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Morphological features of the structure of liver complexes

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Abstract: In an experiment on 226 white male outbred rats from birth to 8 months of age, different periods of postnatal ontogenesis were studied. We found that the initial link of blood outflow from the hepatic lobules are the initial hepatic venules, which are formed from the fusion of sinusoids in the subcapsular zone of the liver. From 2 weeks of age to the end of postnatal ontogenesis, liver revealed constantly occurring hepatic complexes. In postnatal ontogenesis, the main process is the formation of new structural and functional units in the subcapsular zone of the liver.

Key words: Liver, ontogenesis, the lobule, the hepatic venules, sinusoidal vessels.

Introduction

According to modern concepts, the liver, occupying a special place between the external and internal environment of the body, is involved in many metabolic processes. Currently, a significant number of works have been accumulated devoted to the study of the formation of the structural foundations of the liver in humans and some mammals [1,2,3].

Based on the study of the ratio of intracellular and cellular restoration processes in internal organs, K.A. Zufarov (2000) notes that "the form of regeneration depends on the characteristics of the growth and development of the organ in ontogenesis."

Issues of postnatal formation of the liver have been the subject of many studies [4,5]. But in the vast majority of studies, the aim was to study parenchymal cells. Despite numerous studies on organ regeneration, the problem of repairing a damaged liver remains relevant. Liver resection is a convenient and widespread model for studying organ regeneration in an experiment. It is used in surgical practice for injuries, echinococcosis and neoplasms of the liver, of great interest is the study of [5,6,10]. this regard In the morphology of the liver undergoing surgery and the identification of patterns of regeneration processes [7,8,9].

The purpose and objectives of the study

The aim of this study is to study the characteristics of the dynamics of changes in intraorgan vessels and the structural and functional unit of the liver - its segments in different periods of postnatal ontogenesis and to identify the dynamics of recovery processes after resection on the 15th day of postnatal development.

Material and research methods

The work was performed on 226 white mongrel rats' males from birth to 30 months of age. All experimental animals were divided into 2 groups. In series I, postnatal ontogenesis was studied

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on 146 intact rats aged 1,3,5,7,10,12,14,21 days and 1, 3, 8,15,30 months after birth. The second group consisted of 80 animals that served as control. The timing of the study was chosen by us on the basis of the age periodization of laboratory animals (V.I. Zapadnyuk, 1971; R. Gossrau, 1975).

In the first series of experiments, pregnant females were selected and kept in vivarium conditions on an appropriate diet. After childbirth, they were separated separately with newborns and counted postnatal life of the rat pups. To study the vascular architectonics of the liver, the methods of bichromic injection of intraorgan vessels with a mass of Herot in the modification of Kh.K. Kamilov (1970) and a mascara-gelatin mixture in a ratio of 1: 3 were used by F.N. Bakhadirov and F.Kh. Olimkhuzhayev (1995). Injection was performed through the thoracic aorta in the morning, and in young rats up to 1 month of age through the left ventricle of the heart. For the manufacture of enlightened preparations, pieces taken from the right lobe were performed according to the accelerated method of A.M. Malygin (1956). Serial sections 5-20 μm thick were prepared from samples. On serial sections, the cross-sectional area of the lobules, the detection depth and the diameter of the microvessels were measured. A three-dimensional reconstruction of the liver complexes was carried out. The area of the lobules was calculated by their true size at the level of detection of round lobular venules. Slices of the liver for histological studies were fixed in Carnoy fluid, FSU and 12% neutral formalin. Sections 3-5 μm thick were stained with hematoxylin and eosin. Morphometry was performed using an MOV-15X eyepiece micrometer using a P-2 binocular microscope. Liver mass was measured using an VT-500 analytical and torsion balance. The volume of the liver was determined using the device developed by us (rat. Proposal N1024 1991). Statistical processing of digital data was performed using tables to calculate the arithmetic mean and standard error and on the computer. Differences satisfying $P < 0.05$ were considered significant.

Study Results and Discussion

The results of our studies showed that in adult sexually mature rats the following types of lobules are constantly detected in the liver:

1) a lobule of type 1 - has a hexagonal shape, is bounded around by lobular (septal) vessels, and a central vein (hepatic vein of the first order) is located in its center;

2) type 2 lobule - formed from the confluence of 2-3 type 1 lobules, has a polygonal shape, 2-3 hepatic veins of the first order (central veins) are detected in the center, which are located at a certain distance from each other, there are sinusoids between them;

3) type 3 lobule - has a polygonal shape and, unlike type 2 lobules, its first-order hepatic veins (central veins) approach each other. As they deepen between them, sinusoidal vessels disappear, and they merge with the formation of a second order hepatic vein. During the reconstruction of serial sections, in adult animals, along with lobules, constantly occurring liver complexes can be distinguished. They represent a higher than lobule level of structural organization of the hepatic parenchyma. Each such complex includes 2-3 neighboring slices, limited to several portal tracts.

