



Morphometric assessment of age-related structural changes in the vessels of the microcirculatory bed of the prostate gland under conditions of ethanol intoxication

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Abstract. Vessels of the microcirculatory bed ensure the full trophism of the body at the level of capillary-tissue relations and are the first to respond to various functional and pathological conditions of organs. At the same time, morphological changes in prostate microvasculature with age under conditions of prolonged ethanol poisoning have been understudied. The purpose of this study was to determine the age-related remodelling of the prostate vessels of the microcirculatory bed in case of prolonged alcohol intoxication. Injection, histological, morphometric, and statistical methods were used. The microvasculature of the prostate gland of 80 sexually mature white male rats of different ages was studied, 40 animals served as controls, and 40 rats were injected daily for 28 days with a 30% ethanol solution at a dose of 20 ml/kg intragastrically. Morphometric analysis indicated that chronic ethanol poisoning in white rats significantly reduces the lumens of arterial microvessels and hemocapillaries, while expanding the venous vessels in the microcirculatory bed of the prostate gland. When venous congestion occurs, the density of microvessels decreases, and microcirculation bed is disturbed. This disruption is accompanied by atrophic, dystrophic, and necrobiotic changes in endotheliocytes, epithelial cells, muscle cells, stromal structures, infiltration, and sclerosing. Intragastric 28-day administration of a 30% ethanol solution at a dose of 20 ml/kg to laboratory mature white male rats leads to pronounced structural changes in the microvasculature of the prostate microcirculatory bed: constriction of arterioles, precapillary arterioles and hemocapillaries, dilation of the capillary venules and venules, which is complicated by significant venous haemorrhage, development of atrophy, dystrophy, necrosis of vascular endothelial cells, glandular epithelial cells, muscle cells, connective tissue structures,

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cellular infiltration, and sclerosis. Vessels of the microcirculatory bed play a leading role in ethanol-induced damage of prostate structures, which dominate in 24-month-old experimental animals

Keywords: morphological parameters; vascular remodelling; alcohol; age

◆ INTRODUCTION

Ethanol and its metabolites have a powerful membranotropic effect, complicated by a pronounced increase in endogenous intoxication, increased lipoperoxidation, decreased antioxidant defence, deterioration of microcirculation bed, metabolic disorders in the body, structural and functional changes in all organs and systems [1-3]. Modern sources of medical and biological literature indicate that prolonged and systematic use of ethanol leads to damage and dysfunction of the cardiovascular, digestive, nervous, endocrine, and immune systems [4-6]. Thus, J. Fernández-Solà [5] found that cardiovascular damage caused by alcohol is often complicated by cardiomyopathy, which mainly leads to disability and mortality. O.A. Kostiuk & O.V. Denefil [2], studying ethanol cirrhosis and liver fibrosis in high and low emotional rats, found that the intensity of lipid peroxidation dominated in liver cirrhosis in rats with high emotional reactivity. S.O. Nesteruk & I.M. Klishch [1] investigated changes in endogenous intoxication indicators by the level of average mass molecules and erythrocyte index in rats of different sexes with chronic ethanol poisoning. The studies and the results obtained showed that under conditions of prolonged ethanol intoxication of animals, endotoxicity indicators increased, which were dominant in females. The growth of endogenous intoxication in rats under the influence of ethanol adversely affects the state of membrane structures, which is complicated by impaired function of various organs and body systems.

The microcirculatory system is directly important for the full life support of cells and tissue structures of the body. Unlike arteries and veins, microvessels form an orderly system of microcirculation pathways, facilitating continuous blood flow near cells and tissues of organs, carrying out various metabolic processes and ensuring the full functioning of organs and body systems. The microcirculatory system of organs, consisting of arterioles, precapillary arterioles, hemocapillaries, postcapillary venules, venules and arteriolo-venular anastomoses, plays a major role in the development of such general pathological processes as hypoxia, inflammation, degeneration, necrobiosis. Microvessels are the first to react to various changes in hemodynamics and the effects of negative endogenous and exogenous factors on the body [7-9]. Despite numerous studies investigating the structural and functional restructuring of the microcirculatory system in various physiological and pathological conditions, the patterns of reactions to these processes of the microcirculatory system links: arterial (arterioles and precapillary arterioles), metabolic vessels (hemocapillaries), and its venous part (postcapillary venules and venules) are still unresolved [7, 10].

