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ЎТ ПУФАГИ ВА ЖИГАРНИНГ МОРФОЛОГИК ТУЗИЛИШИ

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Аннотация. Ҳозирги замон тиббиётининг долзарб муаммоларидан бири бу ўт чиқарув йўллари ва жигар касалликлари ҳисобланади. Ўт чиқарув йўллари касалликларида моддалар алмашинувининг, иммунологик жараёнларнинг бузилиши, морфологик ўзгаришлар, унинг келиб чиқиш қонуниятлари ва коррекция қилиш усуллари айрим олимлар томонидан асослаб берилган. Бизни ўт йўлларининг ўткир ва сурункали касалликларида ўт пуфаги девори ва девор олди жигар паренхимасининг морфофункционал ўзгаришлари қизиқишимизни ўйғотди. Ушбу мақолада ўт чиқарув йўли ва жигар морфологиясини ўрганиш бўйича хозирги замон қатор олимлари ва тадқиқотчиларининг илмий изланишлари тахлили келтирилган.

Калит сўзлар: жигар, ўт пуфаги, ўт йўллари, морфология, ўт йўллари касалликлари, эксперимент, хайвонлар.

МОРФОЛОГИЧЕСКАЯ СТРУКТУРА ПЕЧЕНИ И ЖЕЛЧНОГО ПУЗЫРЯ

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Резюме. Одной из наиболее актуальных проблем современной медицины являются заболевания печени и желчевыводящих путей. Развитие нарушений обмена веществ, патологические изменения иммунологических процессов и морфологические изменения, а также их закономерности развития при заболеваниях желчевыделительной системы, а также методы коррекции были обоснованы исследователями. Нас заинтересовало строение и морфофункциональные изменения в стенке жёлчного пузыря и в паренхиме печени, прилегающей к жёлчному пузырю (ложе жёлчного пузыря) при заболеваниях желчевыделительной системы с острым и хроническим течением. В данной работе рассматриваются и анализируются работы ряда учёных и исследователей современности, основоположников и их последователей по изучению морфологии желчевыводящей системы и печени.

Ключевые слова: печень, желчный пузырь, желчные протоки, морфология, заболевания желчных путей, эксперимент, животные.

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MORPHOLOGICAL STRUCTURE OF THE LIVER AND GALLBLADDER

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Summary. One of the most urgent problems of modern medicine is diseases of the liver and biliary tract. The development of metabolic disorders, pathological

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changes in immunological processes and morphological changes, as well as their patterns of development in diseases of the biliary system, and methods of correction have been substantiated by researchers. We were interested in the structure and morphofunctional changes in the wall of the gallbladder and in the liver parenchyma adjacent to the gallbladder (gallbladder bed) in diseases of the biliary system with acute and chronic course. In this paper the works of a number of scientists and researchers of modern times, founders and their followers on the study of morphology of biliary system and liver are considered and analysed.

Key words: liver, gallbladder, bile ducts, morphology, biliary tract diseases, experiment, animals.

The liver performs several hundred functions involving thousands of different chemical reactions (Green, N., Stout, W., Taylor, D., 1996; Drozdova, L. I., Kundryukova, U. I., 2010; Gaeva, V. A., Minchenko, V. N., Gamko L. H., 2020). The multifaceted importance of the liver for the organism indicates the complexity of its structure and the presence of significant detailed differences from the general structural organisation typical for the rest of the glands (Klimov, A. F., 2013). It is often compared to the brain in terms of complexity of its structure (Malarkey, D. E., et al., 2005; David, E. Malarkey, Johnson, K., Ryan L., Boorman, G., Robert, R., 2005). The implementation of liver functions is carried out due to the spatial organisation of its tissue components and their interrelation with intraorgan blood vessels (Lemeshchenko, V. V., Krishtoforova, B. V., 2013). To reveal the vital processes occurring in the animal organism and to obtain the possibility of their management in order to increase productivity, a comprehensive study of the liver during its ontogenetic development is necessary (Usha, B. V., 1979). Currently, the most relevant are the studies devoted to the establishment of anatomical and histological regularities of the organisation of internal organs in animals depending on their species, breed, and housing conditions (Kozyrev, S. G. et al., 2018; Donskikh, P. P., Minchenko, V. N., 2020). This is due to the fact that at the moment the actual direction of modern morphology is the study of the norm of organ structure, which reflects the regularities of their individual variability (Avtandilov, G. G., 2002).

