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Morphometric Characteristics of the Parotid Glands in Immature Rats with Intestinal Dysbacteriosis

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ABSTRACT: It is known that in some infectious diseases of the digestive system, the large salivary glands are also involved in the pathological process. In experimental modeling of dysbiosis in laboratory rats, increased adhesion of opportunistic microorganisms to intestinal epithelial cells was revealed. In connection with the above, the goal was to study the features of the morphological and functional differentiation of the major salivary glands in postnatal ontogenesis, as well as to find out the morphological criteria for their functional activity under the influence of intestinal dysbacteriosis.

KEYWORDS: Dysbiosis, Acinus, Epitheliocyte, Intercalary Duct, Hematoxylin, Morphometry, Parotid Gland, Striated Ducts.

INTRODUCTION

The parotid salivary gland is the largest of all salivary jellies. Outside, it is covered with a connecting capsule. Being a complex alveolar gland, it has a soft texture and a well-defined lobed structure. The parotid salivary gland is the largest of all salivary jellies. Outside, it is covered with a connecting capsule. Being a complex alveolar gland, it has a soft texture and a well-defined lobed structure. Bundles of capsule fibers pass into the gland and separate the lobules from each other. The gland is located downward from the auricle on the lateral surface of the lower jaw branch and is limited to the posterior edge of the masticatory muscle, the fascia of which is fused with the capsule of the gland. In the medial part of the maxillary fossa, the deep part of the gland is adjacent to the styloid process and the stylohyoid, stylo-pharyngeal, and stylo-lingual muscles attached to it. The carotid artery and the mandibular vein, as well as the ear-temporal and facial nerves, pass through the body of the gland.

The parotid duct passes into the oral cavity at the level of the fourth premolar in the region of the interbuccal space. The salivary glands include the major and minor salivary glands. The glands of the lips, cheeks, palatine and lingual glands are small, and the large salivary glands include three pairs of large glands: parotid, mandibular, sublingual (single-duct and multi-duct), 12 located deep from the oral mucosa. The parotid salivary gland, with its main mass, is located along the posterior edge of the lower jaw, within the upper 2/3 of the distance from the zygomatic arch to the angle of the lower jaw. The gland is covered by the parotid fascia and the subcutaneous muscle of the head. In adult animals, the gland is located at the level of the middle of the dorsal part of the zygomatic arch and the ventral edge of the lower jaw. In 39.1 - 60.5% of cases, above the masticatory muscle, in 4.5% of cases, the gland is short and its lower edge is located above the level of the ventral edge of the lower jaw. In 19.5% of cases, the lower edge of the gland lies at the level of the ventral edge of the mandible, and in 76% of cases, the gland descends to the middle of the distance between the vascular notch and the caudal edge of the angle of the mandible.

The human parotid salivary gland is subdivided by the facial nerve passing through its body into two parts - superficial and deep [there is a significant variability in the course of the facial nerve, which in some cases can only partially penetrate the gland or pass along its edge, based on embryological studies, some authors deny bilobular structure of the parotid gland). The deep part of the parotid salivary gland has a pharyngeal process located between the styloid process of the temporal bone and the internal pterygoid muscle.Passing through the opening in the peritoneal fascia, it borders on the anterior part of the parapharyngeal space. In the process of studying the relationship of the deep part of the parotid gland with the vessels and nerves of the peripharyngeal space, the pharyngeal process was found in 28 cases out of 40. According to the author, by the presence of the pharyngeal process, clinicians explain cases of the spread of the inflammatory process from the parotid salivary gland to the area of the parapharyngeal space. The duct of the parotid gland in humans is about 2 cm long. It emerges from the anterior edge of the gland and follows the outer surface of the masseter muscle. In humans, the duct of the gland is easily palpable with clenched teeth in the region of the anterior edge of the masticatory muscle. In the elderly and senile ages, there is an uneven expansion or narrowing of different parts of the duct. Having rounded the anterior edge of the masticatory muscle, the duct of the

