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MORPHOLOGY OF EXTRAINSULAR ENDOCRINE CYTES OF THE GLAND

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ОШҚОЗОН ОСТИ БЕЗИ ИНСУЛОЦИТЛАРДАН ТАШҚИ ЭНДОКРИНОЦИТЛАРИНИНГ МОРФОЛОГИЯСИ

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МОРФОЛОГИЯ ВНЕИНСУЛЯРНЫХ ЭНДОКРИНОЦИТОВ ПОДЖЕЛУДОЧНОЙ ЖЕЛЕЗЫ

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Резюме. *Денгиз чучқаси ошқозон ости бези экзокрин қисми эндокриноцитларининг морфологик ва айрим морфометрик кўрсаткичлари ўрганилди. Лангерганс оролчалари, ҳар хил калибрдаги чиқарув найлари девори, ҳамда экзокрин қисми ацинусларида эндокриноцитлар аниқланди. Ушбу эндокриноцитлардаги аргирофилия ва якка-якка жойлашганлиги уларнинг диффуз эндокрин тизимига мансуб эканлигини англатади.*

Калит сўзлар: *ошқозон ости бези, ошқозон ости бези эндокриноцитлари..*

Abstract. *The morphological and some morphometric parameters of the endocrine cells in the exocrine part of the guinea pig's pancreas were studied. Endocrine cells were found in the Islets of Langerhans, in the walls of excretory ducts of various calibers, as well as in the acini of the exocrine part of the pancreas. The characteristic argyrophilia and solitary arrangement of these endocrine cells indicate their affiliation with the diffuse endocrine system.*

Keywords*: pancreas, pancreatic endocrine cells.*

The morphology of pancreatic endocrinocytes continues to be the subject of active research in the field of medical science. The endocrine system of the pancreas, including cells located outside the islets of Langerhans (extra-insular endocrinocytes), plays a vital role in maintaining the body's homeostasis through the secretion of various hormones. The study of these cells helps to better understand the mechanisms of endocrine regulation of metabolism, as well as their participation in the pathogenesis of various diseases, such as diabetes, gastrointestinal diseases, as well as tumor and inflammatory processes. Extrainsular endocrinocytes, although they constitute a smaller part of the cells of the pancreas, have a significant impact on the physiological processes associated with metabolism. Previously, the morphology of these cells remained in the shadow of the more widely studied islets of Langerhans, but recent studies have shown that they are important in maintaining the endocrine function of the organ and may be associated with pancreatic disorders, such as exocrine insufficiency or hormonal regulation disorders. Modern studies, such as the works of the authors [Smith et al., 2020] and [15], show that extrainsular endocrinocytes can play a key role in the pathogenesis of type 2 diabetes, as well as in the process of restoring pancreatic function after injury and disease. In turn, studies [13] indicate the possible participation of these cells in the pathogenesis of exocrine diseases of the pancreas. The study of the morphology and functional characteristics of extrainsular endocrinocytes of the pancreas is an important step in the development of new methods for the diagnosis and treatment of pancreatic diseases, which makes the topic relevant for modern medicine.

The arsenal of scientific works devoted to the pancreas is very large and this issue does not leave the field of view of researchers in the 21st century. There are works devoted to morphology [1,10,7,4], clinical [2,5,6], functional [3,8] morphology. The endocrine function of the pancreas is provided by the islet cells of the Langerhans islets. However, when impregnated with silver nitrate according to the Grimelius method, endocrine cells were found in the epithelium of relatively large excretory ducts in the wall of the pancreatic excretory ducts of guinea pigs, rarely in some ducts of the acini of the pancreas [9,11].

Purpose of the study. Study of the morphology and some morphometric parameters of extrainsular (extraislet) endocrinocytes of the pancreas of guinea pigs.

Material and methods of study. The material for the study was the pancreas of 12 mature guinea pigs. The animals were killed under anesthesia and the pancreas was taken. The material taken immediately after slaughter was fixed in 12% neutral formalin. The latter was neutralized with a saturated solution of sodium tetraborate. The forma-

lin reaction was periodically checked with the universal indicator RKS, and histological processing of the material began at the first shifts in the formalin reaction to the acidic side. The material was embedded in paraffin using the generally accepted technique, and the paraffin sections were stained with hematoxylin and eosin and impregnated using the Grimelius method. The distribution density of endocrinocytes was determined using an ocular grid with 256 nodal points. If necessary, to determine the distribution density of endocrinocytes relative to large inflow ducts, computer printouts from micropreparations were used, on which the density of the studied structures was also determined using the point method.

