Vascular Tissue Relationships of the Prostate in Mature Rats with Chronic Alcoholism

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ABSTRACT

The article analyzes the results of a study on the histological relationship between glandular and non-glandular structures of the prostate gland of mature rats and its structural changes in chronic alcoholism.

In animals with chronic alcoholism, an increase in the diameter of the acini, a decrease in the volume fraction of the glandular parenchyma in the structure of the organ, and foci of epithelial stratification and cell proliferation are observed.

Chronic exposure to alcohol leads to a pronounced degree of lymphocytic infiltration with lymphoid nodular formation, to a pronounced form of connective tissue proliferation, in the interglandular stroma the number and diameter of vessels increase and their wall thickness decreases.

Keywords: rat prostate, gland, acinus, lymphocytes, morphometry, chronic alcoholism

Introduction

The activity of researchers in the study of the morphology of the male reproductive system remains high, which is associated not only with the cognitive interest in this urgent problem of medicine, but is also determined by the ever-increasing range of modern problems of great medical and social importance. The latter include exposure to various environmental factors, including chemical ones. Excessive consumption of alcoholic beverages and the resulting problems are of concern and alarm around the world. Studies have shown that chronic use of ethanol leads to various morphophysiological changes in the male reproductive system, both in humans and in laboratory animals, this leads to various pathologies of the body (2,3,5,6,7,8).

It should be noted that in a comparative aspect, the morphology of the prostate in puberty and under chronic alcohol exposure with a description of the morphometry of all vascular tissue structures has not been practically studied in a comprehensive manner. In this regard, the study of the morphological features of an organ under conditions of chronic alcohol exposure is of undoubted interest for theoretical and practical medicine.

Material and methods

The study was performed on 20 outbred white male rats at the age of 9 months. 2 experimental groups were formed: 1st - control (n=12); 2nd – experimental group (n=8).

In the experimental group, for modeling chronic alcoholism, forced alcoholization of animals was used using a 40.0% ethanol solution (4). The solution was administered intragastrically using a metal probe 1 time per day at a total dose of 7 g/kg of body weight for 1 month before the study age. Control animals received intragastrically equal volumes of 0.9% NaCl solution. Rats were sacrificed by instantaneous decapitation under ether anesthesia, according to approved rules (1).

For histological examination, pieces of the prostate were fixed in 10% buffered formalin and embedded in paraffin according to the standard method. Histological sections

obtained from paraffin blocks, 5-7 μm thick, were stained with hematoxylin and eosin for review purposes, collagen fibers were detected by van Gieson staining.

With a microscope magnification of 70 times (7x10), the sections were determined:

- the shape of the lumen of the glands, the number of terminal sections of the glands in the field of view, the volume fraction of acini with and without secretion (in %), the number of acini with desquamated epithelial cells in the field of view, in the intralobular stroma, the number of intraorgan vessels in the field of view was counted.

In the preparations, at a magnification of 280 times (7x40), using an eyepiece micrometer, the diameter of the lumen of the glands, the height of the epithelium, the inner diameter and wall thickness of intraorganic vessels were measured. In addition, the thickness of collagen fibers and their distribution in the tissues of the gland were determined.

In the field of view (7x40), the presence and severity of lymphocytic infiltration in the tissues of the gland was assessed. When distributing lymphocytes by severity (cell density), the classification of the North American Chronic Prostatitis Collaborative Research Network and the International Prostatitis Collaborative Network was used:

1) mild degree - single lymphocytic cells separated by distinct intermediate zones;

2) moderate degree - confluent fields of lymphocytic cells without tissue destruction and / or lymphoid nodular / follicular formation;

3) severe degree - confluent fields of lymphocytic cells with tissue destruction and / or lymphoid nodular / follicular formation.

To assess the severity (fibrosis) of the proliferation of connective tissue using an eyepiece micrometer with a magnification of the objective x40, eyepiece x7 in the field of view, the thickness of the stroma layers between the glands was measured.

The degree of compaction of the connective tissue was determined by the appropriate method (Gorbunova E.N., Davydova D.A., Krupin V.N., 2011) as follows: 1) mild form (increase in the thickness of stromal septa up to 2 times in 2-4 fields of view out of 10); 2) moderate form (the thickness of the stromal septa is increased up to 2 times in more than 4 fields of view or a sharp thickening - more than 3 times and is present in single (1-2) fields of view); 3) pronounced form (stromal septa are enlarged up to 3 times or more in 7-10 fields of view).

