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THE ROLE AND FUNCTIONS OF MODERN TECHNOLOGIES IN THE DIAGNOSIS AND TREATMENT OF LIVER DISEASES

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DISEASES: ANATOMY,PATHOLOGY,AND MODERN DIAGNOSTIC METHODS

Today,itisnoexaggerationtosaythatliverdiseaseisoneofthemostpressinghealthissuesonaglobal scale. The liver is one of the most vital organs in the human body, performing the most significant functionsinmetabolism, detoxifyingvarioustoxicsubstances, storing vitamins andenergyreserves, and, most importantly, during the digestive phase. Any disruption in its activity harms the functioning of the entire organism and leads to the emergence of various diseases. To prevent such conditions, we must limit harmful habits that lead to disease, regulate our diet, observe hygiene, and abandon several negative habits. However, despite these measures, the early detection and rapid, effective treatment of liver diseases in cases where a healthy lifestyle is not followed remains one of the most relevant challenges in modern medicine. Furthermore, liver disease is widespread globally; according to World Health Organization data, millions of people suffer from liver ailments every year. Specifically, viral hepatitis, livercancer, and livercirrhosisare the most frequently encountereddiseases.Globalstatistics indicate that more than 2 million people are infected with hepatitis viruses, of whom more than 300 million live with chronic hepatitis B and C. Mortality data shows that approximately 1.3 million people pass away annually due to liver disease. These urgent problems demonstrate the necessity of developing new methods for the early detection and treatment of liver diseases.

Keywords: Liverdiseases,livercirrhosis,livercancer,hepatitis,diagnostics,modernmedicaltechnologies,
magneticresonanceimaging,computedtomography,livertransplantation,artificialintelligence,treatmentmethods.

Introduction

The liver (Hepar) is the largest glandular organ in the human body, weighing approximately 1500g in adults. The liver participates in digestion, blood production, and metabolism. The color of the liver is reddish- brown, which is attributed to the high density of blood vessels and the activity of hepatocyte cells. It isnormal for the liver to have a soft consistency and a smooth, even surface. Occasionally, various anomalies are observed. Regarding its pathology, a change to a yellowish color often indicates hepatitis, bile duct obstruction, or jaundice (icterus). In this condition, an overproduction of bilirubin in the body is observed. A change to dark brown or near-black may, in certain cases, indicate hemochromatosis (excessive iron accumulation) or a disruption in pigment metabolism. A change to a whitish or pale color often signifies the development of fatty liver disease (steatosis hepatis), which results from poor diet, obesity, or

metabolic disorders.Achange toward a green color is usually associated with the accumulation of bile (cholestasis).

Hardening of the liver often leads to liver cirrhosis (cirrhosis hepatis). Excessive softening is, in some cases, associated with fatty liver disease or cellular degeneration. An uneven or nodular surface typically indicates the presence of cirrhosis or liver tumors.

Topography

The liver is located in the upper right part of the abdominal cavity, beneath the diaphragm. It touches the diaphragm from above and the internal organs from below. Anatomically, it is divided into thelobus hepatis dexter(right lobe) andlobus hepatis sinister(left lobe). Additionally, there are smallerlobus quadratusandlobus caudatussegments. The liver is externally enclosed by thecapsula fibrosa hepatis(Glisson's capsule), which protects the liver tissue.

ChangesinLiverPositionandPathologies

- **Hepatomegaly (Enlargement of the Liver):**If the liver volume increases, its lower border descends below the rib cage, compressing the stomach and intestines. This condition is observed in fatty hepatosis, viral hepatitis, heart failure, and liver cirrhosis. Patients experience abdominal pain, a sensation of heaviness, and digestive disturbances.

- **Hepatoptosis (Downward Displacement):**In some cases, the liver may drop below its normal position. Causes include sudden weight loss, weakening of abdominal muscles, and loosening of internal ligaments. Consequently, the liver exerts pressure on the intestines, causing abdominal discomfort and pain.