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Diseases of the liver and biliary tract are extremely common and represent an acute problem (Babak, O. Y., 2005; Vovk, E. I., 2011). Many of them complicate the breeding of small ruminants (Vasilevich, F. I. et al., 2008; Kosminkov, N. E., Laipanov, B. K., 2010), as the liver is subject to a large number of parasitic diseases dangerous for both humans and animals. These include echinococcosis, fasciolosis, opisthorchiasis, alveococcosis, dicraceliosis. The liver lies on the migration path of larval stages of nematodes such as ascarids and some strongylids (Vasilevich, F. I. et al., 2008; Akbaev, M. Sh. et al., 2008; Vasilevich, F. I. et al., 2010). In addition to being consumed as a high-calorie dietary food, liver is, along with lungs, a source of heparin production used as a blood stabiliser (Lebedeva, N. A., Bobrovsky, A. Y., Pismenskaya, V. N. et al., 1985). Thus, knowledge of the peculiarities of liver morphology is essential for the development of effective methods of diagnosis and treatment of liver-related diseases (Repina, E. F., Karimov, D. O., Baigildin, S. S., Timasheva, G. V., Khusnutdinova, N. Yu, Musina, L. A., Smolyankin, D. A., 2020; Ubashev, O. I., 2003) and competent veterinary and sanitary examination of slaughter productsThe liver is a walled digestive gland of complex tubular structure (Aliev, A. A., Zelenevsky, N. V., Laishev, K. A. et al., 2002). From the outside it is covered with a smooth, shiny and slightly moistened serous membrane - visceral peritoneal sheet, under which lies a fibrous connective tissue capsule (Khrustaleva, I. V., 2006). The capsule contains many elastic fibres (Vasiliev, Yu. G. et al., 2013). From the capsule there are septa that divide the liver parenchyma into lobules (Ramer, A., Parsons, T., 1992; Sapin M. R., 2002; Sokolov, V. I., Chumasov, E. I., 2004), and in the region of the liver gate it thickens significantly (Vasiliev, Y. G. et al., 2013). Fibrous Glisson's capsule of the liver, in addition to the organ itself, also covers the in and out structures located in the gate region (Green, N., Stout, W., Taylor, D., 1996).

Mesothelial cells covering the serous membrane carry microvilli covered with a thin boundary membrane like a glycocalyx. The labyrinths between the villi contain exudate - serous fluid. Due to this structure, a thin sliding cushion is formed that protects the mesothelial layer from frictional damage (Andrews, P. M. and Porter, K. R., 1973).

According to the new ideas, the structural and functional unit of the liver is the portal hepatic lobule formed by sections of three neighbouring classical hepatic

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lobules surrounding one triad. This lobule has a triangular shape on the transverse section. In its centre lies the triad, and the three central veins of the classical liver lobules serve as the corners. Thus, the portal hepatic lobule is nothing else but a section of the liver, blood flow in which and bile outflow are provided by one triad (Vasiliev, Yu. G. et al., 2013). This idea about the organisation of the liver has not found general acceptance. Therefore, it is generally accepted to consider that the structural and functional unit of the liver is the classical hepatic lobule (Yaglov, V. V., Yaglova, N. V., 2011). The latter is a polyhedral prism (Yakovleva, N. I. et al., 2013). The base of this prism is flat, and the top is slightly convex (Vasiliev, Y. G. et al., 2013).

Histological preparations of the liver, regardless of the cut angle, have practically the same appearance and represent several lobules in the centre of which lies the central vein. This confirms the isotropic organisation of the liver parenchyma (Matsumoto, T., Kawakami, M., 1982).

The size of lobules in mammals varies in the range of 0.5-1.0 mm (Lebedeva, N. A. et al., 1985). Most often in shape they resemble polyhedral truncated pyramids (Semchenko, V. V., 2015). According to V. F. Vrakin, M. V. Sidorova (1991), liver lobules have a polygonal shape. On a slice they have the form of pentagonal or hexagonal lobes, the diameter of which varies within 0.7-2.0 mm.