Conducted a study of the volume fractions of glandular and stromal elements (in%). To do this, using the morphometric grid G.G. Avtandilov (with the number of intersections 100) using an eyepiece x10, a lens x10 in each preparation of the prostate in 10 fields of view, the number of intersections falling on the stromal and glandular (including the lumen of the gland) elements was counted to determine their ratios.

Results and its discussion

The study found that in 9-month-old rats, the prostate consists of terminal glandular sections and muscular-elastic stroma.

Survey microscopy reveals papillary outgrowths in acini in 60-80% of cases, the terminal sections are represented by a cylindrical epithelium with high columnar and basal cells that lie on the basement membrane. The thickness of the epithelial lining varies from 16.8 to 21.0 μm, averaging 19.74 ± 0.21 μm. Acini are predominantly oval and rounded (Fig. 1). The diameter of the lumen of the glands varies from 336.0 to 840.0 μm, averaging 531.7±20.6 μm. The number of acini in the field of view ranges from 10 to 21, averaging 14.9±0.6. The volume fraction of acini with a secret is in the range of 85-100%, on average - 92.0 ± 0.8. The proportion of acini without a secret is 0-15%, on average 8.0±0.8. Acini with desquamated epithelial cells are not detected in preparations.

In the periglandular stroma, single scattered lymphocytes are determined, separated by clear intervals. Their number in the field of view ranges from 9 to 14, on average 12.5±0.3. In the preparations, a thin stroma is determined, the thickness of the stromal septa between the acini ranges from 42.0 to 71.4 μm, averaging 53.3±1.7 μm.

The number of stromal vessels in the field of view is in the range of 7-10, averaging 9.0±0.2. The inner diameter of the venules is in the range from 21.0 to 33.6 microns, on average - 29.8±0.67 microns. The thickness of their wall ranges from 4.2 to 8.4 microns, on average - 7.52 ± 0.21 microns. The diameter of the

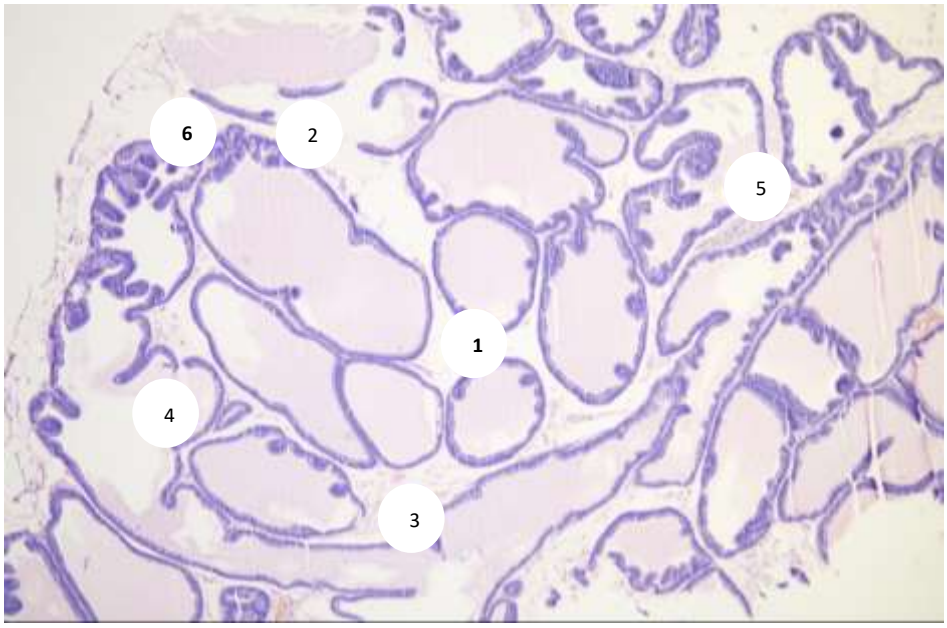

Fig.1. Prostate of a 9 month old rat. Stained with hematoxylin-eosin. 1-round and oval acini with intraluminal homogeneous secretion, 2-interlobular stroma, 3-vessels of the intralobular stroma, 4-epithelial-stromal outgrowths, 5-bundles of smooth myocytes, 6-gland capsule. OK. 10 x vol. 20.

capillaries varies from 12.6 to 16.8 μm, on average 15.2±0.21 μm. The wall thickness is in the range of 4.2-8.4 microns, on average - 5.0±0.21 microns. The inner diameter of arterioles ranges from 12.6 to 16.8 μm, averaging 15.12±0.21 μm. Their wall thickness varies from 4.2 to 8.4 μm, on average 8.0±0.21 μm.