- **Liver Atrophy (Shrinkage):**A decrease in liver size is often associated with liver cirrhosis. Liver tissues are gradually replaced by fibrous tissue. This results in the liver losing its shape, disruption of blood circulation, and the development of portal hypertension.

- **Ectopia (Incorrect Positioning):**Occasionally, during embryonic development, the liver maydevelop in a slightly different location than usual. This is rare but can lead to complications such as bile duct development defects or vascular anomalies.

Impact of Adjacent Organ Diseases: Diseases in neighboring organs can also affect liver topography, such as stomach tumors, right kidney tumors, or diaphragmatic hernias

MorphologicalandFunctionalUnit

The primary morphological and functional unit of the liver is thelobulus hepaticus. In the center of each lobule is thevena centralis, around whichhepatocytus(liver cells) are arranged radially. Between these cells aresinusoid capillariafor blood flow, which facilitate metabolism. The liver is supplied with blood through two main vessels: thevena portae hepatis(portal vein) and thearteria hepatica propria. After being filtered and processed, this blood passes through thevena hepaticainto the inferior vena cava (vena cava inferior).

The liver is the central organ governing complex physiological processes essential for life. It acts as the metabolic center, regulating carbohydrate, protein, and lipid metabolism. It stores energy in the form ofglycogenumand producesbilis(bile). Bile is discharged into the intestine via thevesica fellea(gallbladder) and is crucial for the breakdown of fats. Additionally, the liver performs a detoxification function, neutralizing harmful substances and medications entering the body. Important plasma proteins such asalbuminumandfibrinogenumare also synthesized in the liver.

AnomaliesandPathologiesResultingfromStructuralChanges

1. **Disruption of Lobulus Hepaticus:**If the structure of the liver lobules is compromised, diseases such as liver cirrhosis (Cirrhosis hepatis) develop, where normal lobules are replaced by fibrous tissue, leading to hardening and blood flow issues (portal hypertension, ascites, liver failure).

2. **Hepatocyte Damage:**Injury to liver cells leads toHepatitis(inflammation), caused by viruses,toxins, alcohol, or medications, resulting in hepatomegaly and jaundice.

3. **Sinusoid Capillary Disruption:**Damage to sinusoid vessels leads to portal hypertension, causing fluid accumulation in the abdomen, esophageal varices, and splenomegaly.

4. **VenaPortaeDisruption:**ProblemsintheVenaportaehepatisleadtoportalveinthrombosisorportal hypertension, causing circulatory issues and increasing the risk of internal bleeding.

5. **Bile Production Disruption:**Impaired bile production results inCholestasisor jaundice (Icterus), characterized by yellowing of the skin and eyes and digestive issues.

ImmunologicalFunction

The liver is also a vital immunological organ. Thecellulae Kupfferi(Kupffer cells) located within it participate in phagocytosis, destroying bacteria and harmful particles. Thus, the liver plays a key role in the body's natural defense system.

LifestyleandExternalFactors

Improper nutrition, including regular consumption of fatty, fried, high-sugar, and fast-food products, leads to fat accumulation in the liver, known as fatty hepatosis (Steatosis hepatis). Furthermore, alcohol consumption is one of the most dangerous factors, leading to alcoholic hepatitis, fatty liver disease, cirrhosis, and liver failure. Narcotic substances and toxins also exert a strong toxic effect, causing pathologies such as toxic hepatitis, liver necrosis, and fibrosis.

Conclusion.

In conclusion, the liver is one of the most important and complex organs in the human body. Its specific color, shape, structure, and precise topographical location in the abdominal cavity enable it to function in harmony with other internal organs. Under normal conditions, it regulates digestion and metabolism and ensures the stable detoxification of harmful substances. Any change in its anatomical and topographical characteristics serves as a primary indicator of pathological processes, making its thorough study essentialfor early detection and prevention.