In the brown bear, the size of the liver lobule is 1.2×1.6 mm (Zelenevsky, N. V., Zelenevsky, K. N., 2014). In the domestic bull, its diameter is 1380 micrometres (Zelenevsky, N. V., Vasiliev, A. P., Loginova., L. K., 2008), in the dog it varies from 0.96 to 1.32 mm (Akaevskii, A. I, Yudichev, Y. F., Sleznev, S. B., 2005), in the pig within 1570 to 1700 microns (Klimov, A. F., 2013), and in humans its cross-section varies from 1.0 to 2.5 mm. At the same time, the number of lobules in the composition of the human liver is about 500000 (Borzyak, E. I., Volkova, L. I., Dobrovolskaya, K. A., 1993).

According to Khrustaleva, I. V. (2006), the diameter of liver lobules in a dog reaches 1.0 mm, in a domestic bull 1.3 mm, and in a pig varies from 1.5 to 1.7 mm.

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In sheep of the Tuva short-fat-tailed breed at the age of 6.5 months, the shape of the lobules varies from oval-round to polygonal. Connective tissue interdiolar septa are weakly expressed (Wang, B., Donkova, N.V., 2015). The latter in the Eurasian lynx are also insignificant and indistinguishable to the naked eye (Barteneva, Yu, 2012).

In the pig, the lobules are delimited by layers of connective tissue not only along the ribs, but also along the edges. Due to its strong development in the pig, the lobular system is visible to the naked eye (Sokolov, V. I., Chumasov, E. I., 2004), and the thickness of interdollicular septa reaches 15.0 μm (Lebedeva, N. A. et al., 1985). In addition to the pig, strong development of connective tissue as part of the liver is characteristic of the bear and camel (Zelenevsky, N. V., Shchipakin, M. V., 2018).

In most mammals, connective tissue layers within the liver are very thin: their boundaries can be determined only by the location of blood vessels and bile ducts, which define the boundaries of the lobules (Lebedeva, N. A. et al., 1985).

According to K. E. Madhan, S. Raju (2014), in ruminants the hepatic lobule has a hexagonal shape on sections. In goat and domestic bull, the central vein is located in its centre, while in sheep it is displaced towards the triads. The possibility of eccentric location of the central vein in sheep is also indicated by B. Wang and N. V. Donkova (2015).

In birds, the liver stroma is less developed than in mammals. It forms a thin capsule closely fused with the serous membrane. The boundaries between the lobules are poorly distinguishable (Vrakin, V. F., Sidorova, M. V., 1984; Sulaimanova, G. V., Donkova, N. V., Luto, A. A., 2019).

In humans, the boundaries of the hepatic lobule are weakly expressed due to the absence of interlobular connective tissue. The latter is found only as part of the hepatic tracts. Sinusoid capillaries are clearly visible. The central vein occupies a central position within the lobule (Singh, I., 2007; Madhan, K. E., Raju S., 2014).

As part of the interdilol connective tissue, there are "triads", represented by interdilol vein, artery and bile duct (Gering's canal), accompanied by lymphatic vessels (Podymova, S. D., 2018). The interdollic veins are branches of the portal vein,

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and the arteries are branches of the hepatic artery (Zelenevsky, N. V., Shchipakin, M. V., 2018). They differ in the thickness of the muscular sheath and the size of the lumen (Junqueira, L. C., Carneiro, J., 2009). Interval veins are the largest vessels within the triads and have a large lumen. Their muscular sheath is represented by smooth myocytes, and the intima is characterised by a continuous endothelial lining. The lumen of interlobular arteries is also lined with endothelium, and bile ducts - with cubic epithelium (Wang, B., Donkova, N. V., 2015). The cells of the latter contain rounded nuclei (Lenchenko, E. M., 2009). Also, the bile duct is characterised by the presence of a well-defined connective tissue sheath (Junqueira, L. C., Carneiro, J., 2009).

Triads within the liver of birds are less common than in mammals (Vrakin, V. F., Sidorova, M. V., 1984), they are often surrounded by lymphoid clusters and granular leukocytes (Vasiliev, Y. G. et al. 2013).

In humans, there are three to six triads per liver lobe (Junqueira, L. C., Carneiro, J., 2009). In the places of branching of interdollic vessels, their wall contains sphincters that provide regulation of blood flow into the hepatic lobule (Yaglov, V. V., Yaglova, N. V., 2011).

Electron microscopically, the connective tissue of the hepatic tracts reveals nerve plexuses, the most dense in the area of hepatic artery branches and the presence of unmyelinated fine nerves in the space of Dysse (Forssmann, W. G., Ito, S., 1977).