Age-related changes in the structures and vascular bed of the prostate gland have been investigated by experimentalists and clinicians [3-5]. With age, profound structural and functional changes occur in the epithelial, muscular, stromal components and vascular bed of the prostate gland, which can lead to pathological damage to

this organ, which often occurs under various effects of negative endogenous and exogenous factors on the body [1]. The number of pathological conditions of this organ (inflammatory processes, hyperplasia, adenoma, benign and malignant tumours) is also increasing. In their morphogenesis, the leading role is played by the microcirculatory system, which is a prominent issue in gerontology and urology, as it adversely affects the reproductive function and performance of men [11]. The microcirculatory system in the prostate gland functions most optimally during puberty, adequately and fully meeting the needs of this organ and its tissue homeostasis. At various stages of ontogenesis, the structure and function of the prostate microvasculature change. Quantitative morphological methods (morphometry) are widely used to investigate the angioarchitectonics of the intra-organ vascular bed of intact organs and in various pathological conditions. Complex processes of blood, tissue, and cell interactions are mainly localised in blood vessels. As noted by M.S. Hnatjuk *et al.* [7], the microcirculatory system plays a significant role in the blood supply to organs and metabolic processes. This system not only reacts sensitively to various physiological and pathological conditions, but also substantially changes the structure and function of cells, tissues, organs, and systems. Therewith, the age-related features of the remodelling of the prostate vessels of the microcirculatory bed in the case of prolonged ethanol poisoning have been understudied. Comprehensive morphometry enables the quantitative characterisation of patterns of age-related morphogenesis and adaptive morphology in ethanol poisoning. This approach provides an objective interpretation of processes, significantly enhances researcher capabilities, predicts complications and develops adequate methods for correcting this pathology. The purpose of this study was to investigate the effect of prolonged ethanol intoxication on age-related vascular remodelling of the prostate vessels of the microcirculatory bed.

◆ MATERIALS AND METHODS

The experiment was carried out in September 2021 on 4 groups of laboratory mature white male rats. Group 1 included 20 control intact healthy experimental rats aged 8 months, Group 2 – 20 similar white male rats aged 24 months, Group 3 – 20 rats aged 8 months with ethanol intoxication, Group 4 – 20 animals aged 24 months rats with the indicated modelled pathology. Ethanol intoxication was modelled by intragastric administration of a 30% ethanol solution at a dose of 20 ml/kg once daily for 28 days [1]. The experimental animals were of the same weight: 8-month-old rats – 166-170 g, 24-month-old rats – 295-300 g. The dose of ethanol was calculated for each animal separately according to its weight. According to laboratory practice, intragastric administration of drugs to experimental animals does not require anaesthesia. The euthanasia of the rats was performed by bloodletting under

general thiopental anesthesia on day 28 from the beginning of the experiment. The rats were from the vivarium of the I. Horbachevsky Ternopil National Medical University of the Ministry of Health of Ukraine. The vivarium room was kept at a constant humidity and air temperature, with daily fluctuations in day and night lighting, and the vivarium's diet. The experimental animals were constantly monitored, and sick rats were culled and not used in the experiment.

The vascular bed of the prostate gland was filled with a carcass-gelatin mixture [10]. The excised pieces of the organ under study were fixed in Buen's solution, passed through ethyl alcohols of increasing concentration, and embedded in paraffin to form paraffin blocks. Microtome sections (5-6 μm thick) were deparaffinised and stained with haematoxylin and eosin, a mixture of acid fuchsin and picric acid, Mallory's mixture (including three working solutions: Acid fuchsin solution, phosphoric-molybdenum acid solution, a mixture of aniline blue, orange, and oxalic acid), Masson's trichrome method, toluidine blue, and silver nitrate impregnation [12, 13] and studied light-optically and morphometrically.