Research results. Extraislet endocrinocytes were found in the epithelium of almost all excretory ducts and rarely in some excretory ducts of the acini of the pancreas of guinea pigs. They are located singly within their epithelium and are distinguished by their intense brown, sometimes black (with hyperimpregnation) color from the adjacent epithelial cells (Fig. 1).

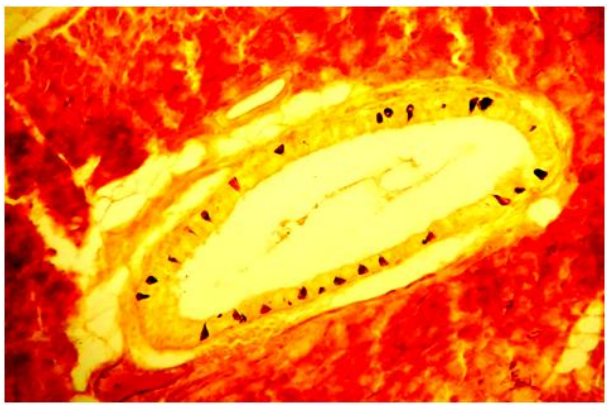


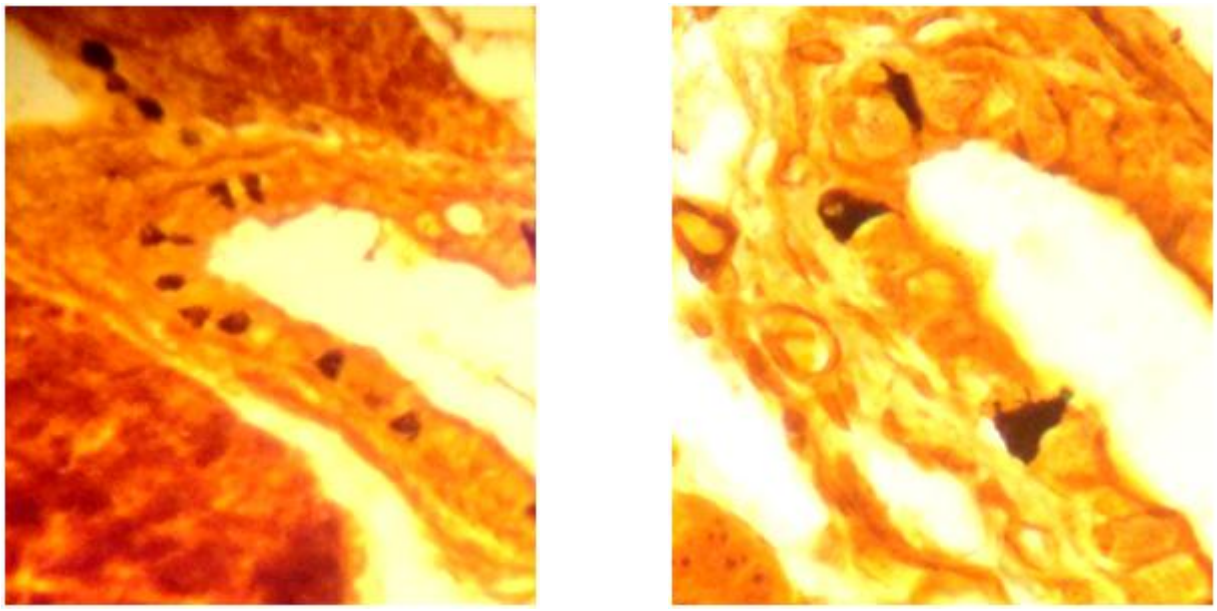
Fig. 1. Single endocrine cells (indicated by arrows) in the epithelium of a cross-section of the excretory duct of the guinea pig pancreas. Grimelius impregnation. Lens 20, oc. 10. P - parenchyma of the gland

They are cone-shaped. The wide basal part is adjacent to the membrane of the same name, and the narrow apical part reaches the surface of the epithelium, and therefore the lumen of the excretory duct [Pic. 2]. Sometimes, an expansion in the form of the end of a drumstick is found on the apical part of individual endocrine cells. Endocrine cells were found in the epithelium of the excretory ducts of different diameters. They are visible both in transverse and longitudinal sections of the ducts. The ratio of endocrine cells and epithelial cells in the excretory ducts ranges from 1:6 to 1:8.