Interdollicular arteries and veins are subdivided into septal arteries and veins covering the lobule from all sides (Zelenevsky, N. V., Shchipakin, M. V., 2018). The terminal branches of interdollic arteries predominantly feed the bile duct wall structures and vessel walls (Novikova, M. S., 2009). Also their main function is to deliver the necessary amount of oxygen to hepatocytes (Junqueira, L. C., Carneiro, J., 2009). Their smaller part with the terminal branches of the portal vein form sinusoidal capillaries (Novikova, M. S., 2009). The latter carry mixed blood to the central vein (Chirkin, A. A. et al., 2015). Thus, in the liver, capillaries appear between the two veins, which allows us to speak about the presence of a "miraculous network" that provides slow blood flow (Vrakin, V. F., Sidorova, M. V., 1991). Mixed blood rich in oxygen and nutrients, as well as metabolic products requiring utilisation, flows

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through sinusoidal capillaries from the periphery of the lobule to its centre (Vrakin, V.F., Sidorova, M.V., 1984).

According to the size of pores of endotheliocytes of sinusoid capillaries can be divided into small pores up to 100 nm, intermediate pores with a diameter of 100-500 nm and large pores with a diameter of over 500 nm. The number of small pores is 69.80% of their total number. This indicator for intermediate pores is 27.60%, and for large pores - 2.60% (Ishimura, K., Okamoto, H., Fujita, H., 1978).

Endotheliocytes of sinusoidal capillaries lie on a continuous basal membrane (Sokolov, V. I., Chumasov, E. I., 2004). However, according to Y. G. Vasiliev, et al, (2013), this membrane is discontinuous. Its presence is usually registered at the beginning and at the end of the microvessel, which allows free penetration of large-molecular compounds through its wall. At the same time, blood formations are unable to pass through it in an adult animal. In the foetus, when the liver performs the function of the central organ of hematopoiesis, this possibility exists. According to N. V. Zelenevsky and G. A. Honin (2004), the basal membrane beneath endothelial cells is absent for a large length. On the contrary, V. F. Vrakin and M. V. Sidorova (1991) indicate its complete absence.

The presence of fenestrae, discontinuous basal membrane, as well as spaces between endothelial cells give sinusoid capillaries a very large permeability, causing the free flow of blood plasma into the space of Dysse and in the opposite direction (Junqueira, L. C., Carneiro, J., 2009). Endotheliocytes of sinusoidal capillaries contain a small number of organelles in the cytoplasm, as well as many transport pinocytosis vesicles (Vasiliev, Y. G. et al., 2013).

Stellate (Kupffer) cells are identified as part of the wall of sinusoidal capillaries (Vrakin, V. F., Sidorova, M. V., 1984, 1991). They are attached to their wall by their outgrowths. Sometimes thin invaginations of these cells are found, penetrating into endothelial slits. (Pietro, M. Motta, 1984). Kupffer cells, large stellate reticuloendotheliocytes, are modified blood macrophages. They are liver macrophages and participate in phagocytosis of microorganisms, toxins and foreign substances (Vrakin, V. F., Sidorova, M. V., 1991). Thus providing a barrier function (Lenchenko,

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E. M., 2009). They account for up to 15.00% of the liver cell population (Junqueira, L. C., Carneiro, J., 2009).

Kupffer cells are larger in size than endotheliocytes. They are characterised by the presence of microvilli and cytoplasmic inclusions in the form of dense cells (Sokolov, V. I., Chumasov, E. I., 2004). Lamellipodia and phiopodia are found on the surface of their bodies (Pietro, M. Motta, 1984). Their nuclei contain large clumps of heterochromatin. The cytoplasm reveals numerous lysosomes, moderately developed endoplasmic reticulum and Golgi complex (Vasiliev, Yu. G. et al., 2013). Due to the presence of a large number of outgrowths directed into the capillary lumen, a large surface of these cells is in contact with blood (Lenchenko, E. M., 2009). At the moment of functional activity these cells increase in size, are separated from the endothelial layer of the capillary, and their outgrowths penetrate deeply into the lumen of the sinusoid capillary and Dysse space, carrying out phagocytosis (Vrakin, V. F., Sidorova, M. V., 1991). They capture foreign particles and old forms of erythrocytes (Green, N., Stout, W., Taylor, D., 1996). Destroying them, they accumulate iron-containing pigment - haemosiderin (Vasiliev, Y. G. et al., 2013). Further Kupffer cells transfer phagocytosed particles and substances for their further processing and utilisation by hepatocytes (Vrakin, V. F., Sidorova, M. V., 1991). Kupffer cells are also characterised by antigen-presenting function (Vasiliev, Y. G. et al., 2013). They are the main participants of the liver regeneration process, as well as fibrogenesis and cirrhosis (Fehrenbach, H. et al., 2001).