The diameters of arterioles, precapillary arterioles, hemocapillaries, postcapillary venules, and venules were measured on the obtained microslides of the prostate gland, and the number of microvessels per 1 mm^2 of tissue of the organ under study was determined [10]. Fifty measurements were made on each microslide. For the morphometry of prostate microvessels, an Olympus light

microscope (Japan) with a digital video camera and the Video Size 5.0 and Video Test 5.0 software packages were used. The obtained morphometric parameters were statistically processed using the Statsoft Statistica software package (licence No. VXXR303F737429FA-8). The reliability of the difference between the comparative characteristics was determined according to Student's t-test [14, 15].

The rats were kept and all manipulations on them were carried out in strict accordance with the "General Ethical Principles for Animal Experiments" adopted by the Fifth National Congress on Bioethics [16], which is consistent with the provisions of the "European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes" [17], the Law of Ukraine № 3447-IV "On the Protection of Animals from Cruelty" [18] and met the requirements of the Bioethics Commission of the I. Horbachevsky Ternopil National Medical University of the Ministry of Health of Ukraine.

RESULTS

Quantitative morphological characteristics of the vessels of the microcirculatory bed of the investigated organ of laboratory mature white male rats, obtained as a result of the study, are presented in Table 1. A comparative assessment of the obtained quantitative indicators of prostate microvessels revealed that they all changed significantly with age and under conditions of chronic alcohol intoxication.

Table 1. Morphometric characteristics of prostate microvessels of mature white laboratory male rats of different ages ($M \pm m$)

Morphometric parameter	Animal group under study			
	1	2	3	4
Diameter of arterioles, μm	15.86 \pm 0.12	15.16 \pm 0.12**	13.40 \pm 0.12***	12.70 \pm 0.09***
Diameter of precapillary arterioles, μm	10.14 \pm 0.11	9.35 \pm 0.09**	8.90 \pm 0.09***	8.10 \pm 0.09***
Hemocapillary diameter, μm	4.82 \pm 0.04	4.60 \pm 0.03**	4.18 \pm 0.04***	3.95 \pm 0.03***
Diameter of postcapillary venules, μm	12.85 \pm 0.06	13.45 \pm 0.06**	14.50 \pm 0.09***	15.40 \pm 0.12***
Diameter of venules, μm	26.90 \pm 0.18	28.10 \pm 0.21**	30.15 \pm 0.21***	32.10 \pm 0.24***
Number of microvessels	3820.5 \pm 27.3	3810.4 \pm 26.4	3550.2 \pm 30.3**	3460.8 \pm 31.2***

Notes: ** – $p < 0.01$; *** – $p < 0.001$ relative to the first group of animals

Source: compiled by the authors

It was found that the diameter of the arterioles of the intact prostate gland in 24-month-old laboratory sexually mature white male rats statistically significantly ($p < 0.01$) decreased from (15.86 \pm 0.12) μm (young animals) to (15.16 \pm 0.12) μm , i.e., by 4.4%. With age, the diameter of the precapillary arterioles changed similarly. Thus, this quantitative morphological index of the prostate gland in 8-month-old laboratory mature white male rats was (10.14 \pm 0.11) μm , and in the second group of observations (24-month-old experimental animals) – (9.35 \pm 0.09) μm . These morphometric parameters were statistically significantly different ($p < 0.01$). Therewith, the diameter of precapillary arterioles in white rats of the second group of observations was 7.8% smaller compared to the same quantitative morphological index of the prostate gland of the first group of animals.

Age also influenced the metabolic link of the microcirculatory bed (hemocapillaries) of the prostate gland of laboratory sexually mature white male rats. It was found that in the 1st group of observations (8-month-old white rats) the diameter of the hemocapillaries of the organ under study was (4.82 \pm 0.04) μm , and in the 2nd group (24-month-old experimental animals) – (4.60 \pm 0.03) μm . The latter morphometric parameter showed that the lumen of prostate hemocapillaries in laboratory mature white male rats of the older age group was smaller by 4.56% compared to 8-month-old animals.

