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## ADAPTATION PECULIARITIES OF THE PANCREATIC BLOOD CIRCULATORY LINKS IN CASE OF POST-RESECTION PORTAL HYPERTENSION

**Abstract.** *The experiment conducted on albino rats determined that resection of 58,1 % of the liver parenchyma results in post-resection portal hypertension and pronounced remodeling of the pancreatic blood microcirculatory stream vessels characterized by a considerable narrowing of the lumen of its arterial (arterioles, pre-capillary arterioles), exchange (capillaries) links and dilation of the capillary veins and venules, decreased thickness of micro vessels, venous plethora, hypoxia, disorders of the structural endothelial cellular homeostasis, dystrophy and necrobiosis of cells and tissues, infiltrative and sclerotic processes.*

**Key words:** *pancreas, blood circulatory stream, liver resection.*

**Introduction.** Blood circulatory disorders in the organs play an important role in the development of their pathological injuries stipulating the interests of scientists to their investigation. Different links of the blood circulatory stream are known to respond and adapt in different ways to acting negative endogenous and exogenous [8]. Resection of large amounts of the liver can lead to different post-resection complications: hemorrhage from varicose dilated veins of the esophagus, stomach, rectum, ascites, splenomegaly, secondary hypersplenism, parenchymatous jaundice, portal systemic encephalopathy, liver failure, and portal hypertension [2, 7, 9]. Post-resection portal hypertension results in structural rebuilding of the organs in the portal hepatic vein pool, and remodeling of their structures. The pancreas belongs to those organs which venous drainage occurs through the portal hepatic vein, where hemodynamic disorders are complicated by different morphological changes in the vessels and structures of the organ. It should be noted that peculiarities of remodeling in the pancreatic blood circulatory stream links in case of post-resection portal hypertension are not studied sufficiently [3].

**Objective** is to study peculiarities of adaptation in the pancreatic blood circulatory stream links in case of post-resection portal hypertension.

**Materials and methods.** The investigations were performed on 45 mature albino male rats divided into 3 groups. The 1<sup>st</sup> group included 15 intact practically

healthy animals, the 2<sup>nd</sup> group – 15 rats after resection of the left lateral lobe – 31,5% of the liver parenchyma, and the 3<sup>rd</sup> group – 15 animals after resection of the right and left lateral liver lobes (58,1 % of the liver parenchyma) [3]. Euthanasia of the experimental animals was performed by means of bloodletting under conditions of thiopental narcosis 1 month later since the beginning of the experiment.

Blood microcirculatory stream of the pancreas was investigated by means of injecting its vessels with ink-gelatin mixture introduced through the abdominal aorta. 3-4 hours after filling the blood stream of the empty intestine with the above mixture small pieces of the organ were taken from different portions, fixed in 10,0 % solution of neutral formalin during 2 weeks. Cuts 30-40 mcm thick were prepared on the freezing microtome, dehydrated in ethyl alcohols of an increasing concentration, clarified in methylene ether of salicylic acid and placed into polystyrene. In a part of the investigations where the vessels were filled with ink-gelatin mixture micro vessels were examined by means of impregnation of film micro slides by V.V. Kupriyanov [6]. Morphometric examination determined diameters of arterioles, pre-capillary arterioles, blood capillaries, capillary veins and venules, thickness of micro vessels of the blood microcirculatory stream per 1 mm<sup>2</sup> of the pancreatic tissue of the experimental animals, the height of endothelial cells, diameters of their nuclei, nuclear-cytoplasmic ratio and relative volume of the damaged

endothelial cells [1]. Quantitative values were statistically processed. The difference between comparative values was determined by Mann-Whitney and Student criteria [4].

**Results.** One month after resection of 58,1% of the liver parenchyma in experimental animals section of the abdominal cavity determined dilation of the portal hepatic vein, plethora and dilation of the mesenteric veins and visible venous stream of the small and large intestines. The mucous membrane of the pancreas is plethoric, swollen, with single foci of point hemorrhages. The above described was indicative of post-resection portal hypertension available.

