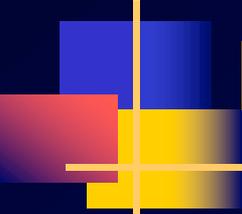


Diseases of the liver and biliary system

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STRUCTURE OF THE LIVER AND BILIARY SYSTEM

- Largest internal organ in the body (1.2–1.5 kg), situated in the right hypochondrium.
- Functionally, it is divided into right and left lobes by the middle hepatic vein.
- The liver is further subdivided into a total of eight segments. Each segment receives its own portal pedicle, permitting individual segment resection at surgery.

STRUCTURE OF THE LIVER AND BILIARY SYSTEM

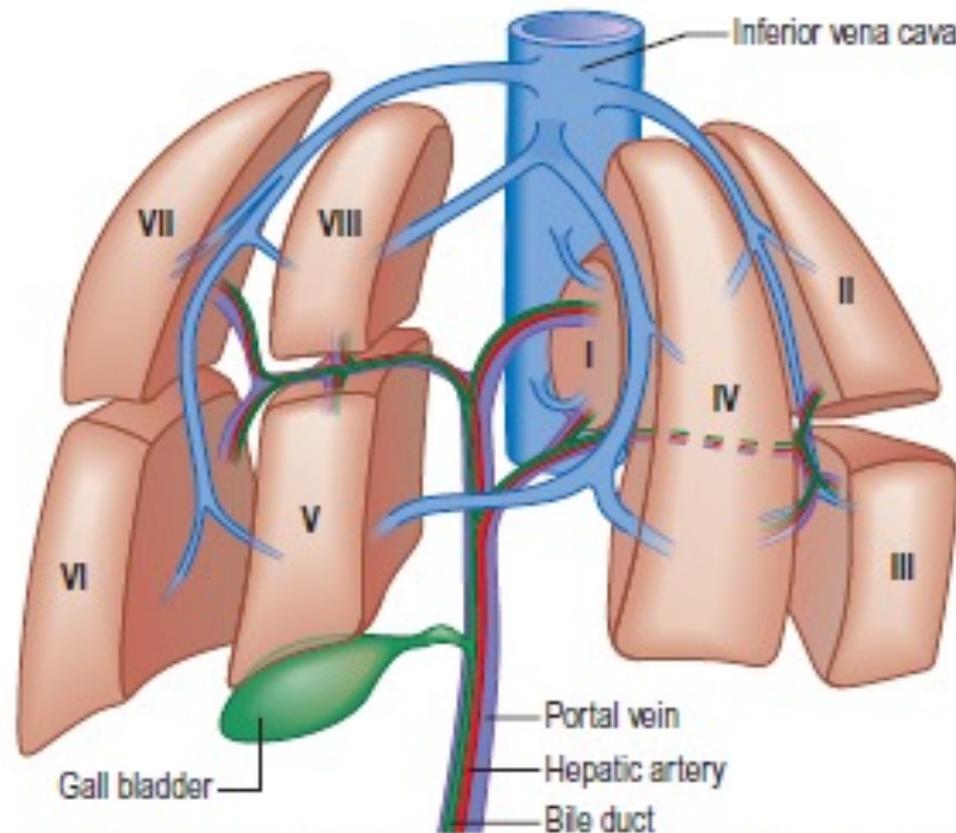
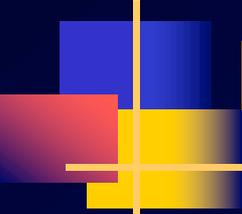
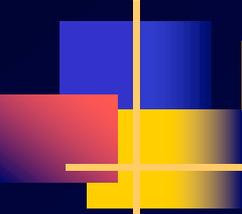


Fig. 7.1 Segmental anatomy of the liver showing the eight hepatic segments. I, caudate lobe; II-IV the left hemiliver; V-VIII the right hemiliver.

STRUCTURE OF THE LIVER AND BILIARY SYSTEM



- The blood supply to the liver constitutes 25% of the resting cardiac output and is via two main vessels:
 1. **The hepatic artery**; a branch of the coeliac axis, supplies 25% of the total blood flow.
 2. **The portal vein**; drains most of the gastrointestinal tract and the spleen. It supplies 75% of the blood flow.
- The normal portal pressure is 5–8 mmHg; flow increases after meals.