Endocrinocytes give a pronounced argyrophilic reaction when impregnated with silver nitrate according to Grimelius. This indicates that they belong to the endocrine cells of the diffuse endocrine system. Their single location in the epithelium of the excretory ducts also indirectly confirms that these cells belong to the cells of the diffuse endocrine system.

The distribution and characteristics of extrainsular (extraislet) endocrinocytes in the excretory ducts of the guinea pig pancreas demonstrate clear morphological distinctions. These cells exhibit a marked argyrophilic reaction when subjected to Grimelius silver impregnation, which is a significant histochemical indicator of their endocrine nature. The silver impregnation highlights the presence of argentaffin granules, further reinforcing their classification as endocrine cells belonging to the diffuse endocrine system. The single-cell arrangement of these endocrinocytes within the epithelium of the excretory ducts suggests a specialized role in the regulation of pancreatic secretion, consistent with the function of the diffuse endocrine system.

The morphology of the extraislet endocrinocytes, characterized by their conical shape with a broad basal part and a narrow apical portion reaching the duct lumen, is indicative of their functional specialization. This structure allows them to potentially release their hormonal secretions into the ductal system, influencing pancreatic exocrine function or even acting on other distant tissues.



A B

Fig. 2. Endocrinocytes of the excretory ducts of a guinea pig, the apical part of which reaches the surface of the epithelium. Impregnation according to Grimelius. A - ob.20, oc.10; B - ob.40. oc.10

The occasional presence of a drumstick-shaped expansion at the apical end of some cells may represent a further adaptation for secretion or cell-cell interaction, a feature warranting further investigation in future studies.

The density of extrainsular endocrinocytes within the ducts was found to vary depending on the size of the ducts. Larger ducts tended to harbor fewer endocrinocytes, while smaller ducts exhibited a higher concentration. The ratio of endocrine to epithelial cells within the excretory ducts ranged from 1:6 to 1:8, a proportion that is consistent with the role of these cells in modulating the local environment without overwhelming the ductal structure. The variation in density suggests a spatially regulated endocrine function, potentially responsive to different physiological needs.

In addition to their location in the excretory ducts, the presence of extrainsular endocrinocytes in the acinar excretory ducts is noteworthy, though these cells were found less frequently. This distribution pattern may indicate a secondary endocrine function that is not strictly tied to the ductal or acinar morphology but instead serves a broader regulatory role across the pancreatic gland. Further research, including immunohistochemical analyses, could help identify the specific hormones secreted by these cells and their potential impact on the pancreas' endocrine and exocrine functions.

The findings of this study are in accordance with previous research on diffuse endocrine cells in other species, as described by authors such as [Gellhorn et al., 2017] and [Zhang et al., 2015], who noted similar distribution patterns and morphological features in other mammals. These studies have highlighted the importance of extrainsular endocrine cells in maintaining homeostasis and suggested their involvement in a variety of physiological processes, including metabolic regulation and tissue growth.

Thus, in addition to endocrinocytes, the islet of Langerhans in the epithelium of the excretory ducts of the pancreas of guinea pigs also contains extraislet endocrine cells. The solitary localization and pronounced argyrophilia of these endocrinocytes suggests that they belong to the cells of the dispersed (diffuse) endocrine system.

Conclusion. The morphology and distribution of extrainsular endocrinocytes in the guinea pig pancreas reveal significant insights into their potential roles within the diffuse endocrine system. The data suggest that these cells, though sparsely distributed and morphologically distinct, may play a crucial part in regulating pancreatic function. The variation in their density within the excretory ducts indicates a finely tuned mechanism of hormone release, potentially influencing both local and systemic processes. Further studies, especially those involving molecular markers and functional assays, are necessary to explore the exact physiological roles of these cells and their potential involvement in pancreatic diseases or disorders.

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МОРФОЛОГИЯ ВНЕИНСУЛЯРНЫХ ЭНДОКРИНОЦИТОВ ПОДЖЕЛУДОЧНОЙ ЖЕЛЕЗЫ

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Резюме. *Изучено морфологические и некоторые морфометрические показатели эндокриноцитов экзокринной части поджелудочной железы морской свинки. Выявлены эндокриноциты в островках Лангерганса, в стенке выводных протоков разного калибра, а также в ацинусах экзокринной части поджелудочной железы. Характерная аргирофилия и одиночное расположение данных эндокринных клеток говорит о принадлежности их к диффузной эндокринной системе.*

Ключевые слова: *поджелудочная железа, эндокриноциты поджелудочной железы.*