The obtained and analysed morphometric parameters of the vessels of the prostate microcirculatory bed in laboratory mature white male rats indicated that venous microvessels (postcapillary venules and venules) expanded with age. Thus, the diameter of the postcapillary venules

of the organ under study in 24-month-old animals was $(13.45 \pm 0.06) \mu\text{m}$. This quantitative morphological parameter with a statistically significant difference ($p < 0.01$) was 4.66% higher than the same morphometric parameter of the prostate gland (12.85 ± 0.06) of micrometre white rats of the younger age group.

The structural age-related changes in the prostate venules of laboratory mature white male rats were similar to the changes in the postcapillary venules described above. In 8-month-old animals, the diameter of the venules of the organ under study reached $(26.90 \pm 0.18) \mu\text{m}$, and in 24-month-old laboratory mature white male rats – $(28.10 \pm 0.21) \mu\text{m}$. A statistically significant difference was found between the above morphometric parameters ($p < 0.001$), and the latter quantitative morphological index exceeded the previous one by 4.46%. The number of microvessels on the area of prostate tissue under study in 8-month-old laboratory mature white male rats was (3820.5 ± 27.3) , and in 24-month-old animals – (3810.4 ± 26.4) . The above morphometric parameters did not differ significantly from each other, i.e., the state of prostate microcirculation bed did not change substantially with age.

Light-optimally, the structure of the prostate gland in 24-month-old laboratory sexually mature white male rats was normal. It contained all the structural components of the organ under study. In some venous vessels of the prostate gland, moderate haemorrhage was noted, and single apoptotically altered glandular epithelial cells, muscle cells, and endothelial cells were found. It was found that the diameter of prostate arterioles in the 3rd group (8-month-old animals) under ethanol intoxication statistically significantly decreased from $(15.86 \pm 0.12) \mu\text{m}$ to $(13.40 \pm 0.12) \mu\text{m}$, i.e., by 15.5%. In 24-month-old laboratory sexually mature white male rats, the morphometric parameter under the influence of ethanol was found to be reduced by 16.2% with a statistically significant difference.

The diameter of the precapillary arterioles of the prostate gland under conditions of prolonged ethanol intoxication also changed markedly. Thus, the studied morphometric parameter of the intact prostate gland in the 1st group of (young laboratory sexually mature white male rats) was $(10.14 \pm 0.11) \mu\text{m}$, and under the influence of ethanol – $(8.90 \pm 0.09) \mu\text{m}$. A statistically significant difference was found between these morphometric parameters ($p < 0.001$). Therewith, the diameter of precapillary arterioles in 8-month-old animals under the influence of ethanol decreased by 12.2% compared with the control group. In animals of the older age group, this quantitative morphological index decreased by 13.3% compared to the same control value.

The diameters of hemocapillaries of the prostate microcirculatory bed also decreased with a high degree of statistically significant difference in prolonged ethanol intoxication. In young animals (8-month-old rats), this parameter was reduced by 13.2%, and in 24-month-old laboratory mature white male rats – by 14.1%. It was found that the venous microvessels of the prostate hemomicrocirculatory bed in the modelled ethanol poisoning tended to dilate. The lumen of the postcapillary venules in young animals under the simulated experimental conditions increased significantly by 12.84%, in 24-month-old white rats – by 14.50% ($p < 0.001$), and similar morphometric

parameters of the venules of the prostate microcirculatory bed also expanded by 12.1% and 14.2%, respectively. The number of microvessels per 1 mm^2 of prostate tissue decreased under the influence of prolonged ethanol poisoning. In young animals, this morphometric index statistically significantly decreased by 7.1%, and in rats of the 4th group (24-month-old animals) – by 9.2% ($p < 0.001$). The dynamics of the number of microvessels in the prostate gland indicated a marked deterioration in microcirculation bed, blood supply, and metabolic processes in the organ under study [7].