In accordance with the structure of the lobules of each of the above types, the liver complex can be divided into 4 zones:

The zone I of the complex, located directly under the capsule of the organ, is characterized by the absence of a lobular structure characteristic of the liver. The vascular bed is represented by

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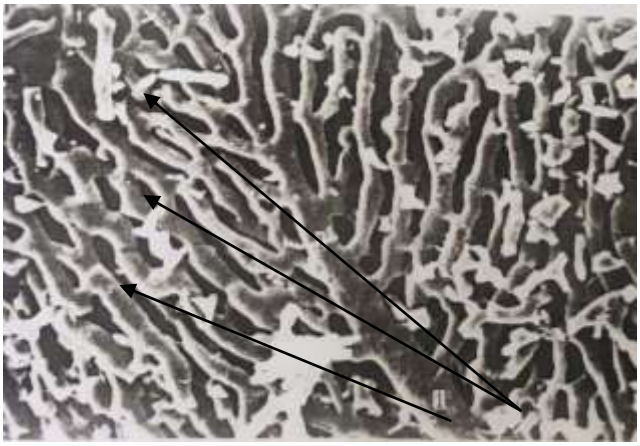
a sinusoidal network, among which are the initial hepatic venules. Each initial hepatic venule is formed from the fusion of several sinusoids. The internal lumen of the initial hepatic venules ranges from 14.7 to 25 microns. And their length is from 150 to 250 microns. The delivery vessels are represented here by terminal portal venules and arterioles. Interlobular and septal vessels do not reach the subcapsular zone and, therefore, lobular organization ofthe liver microvessels is not detectedin this zone.



1 2

Photo 1. Liver slice. The Postnatal period is 14 days. Cut perpendicular to the hepatic fibrosis capsule. Scanning electron microscopy. Lens X50, ocular X20. 1-formation of the initial hepatic vein, 2-sinusoidal veins.

As you know, in the literature published so far, liver slices are described in the following form: a piece of liver has a hexogonal structure with a hexagonal shape, which has a prismatic shape. Portal triads are located at the corners of the lane. The vein in its center is turned in a downward direction, forming a right angle, at the base of the lump, and the lump is poured into the underground vein (Prives M. G. (1985); Sinelnikov R. D. (1979); Sadriddinov A.F.(1993).

In our research, it was found that from birth, that is, from 1 day, up to 10 days of postnatal development, fragmentary structural structure is not found either in the hepatic capsulosti part and deeper parts of it, the formation of primary hepatic venules in all periods from the addition of sinusoids in the hepatic capsulosti zone, rapid growth of the liver at the expense

Our research has found that from the 2nd week of postnatal development of the liver, until the end of life, along with lumps, there are always liver complexes that occur. They have a structural structure above the splinter, are made up of 3 different splinters that are bounded by Portal veins and overlap each other:

The fragments of the 1st type are formed from classic liver fragments with hexagons, at the corners of which are delimited by Inter-articular veins and the septal or fragmented anterior veins separating from them.

Pieces of the 2nd type have a "oblong" shape, characteristic of the addition of 2-3 classic pieces. Such fragments are 7-8 corners, in the center of which 2-3 central veins are located. These veins we called the veins of the first order. In" oblong fragments", the distance between two or three first-order veins decreases as the liver deepens from the fibrosis capsule. The 3rd type of

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splinters also have a "oblong" shape with a difference from the 2nd type of splinters, in which two or three first-order veins join each other, dressing the next, second-order veins.

Liver complexes consist of 4 zones, which are arranged in the following order:

Zone I-there are no lumpy structures under the hepatic fibrosis capsule, and in this zone the sinusoid capillary vascular mesh is located. Between this mesh, the initial hepatic venules are formed from the joint of the sinusoid vessels.

In Zone II, hexagonal (classic) fragments of Type 1 are located, in the center of which I collects blood from the (Central) Viennese sinusoids of the first order.

Zone III was made up of "oblong pieces"of Type 2, dressing from the addition of 2-3 classic pieces. Such fragments are 7-8 corners, in the center of which 2-3 veins of the First Order (Central) are located. Between these veins are located sinusoids.

