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Structure organization of human lacrimal gland excretory ducts

Introduction. Generally, publications devoted to the exocrine glands morphology elucidate the issues connected with mechanisms of secreta discharge through excretory ducts [3, 7, 8, 9,12]. Naturally, they all have a certain common biological traits and distinctive features due to its specific structure and, therefore, functioning [4,10,13].

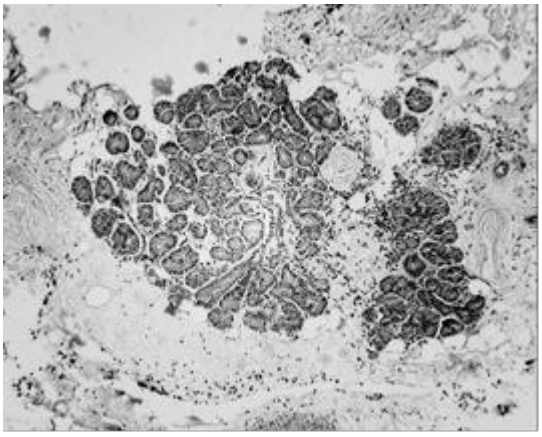
Purpose. The paper was aimed at the study of the structure of lacrimal gland duct system to detect morphological and stereological peculiarities, promoting the tear drain and discharge.

Methods and Materials. Sets of paraffin (5-10) and semi-thin (3μm) sections (total n=900) of human lacrimal glands have been consistently analyzed using light microscopy. Paraffin sections were stained with hematoxylin-eosin and semi-thin section were stained with 0,1 % toluidine blue. Morphometry of the excretory lacrimal gland ducts, two-dimensional graphical and 3D plastic reconstruction has been made on the basis of sets of semi-thin sections [5,13, 14]. Mathematical processing of morphometric data was carries out according to conventional methods of statistics [1, 11].

Results and Discussion. System of excretory ducts of greater and smaller lacrimal glands have not been fully elucidated in recent scientific publications, though excretory portion of the lacrimal apparatus is described in details [2, 6, 12, 15]. While

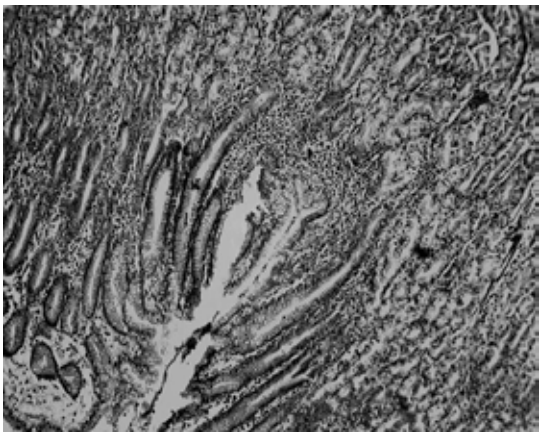
discussing the findings of our research the common morphological data with regard to structure of human lacrimal glands and its excretory function is worth mentioning.

Lacrimal fluid is secreted by lacrimal glands of different localization and size. Similar to salivary gland, they can be divided into greater and smaller lacrimal glands. The amount of produced tears is also varies. In special cases, the required amount of tears in large volume can be produced by the greater lacrimal gland, which is located in the upper outer corner of the orbit. It is traditionally divided into deep orbital and superficial palpebral portions. Small (accessory) lacrimal glands are scattered along both fornices of conjunctiva and, admittedly, in the anterior fornix their number is greater than in the posterior one [12]. They are, so called, accessory lacrimal glands (Figure 1).

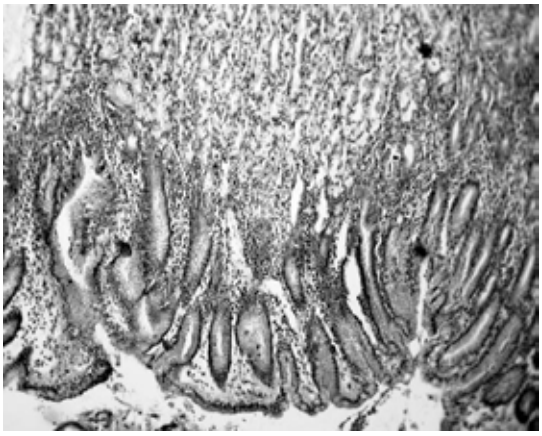


Localization of small lacrimal glands in the posterior fornix of conjunctiva is not mentioned by other authors [2, 5]. Similar glands are found in the caruncula lacrimalis, where their size is lesser in contrast to conjunctival glands [12]. Small accessory lacrimal glands excrete insignificant amount of secretion daily, though it is enough to secrete the eye surface, preventing the development of "dry eye" symptom. Both lacrimal glands are developed from the conjunctiva and are assigned to complex tubuloacinar serous glands.