The light-optical examination of prostate microdissections in case of prolonged ethanol intoxication revealed vascular disorders, haemorrhage, dilation of mainly venous vessels, perivascular and stromal oedema, foci of dystrophically, necrobiotically, apoptotically altered endothelial cells, glandular epithelial cells, muscle cells, focal infiltrates and connective tissue proliferation. Vessels of the prostate microcirculatory bed with uneven lumen, arterioles, precapillary arterioles, hemocapillaries, spasmodic, their lumen is narrowed, the wall was thickened, the lumen of the postcapillary venules, and venules was markedly enlarged, these vessels were tortuous, full of blood with varicose dilations and numerous sacculations, stasis, thrombosis foci, and diapedesis haemorrhages. Plasmorrhagia occurred in the wall of these vessels and perivascular space. The paravascular spaces were enlarged due to oedema, their stroma was distinctly disorganised with disorganisation and sclerosis. The tortuosity of almost all microvessels was noted, which was pronouncedly prevalent in the postcapillary venules and venules of the prostate gland of experimental animals of the older age group. Swollen endothelial cells with processes of atrophy, mainly protein dystrophy, necrosis, foci of desquamation and proliferation were detected. Proliferative processes indicated ischemia and hypoxia of the organ [19]. In some venous microvessels, the absence of endothelial lining was observed. The decrease in the number of microvessels in the prostate tissue was partly due to their reduction, which was visualised in the form of fibrous formations with signs of hyalinosis and incomplete or total obliteration of microvascular lumens on histological sections. Haemolysed red blood cells and hyalinised thrombi were found in the lumen of some microvessels. Basal membranes in arterial microvessels were thickened, often homogeneous with foci of hyalinosis, and there was multiplication and fragmentation of elastic fibres. In the areas of necrotic changes in cells and tissues, cellular infiltration appeared, followed by connective tissue proliferation, i.e., the development of sclerosis. Foci of sclerosis led to a marked reduction in the glandular structures of the prostate gland. The above morphological changes prevailed in the prostate gland of 24-month-old laboratory sexually mature white male rats.

The findings and their comprehensive evaluation prove that prolonged ethanol poisoning of laboratory mature white male rats was complicated by spasm and narrowing of resistive microvessels, which was confirmed by their quantitative morphological characteristics presented in Table 1. The venous microvessels of the microcirculatory bed (postcapillary venules and venules) of the prostate gland under simulated experimental conditions (prolonged ethanol poisoning of animals) were markedly dilated, which

was complicated by venous haemorrhage and hypoxia. The expansion of paravascular spaces with plasmorrhagia, connective tissue proliferation, stasis, thrombosis in the postcapillary venules and venules of the prostate gland significantly increased hypoxia, which disrupted oxygen homeostasis, the full functioning of oxidative enzymes, energy synthesis and all energy-dependent and synthetic processes.

◆ DISCUSSION

In the context of comparable studies, scientists have also previously investigated essential aspects of the microcirculatory system, including its structural changes under different conditions, but there are certain aspects that distinguish the current study from others. It is crucial for the conducted experiment that all links of the prostate gland's microcirculatory channel are comprehensively examined concerning age and long-term ethanol intoxication of experimental animals. This approach allows for an adequate response of the microcirculation bed to the specified exogenous negative factor. Scientists often investigate only a part of the vessels of the microcirculatory system, not covering all its links. Y.V. Silkina *et al.* [3] studied the dynamics of morphometric parameters of the resistive link (arterioles) of the microcirculatory bed of the submandibular gland in chronic alcohol intoxication. The authors considered the outer and inner diameters of the arterioles and their wall thickness and found that ethanol induced spasm of the studied vessels and narrowed their lumen, which is also confirmed by the results of this experiment. These authors investigated only changes in arterioles under the influence of ethanol, i.e., a part of resistive vessels, without examining the long-term effect of ethanol on the patterns of microvascular remodelling of all links of the microcirculatory system, which was supplemented by the present study. Y.V. Silkina *et al.* [3], having conducted a morphometric study of only salivary gland arterioles in chronic ethanol intoxication, indicate that these resistive vessels provide a full blood supply to the organs and adequate oxygenation. The resistive link of the microcirculatory system also includes the pre-capillary arterioles, which play a significant role in the blood supply to organs. These authors did not investigate the metabolic vessels (hemocapillaries), the structure of which determines the fullness of transcappillary metabolism, as well as venous vessels (postcapillary venules and venules), the change in structure and venous fullness of which substantially impairs the oxygenation of cells and tissues, complicated by hypoxia [7].