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gland perforates the buccal muscle, opening with a papilla on the eve of the mouth at the level of the second molar. The papilla of the parotid gland is located asymmetrically, with age its localization changes and it becomes less noticeable, moving down and forward. The projections of all salivary glands with their ducts into the intercheek space of the oral cavity are extremely variable. The author displays various variants of the location of the salivary glands in the form of projection zones relative to other structures of the oral cavity.The anatomical and topographic characteristics of the parotid salivary gland are closely related to the opening of the external auditory canal. In different species of mammals, the topographic relationships of these formations are different. In a dog, cat, mole, the gland is located ventrally from the external auditory canal, in a rabbit, marsupial rat, bat, rostral from it, and in a mouse, rat, echidna, and anteater, caudally.The parotid salivary gland differs in animals in a wide variety of forms. In a horse, the parotid gland is quadrangular, while in a pig, it is triangular with auricular, submandibular, and cervical angles. With regards to the shape of the parotid salivary gland of a dog, the information in the literature is contradictory. The authors often point to a triangular, rounded-triangular, horseshoe-shaped or V-shaped. In the Siberian column, the parotid gland looks like a butterfly, and in American iron mink has the appearance of a crescent. At the Amur badger the parotid salivary gland is one of the major salivary glands large, it looks like an irregular trapezoid. Topography of the parotid the duct in different animals also has significant variations. Atcarnivores, rodents and small ruminants, it runs across the large masticatory muscle, and in horses, pigs and cattle, the ductlies on the medial surface of the pterygoid muscle and, passing through vascular notch extends to the front surface. The duct of the parotid salivary gland of the yak departs from the gland at the level of the angle lower jaw, then follows the ventral edge of its lateral surface and, without reaching the vascular notch, together with the facial artery and vein is directed dorsally. In the Bactrian camel, the parotid salivary gland is located along caudal edge of the lower jaw, the rostral edge of which is adjacent to posterior edge of the masseter muscle. Line from the base of the ear to anterior part of the zygomatic arch to the posterior angle of the mandible is projection of the rostral margin of the parotid gland. Projection line duct of the parotid salivary gland lies from the point between the middle and ventral third of the mandible to the third premolar.

In rats and mice, the parotid gland is located behind the external ear, and in front of it, where the parotid gland is located in many other animals, lies the lacrimal gland. This topographical feature was the cause of frequent errors when the parotid gland was mistaken for the lacrimal. Guinea pigs have a two-lobed gland. One lobe is large, loose, granular in appearance, not homogeneous, topographically extends beyond the parotid region, the other, on the contrary, is compact, smooth, homogeneous, located at the level of the ventral edge of the lower jaw. Dorsally topographically 16, the parotid gland reaches the zygomatic arch, and ventrally does not descend to the angle of the lower jaw.

MAIN PART

The study of the structure of the salivary glands without accurate knowledge of their morphological features is impossible, special morphological studies of the salivary glands in various animal species are extremely rare, and the available information was obtained from the study of pathological processes or other anatomical structures. The actual material accumulated on the morphology of the group of large salivary glands mainly concerns humans and some species of mammals (cattle, goat, pig, rat).], special morphological studies of the salivary glands in various animal species are extremely rare, and the available information was obtained by pathological processes or other anatomical structures.

Dysbiosis (dysbacteriosis) plays a significant role in the development of many diseases. In the mechanism of dysbiotic complications, a significant place is occupied by microbial intoxication, decreased immunity, and impaired neuroendocrine regulation. Dysbiotic disturbances in the qualitative and quantitative composition of the microflora of the body and its functions, caused by various reasons, still remain one of the leading and most difficult problems to solve in modern medicine.

The literature describes various approaches to modeling dysbacteriosis in animals. Known models of dysbacteriosis caused by starvation, total blood loss, radiation exposure, administration of antibiotics [1].An imbalance in the microbial ecosystem of the intestines of animals entails a decrease in the antagonistic and metabolic activity of microorganisms, which is reflected in a number of morphological and functional features of various organs and systems, manifested in a violation of the digestion and absorption of food, the synthesis of vitamins, enzymes, amino acids, a decrease in overall resistance and the development of inflammatory processes. With dysbacteriosis in rodents, changes in the morphology of the major salivary glands, as well as the area of their acini, were observed. A decrease in the functional activity of the salivary glands leads to a violation of homeostasis, the development of pathogenic microflora in the oral cavity, a weakening of the resistance of enamel to demineralizing effects and, as a result, to various dental diseases [2].

