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HISTOLOGICAL AND ULTRASTRUCTURAL CHANGES IN THE CONVULGATED SEMBITIOUS TUBES OF THE TESTIS OF MEN OF FERTILE AGE IN CASE OF HYDROCHLORIDE

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Abstract. As is known, hydrocele is a consequence of bacterial inflammation of the scrotum, in particular orchitis, which is an inflammatory process in the testicles or epididymitis - inflammation of the male epididymis, which is often accompanied by pain.

Provoking factors for opportunistic infections are frequent hypothermia in the perineum, the presence of chronic infection in the organs of the genitourinary system, such as prostatitis, urethritis, previous surgical interventions in the scrotum and diseases of the pelvic organs. Initially, there may be a disease of one testicle, and later the inflammatory process covers both testicles.

The purpose of the study is to determine the nature of structural and functional changes in the testicle during its dropsy**.**

Histological and electron microscopic methods were used to examine 20 testicular biopsies from men aged 22-35 years, 15 of whom had a history of dropsy, which led to infertility. On histological preparations that were stained with hematoxylin and eosin at a microscope magnification of ×400 and ×900 using an ocular micrometer, the diameter of the convoluted seminiferous tubules in μm, the degree of damage to spermatogenic epithelial cells in them in percent, the number of spermatogenic epithelial cells found at stage III of the cycle, the volume of interstitial endocrinocyte nuclei in μm3 were determined.

Results. In microscopic examination of histological preparations from testicular biopsies of infertile men with a history of cauldron dropsy, the average diameter of the convoluted seminiferous tubules is (110.51±4.85) μm versus (218.72±1.56) μm in the control. In 16.8% of the convoluted seminiferous tubules, spermatogenic epithelial cells were absent, in 32.1% of the seminiferous tubules, a severe degree of cell damage was determined, the own membrane of the convoluted seminiferous tubules was significantly thickened due to the growth of connective tissue elements and deformed. It has been established that after the transferred dropsy, testicular atrophy is observed in 60-80% of cases, while the diameter of the convoluted seminiferous tubules is halved, their own membrane thickens, the number of spermatogonia, spermatocytes and spermatids and the volume of interstitial endocrinocyte nuclei are significantly reduced. In some part of the convoluted seminiferous tubules, spermatogenic epithelium cells are absent, or in most of the convoluted seminiferous tubules, a severe degree of cell damage was determined, the own membrane of the convoluted seminiferous tubules is significantly thickened due to the growth of connective tissue elements and deformed. In some of them, a violation of its integrity is observed. Ultrastructurally, in the supporting epithelial cells and spermatids, significant changes in mitochondria, endoplasmic reticulum and Golgi complex are present. In the hemocapillaries of the testis - deformation of the nuclei of endothelial cells, microclasmatosis and deformation of cytoplasmic organelles.

Conclusions. Hydrocele of the testis causes its pronounced atrophy with a halving of the diameter of the convoluted seminiferous tubules, sclerosis of its own membrane and reduction of the layers of cells of the spermatogenic epithelium with a decrease in the number of spermatocytes by 58.0% and spermatids by 53% compared to the control.

Keywords: testicle, hydrocele, orchid, spermatogenesis, histological method, electron microscopic method, Golgi complexes, endothelial cells, microclasmatosis, morphological changes.

Introduction. As is known, hydrocele is a consequence of bacterial inflammation of the scrotum, in particular orchitis, which is an inflammatory process in the testicles or epididymitis - inflammation of the male epididymis, which is often accompanied by pain [14, 18]. Provoking factors for opportunistic infections are frequent hypothermia in the perineum, the presence of chronic infection in the organs of the genitourinary system, such as

prostatitis, urethritis, previous surgical interventions in the scrotum and diseases of the pelvic organs. Initially, there may be a disease of one testicle, and later the inflammatory process covers both testicles. Hydrocele develops in the event of a violation of the balance between the secretion and absorption of serous fluid, the circulation of which is continuously between the membranes of the male sex gland [1, 5, 7].

According to our observations, we can say that hydrocele of the testicle is quite common, which can occur both under the influence of bacteria and as a result of traumatic origin [2, 3, 4]. The fluid accumulating in the scrotum disrupts thermoregulation, and also creates pressure on the parenchyma and blood vessels of the testicle, which negatively affects its spermatogenic and endocrine function and can be the cause of infertility in men. Clinical observations show that hydrocele of the testicle in 60-80% of cases leads to testicular atrophy [6, 7], which determines the relevance of this work.

The purpose of the study is to determine the nature of structural and functional changes in the testicle during its dropsy**.**

Materials and organization of the study. Histological and electron microscopic methods were used to examine 20 testicular biopsies from men aged 22-35 years, 15 of whom had a history of dropsy, which led to infertility. On histological preparations that were stained with hematoxylin and eosin at a magnification of ×400 and ×900 using an ocular micrometer, the diameter of the convoluted seminiferous tubules in μm, the degree of damage to spermatogenic epithelial cells in them in percent, the number of spermatogenic epithelial cells found at stage III of the cycle, the volume of interstitial endocrinocyte nuclei in μm3 were determined (Hessekatal, 1990; