Age-dependent peculiarities of pancreatic exocrine apparatus morphometric changes

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Key words: pancreas, exocrinocytes, excretory ducts, morphometry, age-dependent changes

Introduction. In recent years, there is a clear increase in the prevalence of pancreatic pathology in young people. Among the etiologic causal factors important place belongs to poor diet, lifestyle and genetic factors. Pancreas (pancreas) is part hepatopancreatoduodenal complex and often in violation of the functions of one of its components involved in the pathological process [2, 6]. In the pathogenesis of pancreas changes play an important role ischemic and neuro-reflex effects. The importance of ensuring the functional ability of pancreas owned by the state of its parenchyma, particularly exo- and endocrinocytes [7]. To develop preventive corrective actions morphological changes in pancreas at a given pathology is important to establish its structural features of different age groups [8]. The latter can be a major prognostic factor to determine the depth and extent of regression of morphological disorders during adaptation and compensatory changes. Objective method of assessing morphological state body is a quantitative method that allows for the basis of morphometric measurements to make informed conclusions [3, 4, 5]. In this regard, the study of morphological characteristics typical of exocrine parts of the pancreas in different age groups is relevant and is of practical importance.

The aim of the study was to determine morphometric parameters exocrine component parts of the pancreas different age groups of white rats.

Materials and methods. The study conducted on 24 healthy white male rats, which were divided into two groups: the first — mature (ages 8 months and weighing 200-210 g); second — old (24-month). Euthanasia was performed by bloodletting in rats under ketamine anesthesia. The excised pieces of the pancreas,

which recorded a 10.0% neutral formalin solution and after ethyl alcohol by increasing concentrations were placed in paraffin. Microtome sections were stained with hematoxylin and eosin, by Van-Gizone, Mallory.

Separately taken pancreas sections for making semithin cuts that are stained with toluidine blue.

Histological specimens and semithin sections were studied in morphometric light-optical. Morphometric measured diameter cores exocrinocytes diameter acini, the number exocrinocytes to cut acinus. Calculated area exocrinocytes cores, cross-sectional area exocrinocytes cytoplasm, nucleus-cytoplasmic ratio, cross-sectional area acini [1]. Separately defined as the proportion of parenchyma and stroma share. The resulting digital values processed statistically. The difference between the comparative morphometric parameters were determined by Student's criterion.

Results and discussion. Parenchyma pancreas provided exocrine cells (exocrinocytes) forming acini and internal secretion cells (endocrinocytes), forming islands. Pancreas stromal component represented connective tissue skeleton formed collagen fibers, which are both fibroblasts and fibrocytes. By stromal components of the pancreas are blood and lymph vessels, nerves, excretory ducts. The share of stromal component in the structure of the pancreas different age groups of rats is different in young animals is (17,28 ± 0,34)%, and the old Animal — (21,09 ± 0,46)%. With age, the rats increased the proportion of connective tissue skeleton that has marked significant difference ($p < 0.001$). The share of parenchyma in young rats is (82,31 ± 1,29)% and a low significance ($p < 0.05$) dominates similar data in animals other groups that are (78,58 ± 0,84)%. The difference was (3,78 ± 0,01)%.

Pancreas acini have a rounded shape and formed exocrine pancreatic cells conical shape. The sizes of acini in rats of different ages have different (Table 1). Animals of the first group of acini diameter (34,21 ± 0,18) m and 6.2% prevailing acini diameter of the second group of animals ($p < 0.001$). Area acini, which includes an embedded ductal department together with exocrinocytes in young rats is (907,58 ± 3,61) mm^2, and the 24-month-old rats — (807,86 ± 4,28) mm^2.

Between the values of these parameters there is a significant difference with a high degree of confidence ($p < 0.001$). Light-optical research and semithin histological sections revealed that the number of cells exocrinocytes that form acinus in young animals, 4.7% more compared to older animals. The cytoplasm of these cells has a grainy look, which is especially pronounced in the apical pole. Exocrinocytes nuclei located in the basal part of the cells. The diameter of the nuclei in young rats is ($4{,}23 \pm 0{,}03$) m and 2.6% prevails a similar option in old rats ($p < 0.05$). The area of nuclei with high significance ($p < 0.001$) predominates in young rats over an area of the old cores. An important characteristic of the functional state exocrinocytes and their activity is the proportion of cytoplasm and its structural components. From conducted morphometric measurements and calculations found that the cross-sectional area exocrinocytes cytoplasm in mature young rats and in older animals is inversely proportional to the square of their nuclei. The area of the cytoplasm in old rats by 6.8% predominates similar values obtained in young rats ($p < 0.001$). The functional activity of each cell is determined by structural relationships nucleus and cytoplasm. In exocrinocytes pancreas they have a special meaning, as related to the direct provision of digestion and subsequent absorption of simple substances. This is important as setting parameters and ratios nucleus cytoplasm in different age groups, which will establish the extent and the possibility of compensatory abilities. Nuclear-cytoplasmic ratio may vary depending on hyper- or hypothyroidism cells and indicate the degree of maturity and differentiation of cells. From the studies shows that the parameters of the nuclear-cytoplasmic ratios exocrinocytes young rats by 10.7% dominated by similar data in old rats than proving that with age in these experimental animals decreased functional activity of pancreas and its impact on digestion.

The structure of the exocrine pancreas departments owned and ductal system, which ensures the supply of secret exocrinocytes in digestive system.To the ear ducts include ducts, intrapartial and interlobular ducts. The geometry of the output of the system in different age groups of animal species is different. Plug ducts are single layer of epithelium. The diameter of the duct plug in young

sexually mature rats is (5,81 ± 0,17) mm, and in old rats belonging to the second group, — (5,23 ± 0,10) mm. Value of these parameters have statistical difference (p <0.05). Enlightenment intrapartial and interlobular ducts in older rats, on the contrary, outweigh related parameters obtained in young rats. Intrapartial diameter ducts in animals first group is (20.38 + 0.19) mm, the animals of the second group — (22,79 ± 0,15) mm, and interlobular ducts of the first group of animals — (43,79 ± 1, 27) microns and the (48,56 ± 0,92) m in the second group of animals. Moreover, despite the increase in caliber and order branching ducts, the difference between the parameters of the lumen in the studied age groups did not increase and amounted to 11.82 and 10.89%.

Thus, the results of the studies confirm existing morphometric differences in the investigated parts of pancreas Young and old white experimental rats that should be considered when conducting experimental studies with modeling of pathological processes and conditions.

Table 1

Pancreas acini morphometric characteristics of young and old albino rats (M±m)

Group observed conservation	Investigated option						
	exocrinocytes nuclear area, m^2	diameter cores exocrinocytes, um	exocrinocytes cytoplasm sectional area, m^2	YTV exocrinocytes %	acini sectional area, m^2	acini diameter, mm	number exocrinocytes to cut acinus
The first group (young rats)	14,05 ± 0,03	4,23 ± 0,03	50,18 ± 0,32	0,28 ± 0,02	907,58 ± 3,61	34,21 ± 0,18	7,96 ± 0,42
The second group (old rats)	13,32 ± 0,04 ***	4,12 ± 0,02 *	53.83 + 0.46 ***	0,25 ± 0,01	807,86 ± 4,28 ***	32.08 + 0.23 ***	7.58 + 0.29

Notes: 1) ** P <0.05;

2) *** p <0.001 — compared the values of the first experimental group with the second.

Conclusions

1. The young mature white rats proportion of pancreatic parenchyma is more on (3,78 ± 0,01)% compared with the old rats. Area acini pancreas and their diameters in animals decrease with age, and the proportion of stromal component increases.

2. The nuclear-cytoplasmic ratio exocrinocytes. Pancreas mature young animals dominate those for older animals, indicating the varying functional activity of the external activities.

3. The dynamics of age changes ducts observed narrowing pancreas plug departments ducts and expansion intrapartial interlobular ducts and certifying various adaptive ability ductal system as a whole.

Prospects for further research. A detailed study of the structural changes in the external and internal secretion pancreas components will adequately judged on its ability to function in the development of pathological conditions.

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The peculiarities of pancreas exocrine components structural change in white rats of different age groups were determined by means of morphometric methods. It was found out that parenchyma density decreases and stromal component specific gravity increases with age. The size and area of acini, the area of nucleus surface and the nucleoplasmic ratio in exocrine cells decrease with age. Due to age-dependent changes of pancreatic excretory ducts, the ductile constriction, interlobular and intralobular ducts' dilations are observed. It proves different adaptive capacity of the ductal system in general.