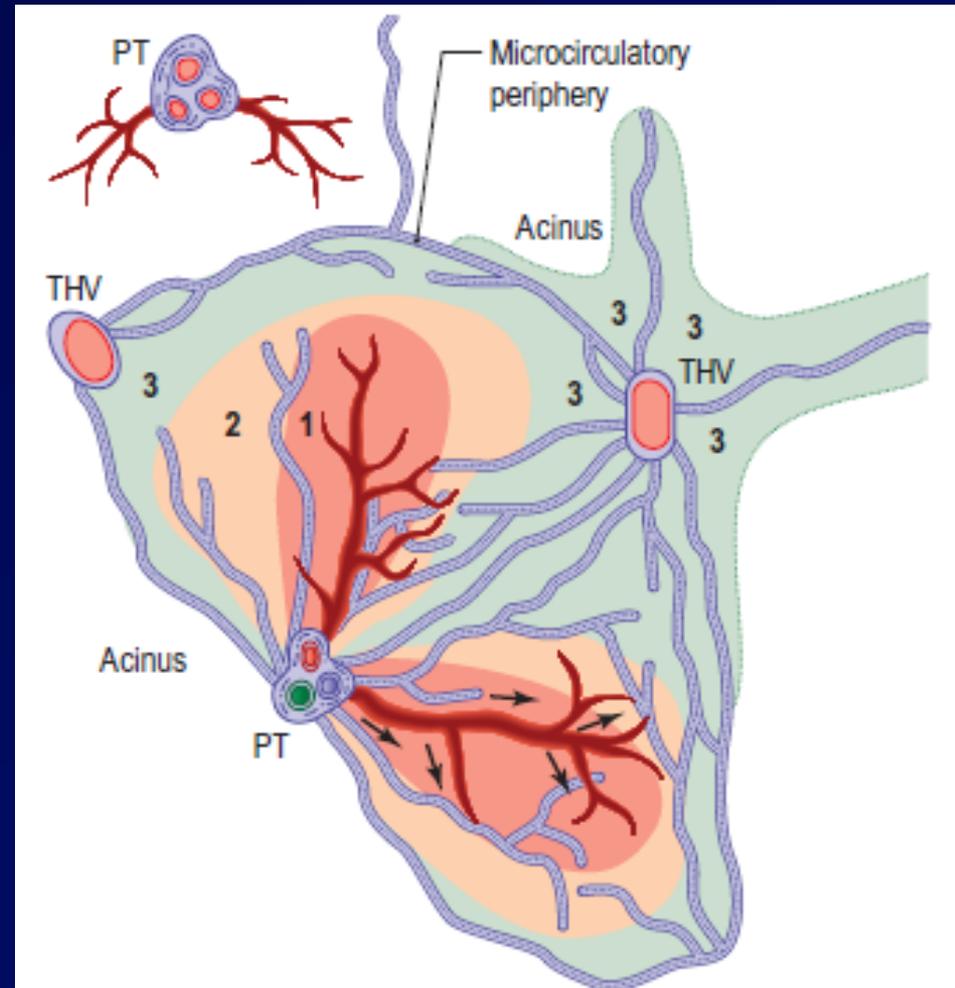


STRUCTURE OF THE LIVER AND BILIARY SYSTEM

- Both vessels enter the liver via the hilum (porta hepatis).
- Blood from these vessels is distributed to the segments and passes into the sinusoids via the portal tracts.
- Blood leaves the sinusoids, entering branches of the hepatic vein which join into three main branches before entering the inferior vena cava.

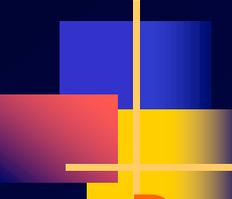
STRUCTURE OF THE LIVER AND BILIARY SYSTEM

- The acinus is the functional unit of the liver.
- This consists of parenchyma supplied by the smallest portal tracts (PT).
- The hepatocytes near this triad (zone 1) are well supplied with oxygenated blood and are more resistant to damage than the cells nearer the terminal hepatic (central) veins (zone 3).