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Diseases of the organs of the oral cavity, and in particular the salivary glands, involve all systems of the body in the pathological process. It is known that each period of the ontogeny of an animal organism has its own patterns of development, high specificity and biological essence, which change the morphofunctional and adaptive capabilities of organs and systems for its provision [3].The duration of these periods in each animal species is fixed by their heredity. Currently, age-related changes in the morphology of the parotid salivary gland of rodents as a single organocomplex and the critical periods of its morphofunctional development have not been studied sufficiently, as required by biology and veterinary medicine. This served as the basis for the proposed study. The aim of the study was to assess the morphological and functional state of the epithelial cells of the parotid glands of rats with intestinal dysbacteriosis.

MATERIALS AND METHODS

The experiment was carried out on immature (20 days) male white rats, divided into two groups: control and experimental. Animals were withdrawn from the experiment at 2, 3, 4 weeks. The morphological and functional state of the major salivary glands of rats was assessed by morphological (hematoxylin and eosin) and morphometric methods.

Pieces of the parotid glands for morphological and morphometric studies were fixed in a 10% formalin solution and embedded in a paraffin mixture. Sections 5 µm thick were stained with hematoxylin and eosin. The results of the morpho metric study are presented as a sample mean and standard deviation.

RESULTS AND DISCUSSION

The stroma of the parotid glands of rats of the experimental group of animals - without control features, the vessel was full-blooded in the microvasculature throughout the experiment. In the parotid salivary glands of rats of the experimental and control groups, protein terminal sections were found. Their epithelial cells had a pyramidal shape, basophilic cytoplasm, and a basally located rounded nucleus with 1–2 nucleoli.

In the parotid glands of rats of the experimental and control groups, the ductal system is represented by intralobular (intercalary, striated), interlobular, and main excretory ducts. The epithelium of the intercalary ducts of the parotid glands is represented by flat or cubic cells with a large flattened or rounded nucleus and intensely oxyphilic cytoplasm. Cubic or columnar epitheliocytes of the striated ducts of the parotid glands were characterized by the presence of a centrally located rounded light nucleus, eosinophilic cytoplasm and basal striation. The cells of the granular convoluted tubes were columnar epitheliocytes with a basally located oval nucleus; the middle and apical parts of the cytoplasm are filled with rounded oxyphilic granules. In rats of the experimental and control groups, from the 3rd week of the experiment, single cells of granular convoluted tubes began to be determined at the border of the intercalary and striated ducts, their number increased by the end of the experiment.

Table №1

Area of acini of large salivary glands of immature rats, µm2, M ± σ			
Group	*The area of the acini of the parotid salivary glands of immature rats*		
	2	3	4
Experienced	311,5 ± 118,1	427,8 ± 102,5	648,8 ± 163,7 #
Control	595,0 ± 2134	515,0 ± 82,4 #	702,5 ± 223,4

The area of acini in the parotid glands of the rats of the control group on the 2nd, 3rd and 4th weeks of the experiment is higher than similar indicators in experimental animals.

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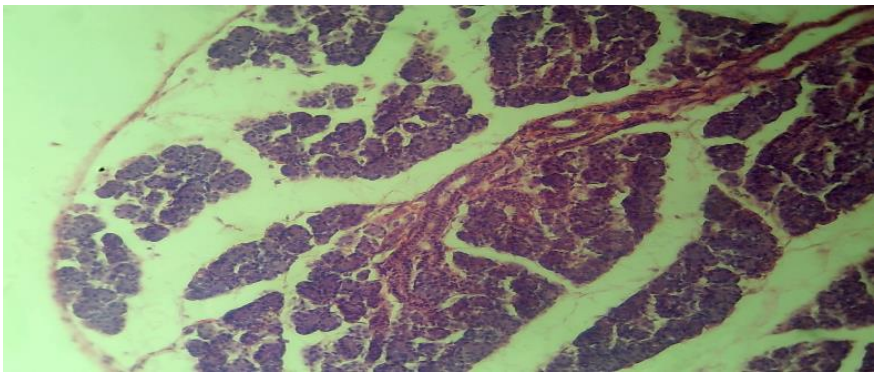

Fig1. Parotid gland of experimental rats on the 4th week of the experiment. Stained with hematoxylin and eosin. Increasing the area of the connective tissue of the septa.