As part of the liver lobules, hepatocytes are arranged in two rows, forming hepatic beams (Barteneva, Yu, 2012). The beams occasionally anastomose with each other, but mostly have a radial arrangement (Lebedeva, N. A. et al., 1985). The intercellular space in the centre of each of the beams forms a biliary capillary (Barteneva, Y. Yu., 2012). The latter as a part of the hepatic bar follows along its entire length and is a blindly closed channel originating near the central vein of the lobule. The wall of the bile capillary is formed by the plasmolemma of the hepatocytes forming it (Zelenevsky, N. V., Shchipakin, M. V., 2018). When considering the liver as an external secretion gland, the hepatic beams should be considered as its end sections producing bile (Yaglov, V. V., Yaglova, N. V., 2011).

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According to N. V. Zelenevsky, M. V. Shchipakin (2018), the diameter of the lumen of the bile capillary varies within the limits of 0.50-1.00 μm. However, according to L. C. Junqueira, J. Carneiro (2009) this value varies within 1.00-2.00 μm.

Biliary capillary is the initial link of intrahepatic biliary tract (Yaglov, V. V., Yaglova, N. V., 2011). Along it, bile flows from the centre of the hepatic lobule to its periphery (Zelenevsky, N. V., Shchipakin, M. V., 2018). Here biliary capillaries pass into cholangioles. The latter are short tubes, and their lumen is formed at the expense of two or three cells of oval shape. Cholangioles flow into bile ducts (Vasiliev, Yu. G. et al., 2013). Bile ducts are formed by the fusion of the latter (Barteneva, Yu. Yu., 2012). In the foetus, bile ducts have a narrow lumen (Silantieva, N. T.

Due to the fact that blood in the hepatic lobe flows from the periphery to the centre, the oxygen contained in it, as well as non-toxic and toxic substances absorbed in the intestine, first reach the hepatocytes lying on the periphery of the lobe, and then the hepatocytes lying in its centre. This causes a difference in the morphology of these cells depending on their zonal location. Especially this duality is manifested in pathologies (Junqueira, L. C., Carneiro, J., 2009).

Hepatocytes are entodermal type epithelial cells (Yaglov, V. V., Yaglova, N. V., 2011). They are often called "the central laboratory of the organism" (Lenchenko, E. M., 2009). They account for 2/3 of the liver mass (Junqueira, L. C., Carneiro, J., 2009). They occupy more than 60.00% of the cells that make up the hepatic lobule and fulfil all the main functions attributed to the liver (Vasiliev, Y. G. et al., 2013). Six or more surfaces can be identified on them and their diameter is 20.00- 30.00 μm (Junqueira, L. C., Carneiro, J., 2009). Forming beams, hepatocytes contact by means of desmosomes as well as interdigitations (Sokolov, V. I., Chumasov, E. I., 2004).

The cytoplasm of hepatocytes is rich in organelles and inclusions, containing many mitochondria, as well as strongly developed smooth and granular endoplasmic networks (Sokolov, V. I., Chumasov, E. I., 2004). These organelles give the cytoplasm an eosinophilic character (Junqueira, L. C., Carneiro, J., 2009). A well-developed Golgi apparatus, numerous lysosomes, glycogen granules and lipid droplets are detected (Green, N., Stout, W., Taylor, D., 1996). The granular

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endoplasmic network forms aggregates - basophilic corpuscles (Junqueira, L. C., Carneiro, J., 2009). Cytoskeleton and peroxisomes are detected, and depending on the functional state, signs of vacuolisation can be detected in the cytoplasm of hepatocytes (Vasiliev, Y. G. et al., 2013). During the day hepatocytes mainly secrete bile, and at night they undergo synthesis and assimilation processes. In this case, glycogen is deposited first in the centre of the lobule and then in the periphery, and fat - vice versa (Vrakin, V. F., Sidorova, M. V., 1991).

Each hepatocyte has one or two round nuclei. One or two nuclei are detected in their composition. Some nuclei are polyploid, are characterised by large sizes proportional to their ploidy and contain an even number of haploid sets of chromosomes (Junqueira, L. C., Carneiro, J., 2009). The electron microscopic method reveals that hepatocyte nuclei are surrounded by a perforated double-loop nuclear envelope (Lebedeva, N. A. et al., 1985).

