
- Trauma.

Principle of hepatic dysfunction

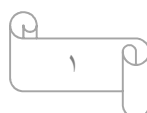
Classification of liver disease :1. Focal liver disease 2. Diffuse liver disease 3. Biliary disease

Diffuse and focal hepatic diseases

Diffuse diseases of the liver are more commonly accompanied by signs of insufficiency than are focal diseases, which produce their effect either by the toxins formed in the lesions or by pressure on other organs, including the biliary system. The origin of a toxemia is often difficult to localize to the liver because of the physical difficulty of examining the organ.

Focal liver disease

- Hemangioma
- Focal nodular hyperplasia (FNH)
- Hepatocellular Adenoma (HCA)
- Focal fatty change (FFC)
- Cyst (bile duct cyst)
- Abscess
- Metastasis
- Hepatocellular Carcinoma (HCC)



Diffuse liver disease

- Steatosis (infiltration of liver cells with fat, associated with disturbance of the metabolism).
- Fibrosis
- Acute and Chronic Hepatitis
- Cirrhosis (a chronic disease of the liver marked by degeneration of cells, inflammation, and fibrous thickening of tissue.
- Iron overload (Hemochromatosis)
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Hepatic dysfunction

There are no specific modes of hepatic dysfunction. The liver has several important functions and any diffuse disease of the organ interferes with most or all of the functions to the same degree. Variations occur in the acuteness and severity of the damage but the effects are the same and the clinical manifestations vary in degree only.

Portal Circulation

The portal circulation and the liver are mutually interdependent, the liver depending upon the portal vein for its supply of nutrients and the portal flow depending upon the patency of the hepatic sinusoids.

☒ Special examination of the liver

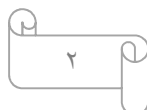
When disease of the liver is suspected after a general clinical examination, special techniques of **palpation, biopsy and biochemical tests of function** can be used to determine further the status of the liver.

▪ Palpation and percussion

The liver lies beneath the costal arch and cannot normally be palpated. If it is grossly enlarged or displaced posteriorly it may be palpated by pushing the fingers behind the right costal arch. **The liver may be enlarged in chronic liver fluke infestation and congestive heart failure.**

▪ BIOPSY

Biopsy of the liver has been used extensively as a diagnostic procedure in **infectious equine anemia, , and experimental work on copper and vitamin A deficiency.** The technique requires some skill and anatomical knowledge. The most satisfactory instrument is along, small-caliber trocar and cannula to which is screwed a syringe capable of producing good negative pressure. For example, in cattle the biopsy is made in the 11th intercostal space at a point on an imaginary line between the right elbow and tuber coxa.



- **Medical Image of The Liver**

- **Ultrasonography:**

Ultrasonography of the liver is used as an aid to diagnosis of diseases of the liver of large animals. A complete ultrasonographic assessment of the liver can provide detailed information about **the size, position and parenchymal pattern of the liver.**

- **Radiography:**

Lateral abdominal radiography can be used to determine the size and location of the liver in foals. Fluoroscopy and contrast media injected into the mesenteric vein have been used to detect the presence of portosystemic shunts in foals and calves.

- **Laboratory test for hepatic disease and function**

Hepatic disease is difficult to diagnose based on clinical findings alone and the use of laboratory tests is necessary.

The results and interpretation of such tests, however, depend on the **nature of the lesion, the duration and severity of the disease, and species variations.** Specific tests that identify the exact nature of the lesion are not available, and a combination of tests is usually necessary to make a diagnosis.

In **the horse** it is suggested that testing for serum bile acids, arginase and gamma-glutamyl transferase (γ GT) gives a sensitive indicator of **cholestasis and/or hepatocellular necrosis**, and a liver biopsy would form the minimum combination of tests for the diagnosis and prognosis of hepatic disease. **A horse with chronic hepatic lesions may a leukocytosis and neutrophilia, hypoalbuminemia, hyperbetaglobulinemia, increased ALP and γ GT and, depending on other factors, there may be increases in AST, SDH, total lactate dehydrogenase.**

In **cattle**, it is suggested that the serum activities of sorbitol dehydrogenase (SDH), γ GT and aspartate aminotransferase (AST, formerly known as SGOT), and the BSP clearance' test, provide sensitive indicators **of hepatocellular injury .**

The laboratory tests for the diagnosis of hepatic disease and to evaluate hepatic function in farm animals can be divided into those that measure:

- Excretory rate of parenterally administered substances such as BSP
 - Ability of the liver to remove substances from the serum and detoxify them
 - Serum levels of liver enzymes that increase following hepatic injury
- Indirect assessment of hepatic function such as blood glucose, serum proteins, clotting factors and urinalysis.



- **Hepatic function:**

The bromosulphthalein sodium (BSP) clearance test has been used in cattle, sheep and horses, and although little information is available the test appears to have diagnostic value. This test uses an injected dye, BSP, for diagnosis of liver disease. After the injection, several blood samples are taken to determine the blood level of the dye. These levels will indicate the liver's ability to excrete the dye and thus the general functioning of the liver.