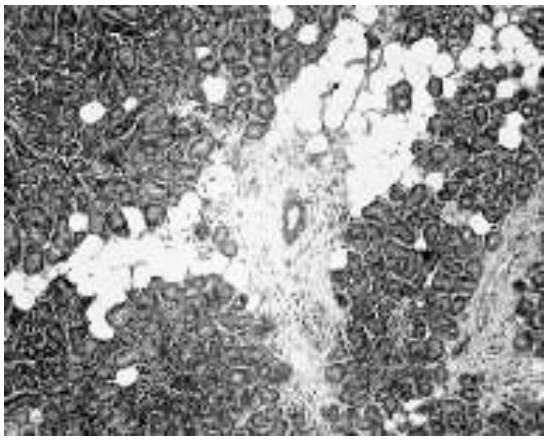
The data shows that the number of orifices of excretory ducts is up to twenty (Figure 2) in the lateral area of anterior fornix of the conjunctiva, but not "from six to fourteen", as admitted by some sources of publications.



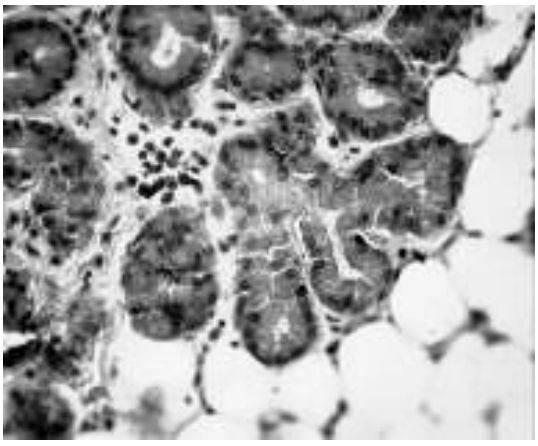
The lacrimal gland itself is the conglomerate of small acinous glandulae grouped into two masses. Numerous cellular tissue has been found inside each mass (Figure 3).



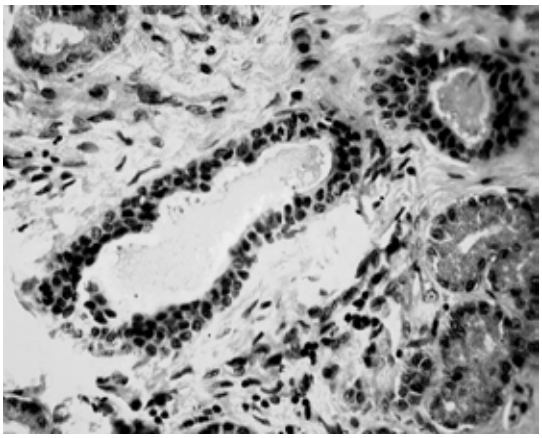
At first sight the structure of lacrimal gland is very different from the salivary glands. Lobules with usually broad interlobular connective tissue sheets can be distinguished within each mass. Each lobule is polymeric and formed by sublobular units. Sublobular unit is represented by a tube with slight enlargement of its dead end (acine) and single intercalated duct. Generally, the intercalated duct integrates only one acine. Such tubes are densely packed within the lobule, and connective tissue sheets between them are very small. The cavity of the acine and intercalated duct is small in its size and may not be detected on the paraffin sections at all (Figure 4).



No sharp narrowing of the outer diameter of the intercalated duct in the point of its transition into the acine has been detected on the sections where the cavity is visualized. Narrowing of its lumen has been detected more frequently. Generally, acine and intercalated portions lie in different sectional plane and at the obtuse angle to each other. No cases of two or more acines integration by single intercalated duct have been found in human lacrimal glands. Radial type of symmetry is preserved in the lobule since intralobular duct, surrounded by inflowing intercalated ducts, forming the branches of intralobular duct, is located in its center. It represents the first chain in the system of tear collectors (Figure 4).



Intralobular ducts are represented by long tubes, lined with cuboidal epithelium, with a narrow opening, having at its length minor enlargements and narrowings. Lobular and interlobular ducts have significantly larger inner lumen and outer diameter in contrast to intralobular ducts. They can sharply change its direction, forming sometimes wavy curves. Narrowings and enlargements of the diameter are detected along its length (Figure 5).



Some specimens show that in lacrimal gland the major amount of acinous epithelial aggregates are located in the mass of conjunctiva and its biggest in diameter interlobular and main excretory ducts are located in the near-epithelial area (Figure 6). Typically, in the section plane they are visualized in different angles, have pyriform enlargements and some of them curved spirally (Figure 2). No sharp narrowings of main excretory ducts lumen have been detected in the orifices area.

Conclusions. All the above mentioned facts indicate that the excretory ducts of human lacrimal gland are adapted to the accumulation of the end secretion products and secreta drain, facilitated by its specific morphological structure (the phenomenon of siphonization and spiralization), promoting the progressive tears drain through the system of excretory ducts.

Perspectives of further research. The follow up studies of morphology of human palatine, labial and lacrimal glands and system of its excretory ducts will encompass comparative structural analysis to ground the possibility of transplantation of smaller salivary glands into conjunctiva in the "dry eye" syndrome.

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