The volume fraction of glandular tissue is 85-91%, on average 88.2±0.3%. The proportion of stromal tissue ranges from 9-15%, averaging 11.8±0.3%.

Collagen fibers envelop the terminal sections of the glands, most of the fibers lie under the epithelium, and form a finely looped network in the stroma (Fig. 2). The thickness of collagen fiber bundles varies from 8.4 to 12.6 μm, averaging 11.6±0.21 μm.

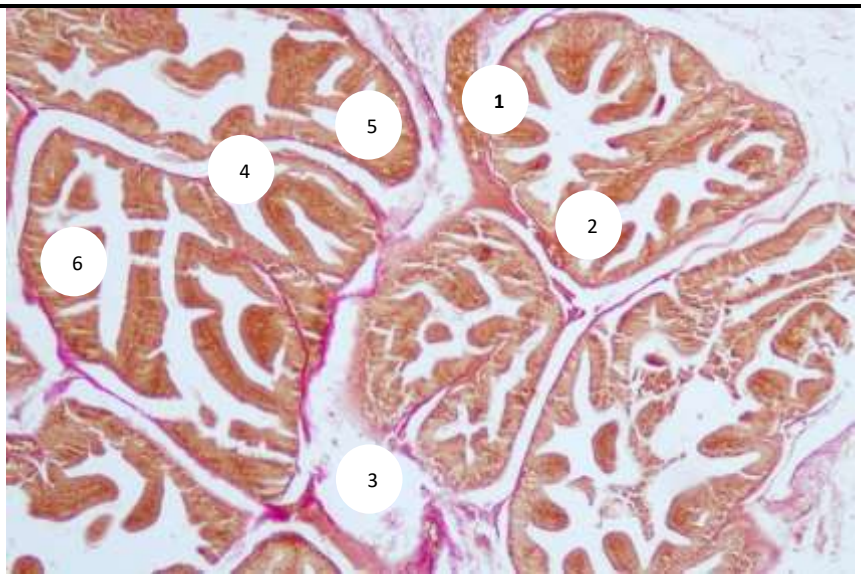

Fig.2. Prostate of a 9 month old rat. Van Gieson coloring. 1-terminal secretory section, 2-cylindrical epithelium, 3-fibrous-muscular stroma, 4-bundles of collagen fibers around the secretory sections, 5-stromal small-loop network formed by collagen fibers, 6-epithelial-stromal outgrowths. OK. 10 x vol. 20.

The study showed that in 9-month-old rats of the experimental group, acini in 50% of cases have a folded appearance, are represented mainly by squamous epithelium, in places there are cubic and highly prismatic epithelium (Fig. 3). The height of the epithelium varies from 4.2 to 12.6 μm, on average 7.56±0.38 μm. In some preparations, areas of cell proliferation are detected in the epithelium, which are distinguished by a dark color due to the high density of epitheliocytes (Fig. 4). In places in the epithelium, foci of epithelial stratification are determined, while in the epithelium the rows of layers are disturbed, cell polymorphism is noted. The terminal sections of the glands are predominantly irregular in shape; oval-shaped acini are found. The lumens of the acini are convoluted (Fig. 3). The diameter of the lumen of the glands ranges from 231.0 to 483.0 microns, on average - 354.9 ± 10.5 microns. The number of acini in the field of view ranges from 12 to 34, averaging 23.5±1.2. The volume fraction of acini with a secret is in the range of 50-70%, on average - 58.8±1.1. The proportion of acini without a secret is 30-50%, on average 41.2±1.1. Fragments of desquamated cells are found in the lumen of single acini. In the field of view, the number of acini with desquamated epithelium varies from 3 to 6, on average 5.1±0.2.