Morphometric examination determined narrowing of the lumens of flow links and blood distribution (arterioles, pre-capillary arterioles), exchange (blood capillaries) part and dilation of the drainage-depot link (capillary veins and venules) of the pancreatic blood microcirculatory stream, decreased thickness of micro vessels. The diameter of the pancreatic capillary veins under conditions of the experiment appeared to be statistically reliably increased ( $p < 0,001$ ) to 26,4 %, and venules – to 23,8 % compared with the control values. The vascular thickness of the microcirculatory blood stream per 1 mm<sup>2</sup> of the pancreatic tissue under modeled experimental conditions statistically reliably decreased ( $p < 0,001$ ) to 20,4 %, which was indicative of trophic disorders of the examined organ [5,8]. Nuclear-cytoplasmic ratio in the endothelial cells of micro vessels appeared to be substantially changed which was indicative of disorders of the structural cellular homeostasis [5]. A relative volume of the damaged endothelial cells increased considerably in all the links of the blood microcirculatory stream. The most pronounced disorders of the structural cellular homeostasis were found in the endothelial cells of the drainage-depot link of the pancreatic blood microcirculatory stream. Thus, in the endothelial cells of venules nuclear-cytoplasmic ratio appeared to be changed to 6,2 %, and relative volume of the damaged examined cells increased in 23,1 times.

Histological examination of micro vessels of the venous part in the pancreatic blood microcirculatory stream determined in all the examined animals from the 3<sup>rd</sup> group their dilation, plethora and with the foci of destruction of myocytes, stromal structures, endothelial cells and local desquamation of the latter. The walls of the venules are of irregular thickness with thinning median part and architectonic disorders of the myocytes and connective tissue structures, with fragmentation, lysis of elastic fibers, their multiplication, hyperelastosis, formed sacculation, dystrophy, necrobiosis and desquamation of endothelial cells. In the paravasal stroma swelling, scleroses and foci of cellular infiltration were found.

Epithelial cells of the pancreatic mucous membrane have local dystrophic, necrobiotic changes and desquamation, the stroma is considerably swollen.

Therefore, post-resection portal hypertension results in pronounced remodeling of micro vessels in all the links of the blood microcirculatory stream with dominating structural changes in the vessels of its drainage-depot part.

**Conclusions.** Resection of 58,1 % of the liver parenchyma results in post-resection portal hypertension and pronounced remodeling of the vessels of the pancreatic blood microcirculatory stream which is characterized by considerable narrowing the lumens of flow links and blood distribution (arterioles, pre-capillary arterioles), exchange (blood capillaries) part and dilation of the drainage-depot link (capillary veins and venules), decreased thickness of micro vessels, venous plethora, hypoxia, dystrophy and necrobiosis of the cells and tissues, infiltrative and sclerotic processes. Post-resection portal hypertension changed considerably nuclear-cytoplasmic ratio in the endothelial cells of the examined micro vessels, and relative volume of the damaged endothelial cells increased. The most pronounced disorders of the structural cellular homeostasis are found in the endothelial cells of the drainage-depot link in the pancreatic blood microcirculatory stream.

**Prospects of further studies.** Comprehensive, adequate, full-value examination of the structural rebuilding of vessels in the pancreatic blood microcirculatory stream in case of post-resection of portal hypertension will enable to extend the diagnostics, correction and prevention of the examined pathology.

#### References:

1. Avtadnilov GG. *Basis of Quantitative Pathological Anatomy*. Moscow: Medicine; 2002. 240 p. [in Russian].
2. Vishnievskii VA, Yefanov MG, Kazakov IV. *Segmentar resections, long-term results in malignant liver tumors*. Ukr J Surgery. 2012;1(16):5-15 [in Ukrainian].
3. Hnatiuk MS, Tatarchuk LV, Jasinovskyy OB. *Morphometric evaluation of the features of remodeling of duodenal structures during resection of different volumes of the liver*. Scientific Journal of Uzhgorod University. Series "Medicine". 2016;1(49):3-5 [in Ukrainian].
4. Lapach SN, Gubenko AV, Babich PN. *Statistical methods in medicobiological investigations Excell*. Kiev: Morion; 2001. 410 p. [in Ukrainian].

5. Sarkisov DS. *Structural basis adaptation and compensation damage function.* Moscow: Medicine; 1998. 230 p. [in Russian].

6. Sorochinnikov AG, Dorosievich AYe. *Histological and microscopic equipments.* Moscow: Medicine; 2007. 448 p. [in Russian].

7. Fiodorov VD, Vishnievskiy VA, Nazarienko NA. *The main complications of extensive liver resections and ways to prevent them.* Bull Siberian medicine. 2007;(4):16-24 [in Russian].

8. Shulgai AH, Tatarchuk LV, Hnatjuk MS. *Remodeling peculiarities of ileum hemomicrocirculatory bed vessels at resection of different liver size.* Scientific Journal of investigation. 2017;4:145-9. [in Ukrainian].

9. Nanashima A, Sumida Y, Abo T. *A modified grading system for post-hepatectomy metastatic liver cancer originating from colorectal carcinoma.* J Surg Oncol. 2008;98:363-70.