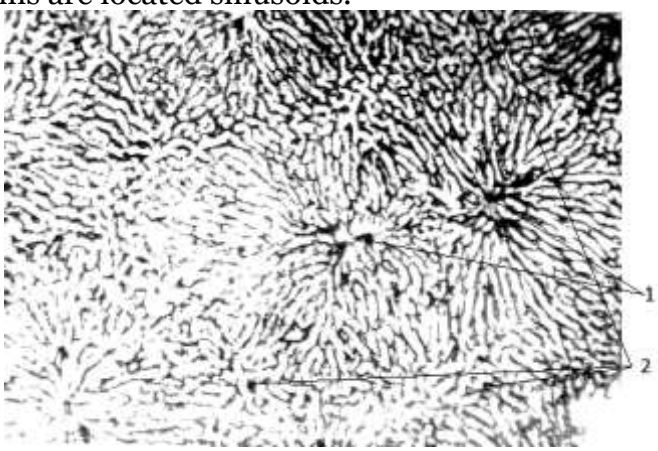

Photo 2. Liver slice. The Postnatal period is 14 days. Cut parallel to the hepatic fibrosis capsule. Fibrosis is at a depth of 180 μm from the capsule. Coloring method: dream-injection of bichrome with gelatin (2% solution). Lens x15, ocular X8. 1-veins of the First Order (central vein), 2-Portal veins.

In Zone IV, fragments of the "oblong" shape of Type 3 are located, the difference from the fragments of Type 2, in which 2-3 veins of the First Order are joined among themselves, dressing the next, second-order veins.

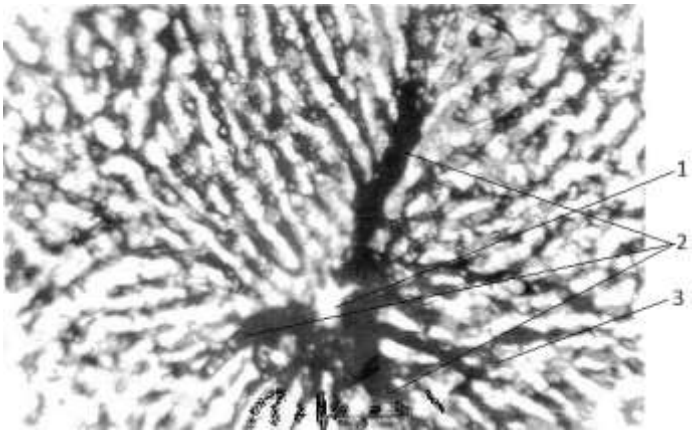

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Photo 3. Liver slice. The Postnatal period is 14 days. Cut parallel to the hepatic fibrosis capsule. Fibrosis is 40 μm deep from the capsule. Coloring method: dream-injection of bichrome with gelatin (2% solution). Lens X20, ocular X10. 1 - veins of the First Order (central vein), 2-initial hepatic vein, 3-sinusoidal capillary vessels.

In addition to the wavy and asynchronous process in the growth of the hepatic cleft and microtomyrs, it was observed that the depth of detection of various zones of liver complexes changes. If on 7 days of postnatal development, asinar structures were detected at a depth of 220-260 μm, on 10 days, fragments of Type 3 were observed at a depth of 240-260 μm, and on 12 days, fragments of Type 2 at a depth of 160-180 μm. On the 14th day, fragments of 1 type were detected from 40-80 μm. These changes will also be evidence of the dressing of liver complexes and lumps and the growth in the direction of capsulaosti, starting from the bases of the complexes.

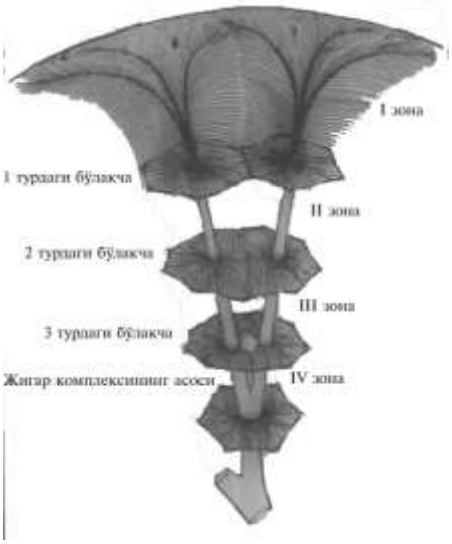

Photo 3. Liver complex drawing. Scheme prepared by the method of reconstruction based on liver incisions of different depths. Above is the hepatic fibrosis capsule. Under it are sinusoidal capillaries tri. Pieces of 1, 2, 3 types. 4 zones of the liver complex.