Bird hepatocytes are characterised by polyploidy expressed in multinucleation and enlargement of nuclei. Its degree increases with age. Thus, in adult chickens more than half of hepatocyte nuclei are tetraploid, while bi-nuclear hepatocytes are less common than in mammals (Sokolov, V.I., Chumasov, E.I., 2004).

In the adult dog about 30.00% of hepatocytes are multinucleated or dinuclear (Zelenevsky, N. V., Honin, G. A., 2004). In ruminants, the number of dinuclear cells is 8.00%, and in the pig it reaches 40.00%. With age, the number of dinuclear and multinuclear hepatocytes increases (Vrakin, V. F., Sidorova, M. V., 1991). The nuclei of hepatocytes are optically light (Vasiliev, Y. G. et al., 2013).

Between hepatocytes and the wall of sinusoidal capillaries lies a slit-like space - Dysse space. The surface of hepatocytes, facing towards it, bears many microvilli (Sokolov, V. I., Chumasov, E. I., 2004). Through this space, metabolism between blood and hepatocytes takes place. The surface of hepatocytes facing the lumen of the bile capillary also bears microvilli. These structures ensure the exit of bile from the cytoplasm of hepatocytes by active transport (Green, N., Stout, W., Taylor, D., 1996). Hepatocytes in poultry are similarly organised (Vrakin, V. F., Sidorova, M. V., 1984).

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Thus, two poles can be distinguished on hepatocytes - biliary and vascular (Lenchenko, E. M., 2009). The biliary one faces the biliary capillary, and the vascular one faces the sinusoidal blood capillary towards the Dysse space (Vrakin, V. F., Sidorova, M. V., 1991). The membranes forming these poles contain various membrane proteins. Diffusion of bile into the blood is blocked due to the lateral - intermediate - surfaces of hepatocytes contacting near bile capillaries by means of tight contacts and desmosomes (Vasiliev, Y. G. et al., 2013).

The vascular pole of the hepatocyte has high endocytosis and pinocytosis activity (Junqueira, L. C., Carneiro, J., 2009). According to V. F. Vrakin and M. V. Sidorova (1984) Dysse space is filled with tissue fluid. On the contrary, MacSween R. N. M. et al. (2002) believe that it is filled with lymph. In turn, Vasiliev, Y. G. et al. (2013) believe that it is filled with a fluid with a high content of protein. Pietro, M. (1984) it was found that the zones of minimum distance between Dysse space and the lumen of the biliary capillary are 0.1 μm.

In goat and domestic bull, hepatocytes are polygonal in shape containing small nuclei. In sheep, the nuclei are larger than in goat and domestic bull. In human, nuclei are larger than in ruminants and have hexagonal shape (Madhan, K. E., Raju S., 2014). In sheep of Tuva short-fat-tailed breed at the age of 6.5 months, hepatocytes have predominantly 4-5-angular shape, sometimes oval-extended. Their cytoplasm is homogeneously oxyphilic and contains fine granularity. The nucleus is basophilic, large, lies in the centre of the cell. Sometimes binuclear cells are found (Wang, B., Donkova, N. V., 2015).

Poultry hepatocytes are large cells with a variety of shapes. Their height reaches 8.0-10.0 μm in chickens, 10.0-14.0 μm in turkeys, and 10.0-12.0 μm in geese and ducks. With narrower apical pole they are directed towards biliary capillary. The lumen of the latter in chicken is formed by 2-7, and in goose 2-5 hepatocytes (Vrakin, V. F., Sidorova, M. V., 1984).

The liver has a huge regenerative potential (Mustafin, A. H. et al., 2008; Repina, E. F. et al., 2019). Thus, in a rabbit, after removal of half of the liver, its remaining part reaches its original mass after ten days (Lenchenko, E. M., 2009). However, within the liver lobule hepatocytes have unequal ability to regeneration,

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which is more pronounced in hepatocytes located in its peripheral parts. At the same time, hepatocytes of its central field are most sensitive to harmful factors (Turovina, L. P., Streltsova, N. A., 2010). During regeneration, cells divide by amitosis and endomitosis. When hepatic beams are regenerated, their regeneration is mitotic (Lenchenko, E. M., 2009). Hepatocyte regeneration is closely related to pit-cells that secrete growth factors (Vasiliev, Y. G. et al., 2013).