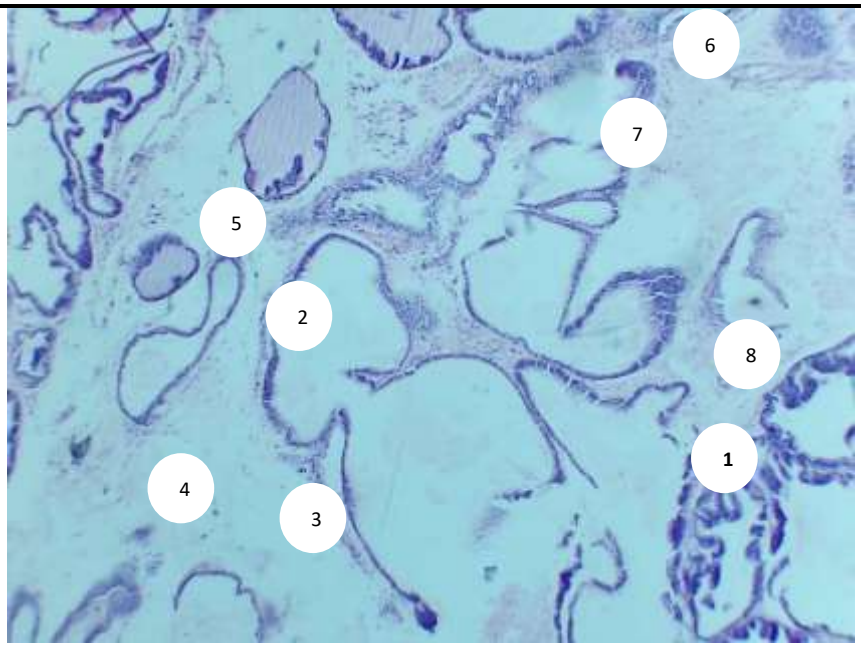

Fig.3. Prostate of a 9-month-old rat of the experimental group. Stained with hematoxylin-eosin. 1-acinus with papillary structures, 2-acinus without papillary structures, 3-squamous epithelium of the acinus, 4-dilated stromal septa, areas of exposure, tissue structure of the gland disappears, 5-intraluminal desquamated epithelial cells, 6-rounded lymphoid nodule in the interglandular stroma , 7-diffuse accumulations of a large number of lymphocytes in the stroma, which destroy the epithelial lining of the acinus, 8-venule, filled with blood cells. OK. 10 x vol. 20.

In the fibromuscular stroma, diffusely scattered accumulations of lymphocytes are determined in the subepithelial layer of the stroma, while in some places there is a violation of the integrity of the epithelial lining. Also, accumulations of lymphocytes are visualized inside the lumens of the acini and around the vessels of the intralobular stroma, which infiltrate the walls of the vessels. In most preparations, focal accumulations of lymphocytes are observed in the form of lymphoid nodules of round, oval shapes (Fig. 3,4). It is not possible to count the number of lymphocytes in the stroma (in the field of view) because of their huge number. The thickness of the stromal septa between the acini is sharply increased, especially in the subcapsular zone, exposure occurs between the acini, and the tissue structure of the gland is lost (Fig. 3). The thickness of the partitions ranges from 252.0 to 462.0 μm, averaging 326.3±11.3 μm.

In the interglandular stroma, a large number of venules, capillaries and arterioles are determined, in almost all of them phenomena of stasis of blood cells in vessels with extensive areas of hemorrhages are observed. The diameters of the vessels are sharply expanded, the wall thickness is reduced (Fig. 5). The number of stromal vessels in the field of view is in the range of 12-18, averaging 15.4±0.3. The inner diameter of the venules ranges from 25.2 to 37.8 μm, on average 34.44±0.67 μm. The thickness of their wall ranges from 4.2 to 8.4 microns, on