STRUCTURE OF THE LIVER AND BILIARY SYSTEM

- The biliary system
- Bile canaliculi form a network between the hepatocytes, join to form thin bile ductules which enter the bile ducts in the portal tracts.
- These then combine to form the right and left hepatic ducts that join at the porta hepatis to form the common hepatic duct.
- The cystic duct connects the gall bladder to the lower end of the common hepatic duct.
- The common bile duct is formed by the combination of the cystic and hepatic ducts
- The common bile duct and pancreatic duct open into the second part of the duodenum

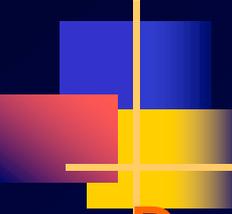


FUNCTIONS OF THE LIVER

■ Protein metabolism

1. Synthesis

- The liver is the principal site of synthesis of all circulating proteins (except γ globulins).
- Plasma contains 60–80 g/L of protein, mainly in the form of albumin, globulin and fibrinogen.
- 10–12 g of Albumin are synthesized daily.
- The liver also synthesizes all factors involved in coagulation as well as components of the complement system.

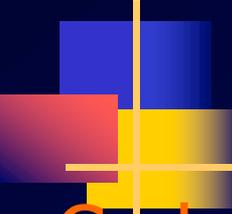


FUNCTIONS OF THE LIVER

■ Protein metabolism

2. Degradation (nitrogen excretion)

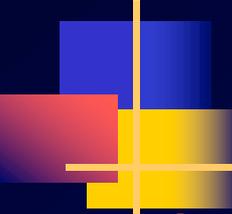
- Amino acids are degraded by transamination and oxidative deamination to produce ammonia, which is then converted to urea and excreted by the kidneys.
- Failure of this process occurs in severe liver disease.



FUNCTIONS OF THE LIVER

Carbohydrate metabolism

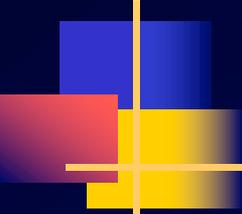
- Glucose homeostasis and the maintenance of the blood sugar is a major function of the liver.
- It stores approximately 80 g of glycogen. In the immediate fasting state, blood glucose is maintained either glycogenolysis or gluconeogenesis.
- In prolonged starvation, ketone bodies and fatty acids are used as alternative sources of fuel



FUNCTIONS OF THE LIVER

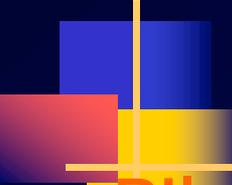
Lipid metabolism

- Fats are insoluble in water and are transported in the plasma as protein–lipid complexes (lipoproteins).
- The liver has a major role in the metabolism of lipoproteins.
- It synthesizes very-low-density lipoproteins (VLDLs) and high-density lipoproteins (HDLs).
- Oxidation or de novo synthesis of FFA occurs in the liver, depending on the availability of dietary fat.
- Cholesterol may be of dietary origin but most is synthesized from acetyl-CoA mainly in the liver, intestine, adrenal cortex and skin.



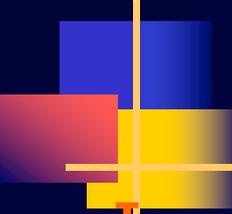
FUNCTIONS OF THE LIVER

- Bile secretion and bile metabolism.
- Hormone and drug inactivation
 - The liver catabolizes hormones such as insulin, glucagon, oestrogens, growth hormone, glucocorticoids and parathyroid hormone. It is also the prime target organ for many hormones (e.g. insulin).
 - It is the major site for the metabolism of drugs and alcohol.
 - Fat-soluble drugs are converted to water-soluble substances that facilitate their excretion in the bile or urine.
 - Cholecalciferol is converted to 25-hydroxycholecalciferol.



FUNCTIONS OF THE LIVER

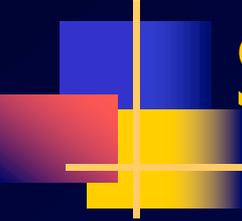
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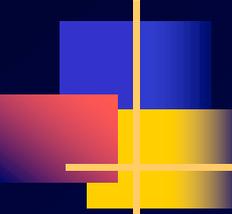
■ Immunological function

- The reticuloendothelial system of the liver contains many immunologically active cells.
- The liver acts as a 'sieve' for the bacterial and other antigens carried to it via the portal tract from the gastrointestinal tract.
- These antigens are phagocytosed and degraded by Kupffer cells.
- Kupffer cells are activated by several factors, such as infection. They secrete interleukins, tumour necrosis factor (TNF), collagenase and lysosomal hydrolases.



