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NEW INSIGHTS INTO FUNCTIONAL ASPECTS OF LIVER MORPHOLOGY

Oblokulova O.A.

Email: obloqulova.olima@bsmi.uz

https://orcid.org/0009-0003-6062-813

Assistant of the Department of Clinical Pharmacology,

Bukhara State Medical Institute named after Abu Ali ibn Sina Uzbekistan Bukhara, A.Navoi st. 1. Tel:+998(65) 223-00-50

e-mail:info@bsmi.uz

Resume: The liver is a heterogeneous tissue, the functional unit of which, the lobule—continues to baffle morphologists for more than 300 years. Surprisingly, regardless of the angle at which the liver is cut, it mostly has the same histological appearance, i.e. multiple units with a hepatic venule (also known as a central vein) surrounded in the center by about 4-6 portal areas. This phenomenon is the basis for the liver to be called having an "isotropic parenchyma," and it contributes to a mysterious, complex, three-dimensional architecture. Trying to understand three-dimensionality has helped us better understand liver function.

Keywords: liver, morphology, hepatocytes, bile duct, proliferation, eosinophilic normoblasts, megakaryocytes, nuclear-cytoplasmic ratio, parenchyma.

Introduction

The functions of the liver are extremely diverse: it takes part in digestion processes, secretes bile, synthesises blood plasma proteins, forms and accumulates glycogen, participates in the exchange of cholesterol, vitamins, hormones and enzymes, is a depot of a number of microelements, in newborn animals it performs the function of hematopoiesis. Also, the liver protects the body from pathological microorganisms and foreign substances coming from the intestines into the blood, neutralises many harmful products of intermediate and final metabolism, inactivates hormones, biogenic amines, drugs [1,2,4].

The dependence of most processes of organism vital activity on the ambient temperature makes temperature effects the most important factor of ecology, which can be crucial for human survival. A person often has to meet with the impact of low and ultra-low temperatures when working at various production facilities, as well as by virtue of living in some climatic zones. At the same time, staying in hypothermic conditions can lead to significant metabolic and functional changes.

Under hypothermia conditions, the liver as an organ that contributes significantly to thermoproduction plays a very important role [3,5]. Due to complex biochemical reactions,

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this organ is able to ensure the adaptability of the organism to complex conditions of existence. The liver provides plastic and energy processes, as well as regulates adaptive compensatory and adaptive processes occurring under the influence of all exogenous and endogenous unfavourable processes, and this regulation is carried out even when the damaging factors do not have a pronounced hepatotropic effect [4]. Therefore, the morphofunctional state of the liver is a reflection not only of the functional state of the organ itself, but also of the response of the organism as a whole.

Morphological changes in human and animal organs under the influence of unfavourable exogenous factors have been widely studied in recent years [7].

Mice and rats each have 4 lobes of liver: medial (or middle), left, right, and caudate, and all but the left are further subdivided into 2 or more parts. Mice and humans have a gallbladder, but not the rat. The human liver lobes are traditionally labeled as right, left, quadrate, and caudate, but it has recently been proposed that the liver can be subdivided into 9 segments based on vascular and ductal branching patterns on the right and left sides [5]. This compartmental scheme is useful for understanding lobar or intra-valvular degeneration associated with impaired blood supply and for facilitating surgical resection. The rat hepatic lobes appear to have similar fundamental portal and hepatic venous systems, and thus segments comparable to those in the human liver. The vascular systems running to or from the lobes show individual variation in both humans and rats [7]. At any given moment, the liver contains blood equivalent to approximately 25% of cardiac output. The portal vein and hepatic artery are the two major vascular systems that supply blood to the liver. The portal vein supplies approximately 70% of blood flow and 40% of oxygen, while the hepatic artery supplies 30% of blood flow and 60% of oxygen. Portal blood drains from the mesenteric, gastric, splenic and pancreatic veins and travels to the liver where it branches into the right and left sides of the liver. There may be incomplete mixing of blood coming from the gastrointestinal tract and the spleen, resulting in altered delivery of various nutrients, toxins, and other elements to the liver lobes (so-called portal leakage) [11]. For example, blood flowing away from the stomach and spleen tends to flow to the left side of the liver. In addition, localized or generalized redistribution of major blood flow or blood deposition is controlled by nerve stimulation or by hepatic stellate cells, potentially leading to lobe changes in liver disease. Altered lobes have been reported for acetaminophen hepatotoxicity, copper distribution, iron and phosphorus, chemical carcinogenesis, cirrhosis, and regeneration [3]. The conducting portal vessels deliver blood to parenchymatous vessels called preterminal and terminal portal venules, respectively. Blood from the terminal portal venules enters the sinusoids.The hepatic artery usually accompanies the portal veins in portal triads, and its smaller branches supply the sinusoids at various levels and the biliary tracts (which most often subsequently drain into the sinusoids; the so-called portal-portal flow). Sinusoidal blood flow is carefully regulated [9] and collects in the terminal hepatic venules (also called central veins) before flowing into the larger hepatic veins and ultimately into the vena cava. Lymphatic fluid accumulates in the space of Dysse and periportal Malla tissue before draining into the lymphatic vessels in the portal duct and then into the lymphatic channels of the hepatic gate and ultimately into the thoracic duct. The portal triad is defined by the portal vein, bile duct, and hepatic artery, but the portal vein region contains an average of about 6 profiles (range 2 to 35) with an average of 1-2 arteries, 1 portal vein, 1-2 bile ducts, lymphatic vessels, and nerves in a connective tissue matrix composed mainly of type 1 collagen[10].

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However, the histostructure of the liver under hypothermia has been studied only in a number of works [8, 9], and the data obtained are contradictory. This concerns, in particular, the peculiarities of hepatocyte reactions to the cold factor, the characterisation of the number of dinuclear hepatocytes and the reaction of liver cell nuclei in general. The organism of animals and humans is subjected to constant action of a number of damaging factors of different genesis: biological, chemical and physical. Among the latter, the analysis of the influence of mechanical trauma of the organism on the functional morphology of a number of organs and systems in the organism is of undoubted importance and relevance. Of particular importance in norm and pathology (experiment, clinical medicine) is the liver - a vital polyfunctional organ. The mechanisms of response reactions developing in the tissues of the traumatised limb segment have been studied to a sufficient extent using various research methods. Only a few studies have investigated structural and/or functional changes in the liver after skeletal trauma. Disturbance of liver function in trauma is associated with the development of hypoxia, impaired blood circulation and, as a consequence, with increased endotoxicosis. The severity of these changes depends on the severity and nature of trauma. At the same ti The search for effective means to prevent and correct functional disorders in the organism after trauma continues.A number of publications note the positive results of the use of various biological and pharmacological methods of activation of metabolic processes of the liver in diseases of the musculoskeletal system [10].

Conclusion

Thus, despite many years of study of reparative regeneration of skeletal bones, the study of morphofunctional changes of the liver in the recovery period after trauma and the search for effective means influencing the course of the reparative process is of particular interest. The presence of these problems substantiates the relevance of the present work in terms of the development of fundamental aspects of biology and medicine.

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