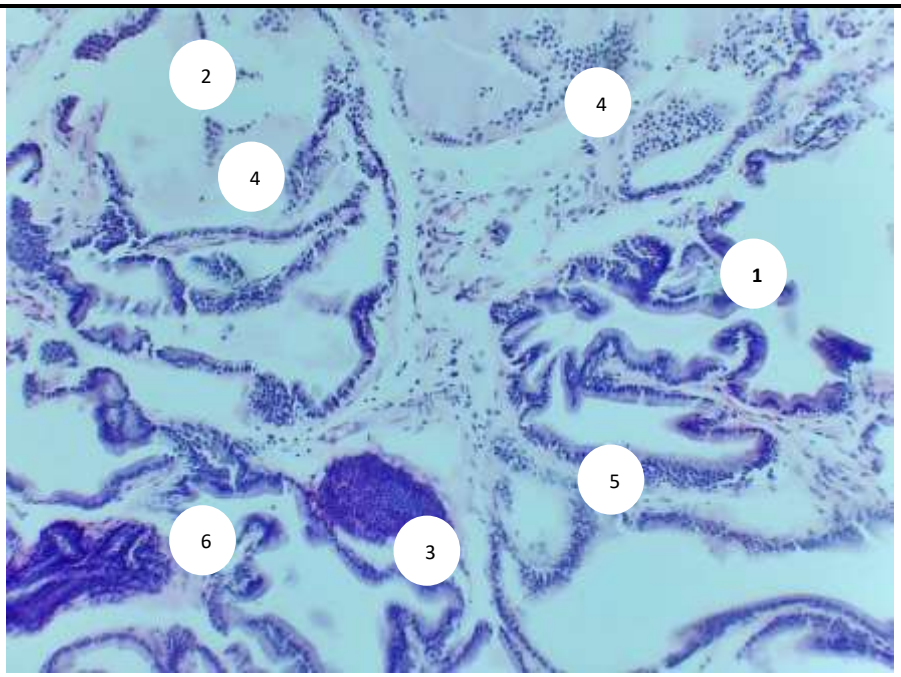

Fig.4. Prostate of a 9-month-old rat of the experimental group. Stained with hematoxylin-eosin. 1 - tortuous, irregularly shaped acini, 2 - ruptures of the epithelial lining of the acini, 3 - oval-shaped lymphoid nodule in the interglandular stroma, 4 - diffuse accumulations of lymphocytes within the acini, 5 - diffuse accumulations of lymphocytes in the subepithelial layer of the stroma, which destroy the epithelial lining of the acinus, 6 -areas of cell proliferation. OK. 10 x vol. 20.

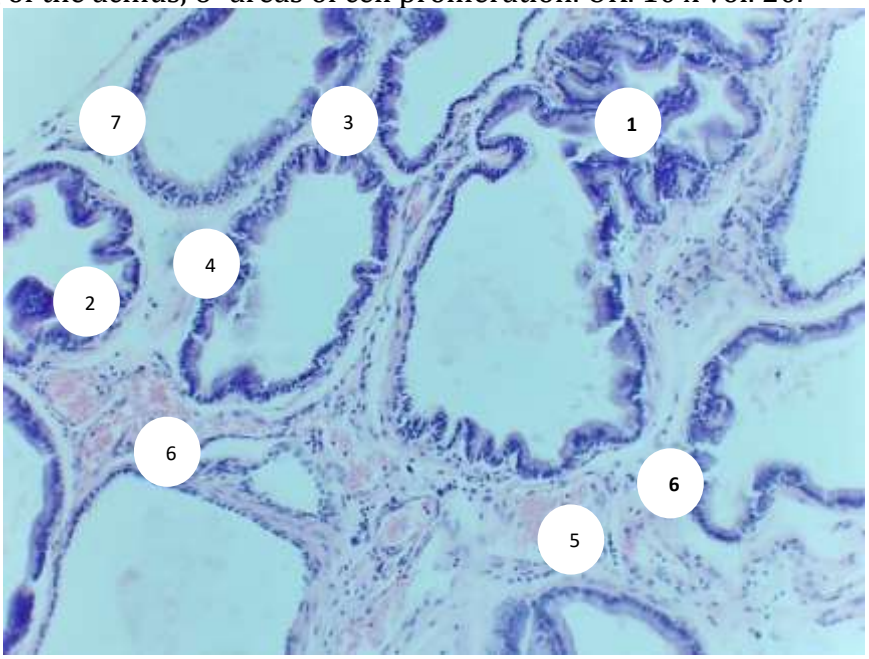

Fig.5. Prostate of a 9-month-old rat of the experimental group. Stained with hematoxylin-eosin. 1-tortuous, folded, irregularly shaped acini, 2-fibromuscular stroma, 3-acinus cavity, oval-shaped lymphoid nodule in the interglandular stroma, 4-diffuse accumulations of lymphocytes in the subepithelial layer of the stroma, 5-accumulations of lymphocytes around the vessels of the stroma, 6-phenomena of stasis shaped elements in vessels with extensive areas of hemorrhages, 7-capsule of the gland. OK. 10 x vol. 20.