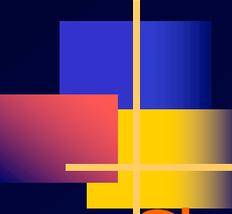
SYMPTOMS OF LIVER DISEASE

- Acute liver disease
 - This may be asymptomatic and anicteric.
 - Symptomatic disease (which is often viral) produces generalized symptoms of malaise, anorexia and fever.
 - Right hypochondrial pain.
 - Jaundice may appear as the illness progresses.



SYMPTOMS OF LIVER DISEASE

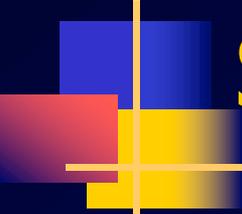
- Chronic liver disease
- Patients may be asymptomatic or complain of non-specific symptoms, particularly fatigue. Specific symptoms include:
 1. Right hypochondrial pain due to liver distension.
 2. Abdominal distension due to ascites.
 3. Ankle swelling due to fluid retention



SYMPTOMS OF LIVER DISEASE

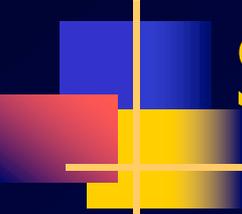
■ Chronic liver disease

4. Haematemesis and melaena from gastrointestinal haemorrhage.
5. pruritus due to cholestasis.
6. Breast swelling (gynaecomastia), loss of libido and amenorrhoea due to endocrine dysfunction.
7. Confusion and drowsiness due to neuropsychiatric complications (portosystemic encephalopathy).



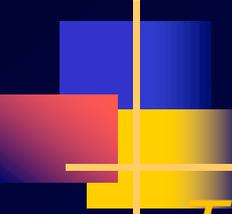
SIGNS OF LIVER DISEASE

- Acute liver disease
- There may be few signs
 1. Jaundice is a yellow coloration of the skin and mucous membranes
 2. In the cholestatic phase of the illness, pale stools and dark urine are present.
 3. Enlarged liver.
 4. Spider naevi and liver palms usually indicate chronic disease but they can occur in severe acute disease.



SIGNS OF LIVER DISEASE

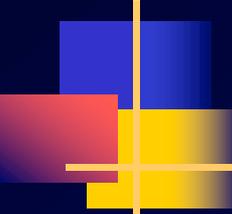
- Chronic liver disease
- Examination may be normal
- *The skin*
 1. The chest and upper body may show spider naevi. These are telangiectases that consist of a central arteriole with radiating small vessels. They are found in the distribution of the superior vena cava (i.e. above the nipple line). They are also found in pregnancy.



SIGNS OF LIVER DISEASE

■ *The skin*

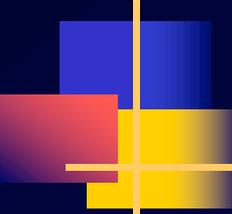
2. In haemochromatosis the skin may have a slate-grey appearance.
3. The hands may show palmar erythema, which is a nonspecific change indicative of a hyperdynamic circulation; it is also seen in pregnancy, thyrotoxicosis or rheumatoid arthritis.
4. Clubbing occasionally occurs, and a Dupuytren's contracture is often seen in alcoholic cirrhosis.
5. Xanthomas (cholesterol deposits) are seen in the palmar creases or above the eyes in primary biliary cirrhosis.



SIGNS OF LIVER DISEASE

- *The abdomen*

1. Initial hepatomegaly will be followed by a small liver in well established cirrhosis.
2. Splenomegaly is seen with portal hypertension.



SIGNS OF LIVER DISEASE

- *The endocrine system*

1. Gynaecomastia (occasionally unilateral) and testicular atrophy may be found in males. The cause of gynaecomastia is complex, but it is probably related to altered oestrogen metabolism or to treatment with spironolactone.

General

Jaundice
Fever
Loss of body hair

Compensated

Xanthelasmas
Parotid enlargement
Spider naevi
Gynaecomastia
Liver (small or large)
Splenomegaly

Liver palms
Clubbing
Duputren's contracture
Xanthomas

Scratch marks
Testicular atrophy
Purpura
Pigmented ulcers

Decompensated

Neurological, i.e.
Disorientation
Drowsy → coma
Hepatic flap
Fetor hepaticus

Ascites
Dilated veins on abdomen

Oedema