V.I. Babenko *et al.* [10], studying the long-term effect of various food additives on the microcirculatory system of the gums of rats, histologically, morphometrically, and statistically examined only hemocapillaries, i.e., only the metabolic link of the microcirculation bed, without showing structural changes in arterial and venous microvessels. It is known that the study of the vessels of one link of the microcirculation bed cannot adequately and fully elucidate the patterns of reactions of the microcirculatory system of organs in various physiological and pathological conditions [7, 9].

The analysis of the quantitative morphological studies and the data obtained showed that in healthy 24-month-old laboratory mature white male rats, arterioles, precapillary arterioles, hemocapillaries were moderately narrowed

and postcapillary venules and venules of the prostate gland were dilated. The age-related changes in the vessels of all links of the microcirculatory bed of the intact prostate gland were objectively and adequately obtained. The study was conducted on healthy laboratory mature white male rats, excluding any adverse effects on this organ, which cannot always be fully investigated in the human body that develops various comorbidities with age [1, 11]. The detected age-related changes in the vessels of the prostate microcirculatory bed were substantially enhanced by ethanol, which led to a pronounced disturbance of microcirculation bed and morphological changes in the structural components of the organ under study.

The obtained and analysed results of the study indicate that the effect of ethanol on the body of experimental animals leads to unequal severity of remodelling of arterial, metabolic and venous vessels of the prostate microcirculatory bed, i.e., these microvessels are characterised by different reactions to the action of negative endogenous and exogenous factors. J. Paloczi *et al.* [4] also agree with this statement. The main properties of arterioles, precapillary arterioles, and hemocapillaries are mobility, permeability, and plasticity [7]. These features of these microvessels are different. These vessels of the microcirculatory bed, in the wall of which smooth muscle cells are localised, can change the lumen to the greatest extent, which correlates with the morphometric parameters obtained. The above is adequately confirmed by the pronounced narrowing of arterioles, precapillary arterioles, hemocapillaries and dilation of the postcapillary venules and venules of the prostate gland of laboratory mature white male rats of different ages under prolonged ethanol intoxication.

Most authors [3, 7, 9] assert that a significant constriction of arterioles, i.e., a reduction in the luminal space within arterial vessels of the microcirculatory bed due to adverse endogenous and exogenous factors, impedes organ blood supply, exacerbates major pathologies, and elevates complication rates. A.V. Omelchenko-Seliukova *et al.* [20], having investigated the frequency and nature of complications in patients with polytrauma who consumed alcohol, found a substantial increase in the frequency of various complications in them compared to patients with polytrauma who did not consume alcohol. The current study fully confirms the above statement.

For the first time, the number of microvessels in prostate tissue was studied. It was found that this morphometric parameter decreased slightly with age in the intact organ, with ethanol intoxication in 8-month-old rats – by 7.1%, in 24-month-old animals – by 9.4%. The detected decrease in the number of microvessels of the microcirculatory bed in the prostate tissue in ethanol poisoning leads to a deterioration in microcirculation, blood supply, and metabolic processes in the organ under study. The established tortuosity of the venous microvessels of the prostate microcirculatory bed in case of prolonged ethanol intoxication indicates a compensatory restructuring of the microcirculatory system and an increase in vascular resistance and impaired venous blood drainage [7].

Vessels of microcirculatory bed of the prostate gland exhibits expanded, full-blooded, dilated microvessels in ethanol intoxication. This condition is further complicated by venous congestion, plasmorrhagia and hypoxia, which

causes cell and tissue atrophy, dystrophy, and necrobiosis. Infiltration and sclerosis foci are also observed. The latter leads to a pronounced reduction in the glandular structures of the organ under study and impairment of its function. The described changes in the structure of microvessels cause a marked decrease in the size of the glandular structures of the organ under study and impairment of its functions. The findings confirm that prolonged ethanol intoxication of laboratory mature white male rats leads to a pronounced structural alteration of microvessels in all parts of the prostate microcirculatory system. This is especially pronounced in 24-month-old experimental animals.