Average - 6.3 ± 0.21 microns. The diameter of the capillaries varies from 12.6 to 21.0 μm, on average 17.64±0.42 μm. The thickness of their wall is in the range of 2.1-4.2 microns, on average - 3.74±0.42 microns. The inner diameter of arterioles ranges from 12.6 to 21.0

μm, averaging 17.68±0.42 μm. Their wall thickness varies from 4.2 to 8.4 μm, on average 5.59±0.21 μm.

In 9-month-old rats of the experimental group, the stroma is larger than the glandular tissue. Morphometry of the parenchymal-stromal ratio showed that the relative area of its parenchyma varies within 17-52%, averaging 30.9±1.9%. The proportion of stromal tissue ranges from 60-83%, averaging 69.1±1.2%.

In the experiment, numerous, wide strands of dense fibrous tissue of collagen fibers occupy all the interglandular regions of the stroma. They are found around the acini and ducts of the gland, where they densely braid the smooth myocytes of the stromal layer. In some preparations, a coarse network of collagen fibers is formed in the interacinar stroma, which push the network away from the basement membrane of the terminal sections. In places they are torn and torn. The thickness of collagen fiber bundles varies from 4.2 to 8.4 μm, averaging 7.35±0.21 μm.

Conclusions

1. The prostate of 9-month-old rats is characterized by folded acini of oval and rounded shapes, a high percentage of glandular tissue and a predominant volume of secretory end sections filled with secretion.

2. In rats, under the influence of alcohol, a decrease in folding and secretory activity of the terminal sections, an increase in the diameter of the lumen of the glands, a decrease in the volume fraction of the glandular parenchyma in the structure of the organ, and foci of epithelial stratification are observed.

3. In the experiment, a pronounced degree of lymphocytic infiltration with tissue destruction, a violation of the integrity of the epithelium and a lymphoid nodular formation, a pronounced form of connective tissue proliferation with a sharp increase in the thickness of stromal septa, exposure, loss of the tissue structure of the gland is noted.

4. Exposure to alcohol leads to vascular changes, manifested by an increase in the number and diameter of blood vessels, a decrease in the thickness of their walls and lymphoid infiltration of perivascular zones, phenomena of stasis of blood cells in vessels with extensive areas of hemorrhages are revealed.

References

1. Koptyaeva K.E., Muzhikyan A.A., Gushchin Ya.A., Belyaeva E.V., Makarova M.N., Makarov V.G. Method of autopsy and extraction of organs of laboratory animals // Message 1: rat. Laboratory animals for scientific research. - 2018. - No. 2. - C. 71-92. DOI: 10.29296/10.29296/2618723X-2018-02-08.
2. Moiseev V.S. Alcoholic disease. Damage to internal organs. 2nd ed., revised. and additional M.: GEOTAR - Media. 2014; 480.
3. Radjabov A.B. Morphometric analysis of body weight and anatomical parameters of the prostate gland in rats with chronic alcohol intoxication. Vestnik vrach. - 2022. - No. 3 (106). - P.89-93.
4. Sidorov P.I. The use of laboratory animals in a toxicological experiment: guidelines. Ed. Sidorova P.I. - Arkhangelsk. - 2002; 15 s.
5. Shcherbakova V.M. Morphometric indicators of the main structural components of white rat nephrons in acute and chronic alcohol intoxication in the experiment // Forensic medical examination. - 2016. - No. 4. – S. 28-30.
6. 6.Candido, E.M. Experimental alcoholism and pathogenesis of prostatic diseases in UChB rats / Candido E.M., Carvalho C.A., Martinez F.E. et al. // Cell Biology International. - 2007. - Vol. 31, No. 5. - P. 459-472.
7. Gastfriend D.R., Garbutt J.C., Pettinati H.M., Forman R.F. Reduction in heavy drinking as a treatment outcome in alcohol dependence. // Journal of Substance Abuse Treatment. Vol.33 Issue 1. (2017) pp.71-80.
8. Mendes, L.O. Mast cells and ethanol consumption: interactions in the prostate, epididymis and testis of UChB rats // L.O. Mendes, J.P. Amorim, G.R.

Teixeira et al. // American Journal of Reproduction Immunology. - 2011. - Vol. 66, No. 3. - P. 170-178.