In newborn animals, the structure of the liver is very different from that of adults. Thus, in diurnal animals in its composition can be distinguished stroma and parenchyma. The stroma is formed by loose fibrous connective tissue containing a small amount of elastic fibres. It is very difficult to determine the boundaries between the liver lobules because of the weak development of interlobular septa. In day-old piglets and puppies, hepatocytes have no definite spatial organisation and are located between blood vessels (Lemeshchenko, V.V., 2011; Lemeshchenko, V.V., Krishtoforova B.V., 2013).

In day-old lambs liver tissues are represented mainly by parenchyma, stroma is found in small quantity. Hepatocytes have slightly eosinophilic cytoplasm with irregular granularity. Liver lobules contain foci of haemopoiesis, indicating immaturity of the liver parenchyma and its incomplete structure (Skobelskaya, T. P., 2016). Features of the structure of the gallbladder wall remain poorly studied until now (Allakhverdiev, M. K., Nikityuk, D. B., Shadlinsky, V. B., 2005). It consists of mucous, muscular and serous membranes (Lenchenko, E. M., 2009). The mucosa is lined with highly prismatic caemic epithelium capable of absorbing water (Zelenevsky, N. V., Zelenevsky, K. N., 2014). In humans, microvilli of epitheliocytes are covered by a layer of glycoprotein (Seiden, D., 2002). Bocaloid cells that secrete mucus are found as part of the epithelial layer (Yaglov, V. V., Yaglova, N. V., 2011; Bamaniya, M., Barolia., Y, Mathur., R, Shende., K, Joshi., S., 2016). The intrinsic lamina forms numerous folds that flatten when the bladder is filled with bile. The submucosal base contains many elastic fibres that ensure its extensibility (Vasiliev, Y. G. et al., 2013). In the area of the bladder neck it contains alveolar-tubular glands that secrete mucous secretion (Yaglov, V. V., Yaglova, N. V., 2011).

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The muscular coat of the gallbladder is thin (Yaglov, V. V., Yaglova, N. V., 2011), formed by smooth myocytes that do not form contoured layers (Zelenevsky, N. V., Zelenevsky, K. N., 2014). However, their predominant circular orientation is traced, and between them are revealed interlayers of loose connective tissue containing many elastic fibres. In the neck region, the number of circular fibres forming the sphincter increases (Vasiliev, Yu. G. et al., 2013). The structure of myocytes of the guinea pig gallbladder muscular wall resembles those of the intestinal mucosa (Cai, W. Q., Gabella, G., 1983). The greater part of the gallbladder wall is covered with peritoneum, and the smaller part adjacent to the liver is free from serosa. Here adventitia (Borzyak, E. I., Volkova, L. I., Dobrovolskaya, K. A., 1993) formed by loose connective tissue is located instead of it (Yaglov, V. V., Yaglova, N. V., 2011). In this place, the hepatic ducts lying nearby can open independently into the gallbladder, penetrating its wall (Zelenevsky, N. V., Zelenevsky, K. N., 2014).

Thus, the structural and functional unit of the liver in birds and mammals is the hepatic lobule. The latter has the form of a polygonal prism and is characterised by the sequential arrangement of the elements of the bloodstream and biliary system. Due to the organisation of its vascular channel we can speak about the presence of a "miraculous network" in the liver, as sinusoidal capillaries in the liver lobule lie between two veins - interlobular and central. The lobules are based on liver cells - hepatocytes, which have characteristic morphological features of structural organisation. Lining up in two rows, they form hepatic beams. In the centre of the latter due to the cell wall of hepatocytes a biliary capillary is formed. Blood flow in the liver lobule is carried out from the periphery to the centre, and bile - in the opposite direction. At the same time, blood flows out into the central vein, which represents the initial link of the hepatic venous system. The barrier function of the liver is performed by its macrophages - Kupffer cells. Cellular antitumour immunity is provided by pit cells. Ito cells, capable of forming fibrous structures of stroma and accumulating some substances, are also found in the liver.

The structural organisation of hepatic lobules changes during early postnatal ontogenesis. The description of these changes in the available sources of literature is extremely scarce. The issues concerning the microstructure of the gallbladder wall

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and biliary tract are also poorly covered. Having analysed the available sources of literature, we believe that up to now these issues are open and need to be studied.

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