- **Icteric index**

Measurement of the icteric index of plasma, by comparing its color with a standard solution of **potassium dichromate**, cannot be considered to be a liver function test but it is used commonly as a measure of the degree of jaundice present. **The color of normal plasma varies widely between species depending upon the concentration of carotene. Horse, and to a less extent cattle, plasma is quite deeply colored, but sheep plasma is normally very pale. The color index needs to be corrected for this factor before the icteric index is computed.**

Hyperbilirubinemia occurs in many diseases of cattle and in most cases is related to a failure of the liver to remove unconjugated bilirubin from the serum rather than to a failure of the liver to excrete conjugated bilirubin.

- **Serum hepatic enzyme :**

The determination of serum levels of hepatic enzymes is used commonly for the detection and evaluation of hepatic disease. The interpretation of elevated values of enzymes in plasma is dependent not only on the tissue and site of origin but also on the half-time of clearance of the enzyme.

- ✓ **Sorbitol dehydrogenase (also called L-iditol dehydrogenase (ID))** is almost completely selective as an indicator of liver damage and is the preferred test for hepatic damage in sheep and cattle.
- ✓ **Lactate dehydrogenase (LDH)** is abundant in liver, kidney, muscle and myocardium .
- ✓ **Aspartate aminotransferase or L-alanine aminotransferase (ALT, previously known as SGPT)** are of some value as an indicator of liver damage because of their high content in liver but are generally considered to be too nonspecific to be of great diagnostic value.
- ✓ **Arginase** is a specific indicator of hepatic disease because it is not found in appreciable quantities in other organs. Useful for the diagnosis of acute hepatic disease.



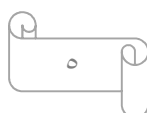
- ✓ **Gamma-glutamyl transferase** is an enzyme widely distributed in a variety of equine tissues. Specific activity of γ GT in the horse is highest in the kidney, pancreas and liver. Serum γ GT activity is used as a diagnostic criterion for hepatobiliary diseases in cattle, sheep and horses. In the horse, increases in serum γ GT may be associated with hepatocellular damage and liver necrosis in a variety of natural and experimentally induced liver diseases. In foals during the first month of life values were 1.5-3 times higher than the upper physiological reference values for healthy adult horses. In neonatal foals, the serum ALP, GGT and SDH activities were increased during the first 2 weeks of life.
- ✓ **Glutamate dehydrogenase (GD)** occurs in high concentration in the serum of ruminants and horses with liver disease .
- ✓ **Ornithine carbamoyl-transferase (OCT)** levels are also elevated even in chronic diseases, but only when there is active liver necrosis and not when the lesions are healing .
- ✓ **Alkaline phosphatase levels** are used as a test of hepatic excretory function in the horse and are of value in that species but variations in normal cattle have such a wide range that results are difficult to interpret. Of the tests available for testing of biliary obstruction the serum ALP test is preferred. However, there is a similar response to damage in other tissues.

▪ Serum bile acids

The concentration of total serum bile acids has been reported as a sensitive and specific indicator of hepatobiliary disease in humans and animals. Abnormalities of bile acid metabolism may be detectable in animals with liver disease that have little evidence of hepatic dysfunction as determined by other common liver function tests. **Bile acids are the end-products of the metabolism of cholesterol by the liver. They are excreted in the bile and reabsorbed from the intestine either unchanged or after further transformation by bacterial action.**

▪ Blood ammonia levels

The microbial deamination of amino acids in the intestinal tract is the major source of ammonia which is absorbed by the intestine into portal venous blood and converted into urea by the liver. The concentration of blood ammonia can be an indication of functional hepatic mass. Generally, **in the horse** plasma ammonia concentration is a sensitive and specific indicator of hepatic disease.



☒ Principles of treatment in diseases of the liver

In diffuse diseases of the liver

No general treatment is satisfactory and the main aim should be to remove the source of the damaging agent.

❖ In acute hepatitis

- Oral or intravenous injections of **glucose** to maintain the level of blood glucose.
- Intake of an adequate amount of **calcium salts** should be insured by oral or parenteral administration. There is some doubt as to whether protein intake should be maintained at a high level, as incomplete metabolism of the protein may result in toxic effects, particularly in the kidney.
- **Amino acid mixtures**, especially those containing **methionine**, are used with apparently good results. The same general recommendations apply in prevention as in the treatment of acute diffuse liver disease.
- **Diets high in carbohydrate**, calcium and protein of high biological value and a number of specific substances are known to have a protective effect against hepatotoxic agents.

❖ In chronic, diffuse hepatic disease fibrous tissue replacement causes compression of the sinusoids and is irreversible except in the very early stages,

- Removal of fat from the liver by the administration of **lipotropic factors including choline** and maintenance on a diet low in fat and protein may reduce the compressive effects of fibrous tissue contraction.
 - A **high-protein diet** at this stage causes stimulation of the metabolic activity of the liver and an increased deposit of fat, further retarding hepatic function.
- ❖ Local diseases of the liver require:
- surgical or medical treatment depending upon the cause, and specific treatments.