Thus, a waveform and asynchronous process was observed in the growth of the hepatic cleft and microtomyrs. This is evidenced by the dressing of new microtomyrs and structures in them. Growth occurs due to the fact that in our opinion the lower part of the liver capsule. The waveform and asynchronous process in the growth of the liver fragment and microtomyrs indicates that the liver fragments and complexes are newly dressing under the liver capsule.

Discussion

Liver sinusoids have been studied in laboratory animals and humans under experimental Hepatology.

A.V.Kolasov, V.M.Balashov (1963) studied the morphological structure of sinusoids in liver fragments, their thickness and relationship with liver cells as well as liver sinusoids in people aged 9-87 years. In children, sinusoids are located in an indeterminate direction. With age changes, the

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sinusoids acquire a radial orientation and accumulate in the central vein. Children will have mesh sinusoid nets. In people who have lived a lot and are old, the sinusoid parts are transformed into fragments by reduction.

S.K.Mitra (1966) found anastomoses between the terminal of the liver cell and the sinusoid in the peripheral part of the liver fragment.

R.S.According to the definition of the Cascade (1976), the path of sinusoid and arterial blood is uneven and consists of the sphincters of endothelial cells located in the part of the sinusoids away from the gate vein and in the part of the sinusoids that fall into the central vein.

V. E. According to Burkel(1980), sinusoids store endotheliocytes in their wall, regardless of whether they start with the artery system or the venous system. Their starting section is bounded by the basal membrane. During the next course of the sinusoids, the basal membrane, while in the endothelium, the phenestrasias are characteristic clouded.

X. E. According to the indication of Blox(1994), the functional unit of the liver is the sinusoids, which lie in an area surrounded by a perisinusoidal cavity, corresponding to a diameter of 1/2 of the sinusoid with liver cells and bile ducts. The size of the functional unit of the liver varies depending on its specialization.

The literature shows that until now there are different views on the functional-structural unit of the liver: while most scientists look at a piece of liver, clinicians – a Portal piece or asinus, some authors believe that it is a perisinusoidal cavity.

N.Stefanelli (2005) performed a chyotic microscopy in a combination of constant changes in Venous and arterial blood pressure, which made it possible to see a more complete picture of the sinusoid and central venous route. Blood is visible in the Portal fragments in rare cases. With the help of chyotic microscopy, it is possible to see the full structure of the liver barrier, and in the norm, the diameter of the sinusoid can be determined.also, in pathological cases, changes in the liver sinusoids can be observed.

Ecataxine Wichai, Wake Kenjiro opinion, liver sinusoids differ significantly from other vessels in the fetus and newborns. The artery maintains a 3-storey structure in itself, while Vienna has a well-developed adventitious floor and an endothelialosti floor. Which of these Hech in the sinusode does not exist. In histological preparations, sinuses of various forms are observed. Some sinusoids will have several sinuses.

As can be seen from yukoridaki, liver sinusoids have a much more complex morphological relationship with blood vessels in the fetus and newborn babies, on the one hand with arteriola and artery anastomoses, on the other hand with the venula and the central vein.

Conclusions

As a result of the examination, the following was found: the first system of blood flow from the liver is the primary hepatic Venule, which is characteristic of the addition of sinusoids in the hepatic capsulaosti zone. The primary hepatic venules are located between the sinusoids and the primary hepatic veins.

Postnatal development of the liver from the 2nd week to the end of life, along with lumps, it is possible to distinguish between constantly occurring liver complexes. They have a structural structure above the splinter, are made up of 3 different splinters that are bounded by Portal veins and overlap each other.

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The early period of Postnatal ontogenesis is characterized by the following: the absence of a fragmentary structure even in the hepatic capsulosti part and deeper parts of the hepatic structure, the formation of primary hepatic venules from the joining of sinusoids in the hepatic capsulosti zone, rapid growth of the liver at the expense of the subcapsular zone.

Growth in the liver of young mammals the basis of the process is an increase in the number of structural-functional units. In the death of the liver fragment and microtomyrs, a wavy and asynchronous process is observed. This indicates that the liver slices and complexes will be hsil under the liver capsule anew.

It has been found that hepatic microtomeres have something in common between postnatal growth, compensatory-adaptive processes in hepatic blood vessels and fragments. The main change in this is the formation of new structural-functional units in the hepatic capsulaosti part.

In conclusion:

1. The fact that the structure of the fragmented structure does not occur on days 1-10 in the hepatic capsulosti part and deeper parts from it;
2. Dressing of the initial hepatic venules from the addition of sinusoids in the hepatic capsulaosti zone;
3. Rapid growth of the liver in the form of a subcapsular zone.

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