★ CONCLUSIONS

The study is aimed at revealing the effect of long-term alcohol intoxication on the remodelling of the prostate vessels of the microcirculatory bed. The main purpose of this study was to determine structural changes in the vessels of the organ under the influence of ethanol and to determine the effect of age on this process. To fulfil this purpose, a range of morphological research methods was utilised, enabling the acquisition of the most objective and appropriate evaluation of structural alterations in the microvasculature of the prostate gland. Specifically, it was found that morphometric methods of research allow for an accurate assessment of changes in the diameters of arterioles, precapillary arterioles, hemocapillaries, and venules. It was also discovered that alcohol intoxication impacts various segments of the prostate microcirculatory system in distinct ways. The experiment revealed that arterioles of the prostate gland constrict under the influence of ethanol, and this process depends on the age of the animals. Morphometrically, it was found that under prolonged alcohol poisoning in 8-month-

old experimental animals, prostate arterioles were narrowed by 15.5%, precapillary arterioles – by 12.2%, hemocapillaries – by 13.2%, in 24-month-old laboratory mature white male rats – by 16.2%, 13.3%, and 14.1%, respectively. It was found that the venous vessels of the microcirculatory bed (postcapillary venules and venules) dilated under prolonged exposure to ethanol. Quantitative morphology revealed that in the modelled pathology in 8-month-old rats, the lumen of venules increased by 12.84%, venules – by 12.1%, in 24-month-old experimental animals – by 14.5% and 14.2%, respectively. Increased venous vessel diameters led to venous haemorrhage, hypoxia, which was complicated by atrophy, dystrophy, necrosis of endothelial cells, glandular epithelial cells, muscle cells, prostate stromal structures, and the emergence of cellular infiltration and sclerosis. The detected morphological changes in the organ under study were dominant in 24-month-old rats. The potential for additional research lies in an exhaustive and thorough examination of the quantitative morphology of structural changes in the vessels of all components of the prostate microcirculatory system while under the influence of ethanol. Such a study would greatly enhance the ability to diagnose, correct and prevent related pathologies.

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★ CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Морфометрична оцінка вікових структурних змін гемомікроциркуляторного русла передміхурової залози в умовах етанолової інтоксикації

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Анотація. Гемомікроциркуляторні судини забезпечують повноцінну трофіку організму на рівні капілярно-тканинних відношень та першими реагують на різні функціональні та патологічні стани органів. В той же час морфологічні зміни мікросудин передміхурової залози з віком в умовах тривалого етанолового отруєння повністю не вивчені. Мета дослідження полягала у з'ясуванні вікових ремодельовань судин гемомікроциркуляторного русла передміхурової залози при тривалій алкогольній інтоксикації. Використані ін'єкційні, гістологічні, морфометричні, статистичні методи. Вивчено мікросудини передміхурової залози 80 статевозрілих білих щурів-самців різного віку, 40 тварин слугували контролем, а 40 шурам щоденно протягом 28 днів внутрішньошлунково вводили 30 % розчин етанолу в дозі 20 мл/кг. Морфометрично виявлено, що під впливом тривалого отруєння білих щурів етанолом виражено зменшуються просвіти артеріальних мікросудин та гемокапілярів, значно розширюються венозні судини мікрогемодинамічного русла передміхурової залози, виникає венозне повнокрів'я, зменшується щільність мікросудин, порушується гемодинаміка, що супроводжується атрофічними, дистрофічними та некробіотичними змінами ендотеліоцитів, епітеліоцитів, міоцитів, стромальних структур, інфільтрацією та склерозуванням. Внутрішньошлункове 28 добове введення лабораторним статевозрілим білим шурам-самцям 30 % розчину етанолу в дозі 20 мл/кг призводить до виражених структурних змін мікросудин гемодинамічного русла передміхурової залози: звуження артеріол, передкапілярних артеріол і гемокапілярів, розширення закапілярних венул та венул, що ускладнюється значним венозним повнокров'ям, розвитком атрофії, дистрофії, некробіозу ендотеліоцитів судинного русла, залозистих епітеліоцитів, міоцитів, сполучнотканинних структур, осередків клітинної інфільтрації та склерозу. Судинам гемодинамічного русла належить провідна роль в етаноловому пошкодженні структур передміхурової залози, що домінують у 24-місячних експериментальних тварин

Ключові слова: морфологічні параметри; ремодельовання судин; алкоголь; вік