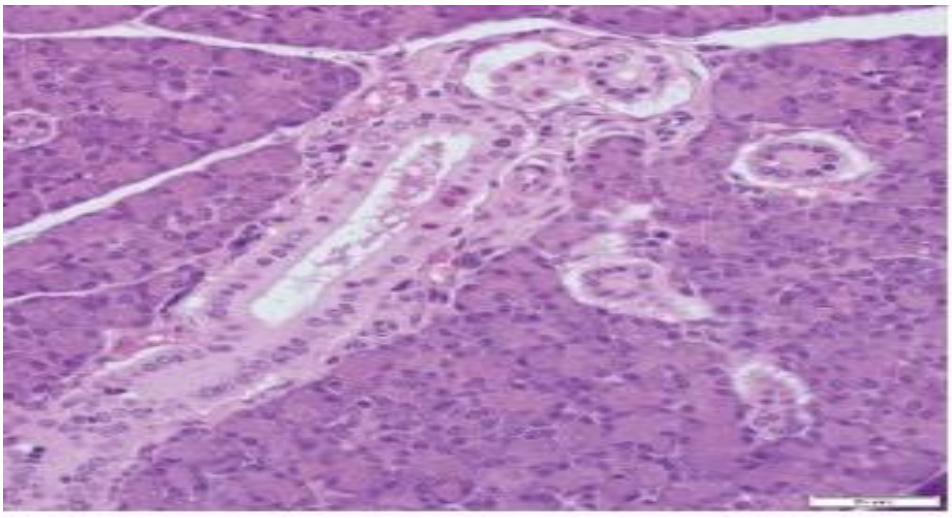

Fig.2. Parotid gland of control rats on the 4th week of the experiment. Stained with hematoxylin and eosin. Enlargement of blood vessels.

In the rats of the experimental group on the 4th week of the experiment, the acini of the parotid glands were visually more intense than in the animals of the control group at the same time. In the parotid glands of the rats of the Experimental group, acini epithelial cells were characterized by intense pyroninophilia of the basal and perinuclear parts of the cytoplasm, which decreased towards the end of the experiment.

Table №2

Specific volume of intralobular ducts of large salivary glands of immature rats, %, M ± σ			
Group	*Specific volume of intralobular ducts of the parotid glands of immature rats*		
	2	3	4
Experienced	25,07 ± 5,02	25,87 ± 4,79	19,70 ± 9,75
Control	23,95 ± 4,62	25,49 ± 6,43	23,95 ± 5,47

In the earliest periods of postnatal ontogenesis, we note critical points in the development of the parotid salivary gland, when the organ is in a state of mobilization of all supply systems, and in the involutory period, when the process of active compensatory activity leads to a change in both the gland itself and its organocomplex as a wholeThe most significant changes in the micromorphology of the gland also occur in the milky and involutory periods, when mucocytic cells that are not characteristic of other periods of development are clearly visualized in the

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histostructures of the parenchyma, which leads to changes in the nature of the secret and the functional characteristics of the organ.

CONCLUSION

From the foregoing, it follows that the development of the parotid salivary gland occurs as a result of the implementation of its genetic program, and its innervation pathways and blood vessels implement their program. The parotid salivary gland, the ways of its innervation and blood supply develop along converging trajectories, which are combined in their last, third, stage of development, the stage of late organogenesis, when an organ with its parenchyma and stroma is formed. It is shown that according to the results of the experiment, not only structural, but also morphological changes develop, most pronounced in the epithelial cells of the terminal sections of the parotid glands of immature rats. Summing up the results of our own research on the morphology of the parotid salivary gland, we note that in immature rats, as a result of intestinal dysbacteriosis, acini cells are accompanied by a slowdown in the development of epithelial cells of granular convoluted tubes, which are the site of synthesis and secretion of endocrine biologically active factors of the submandibular glands.

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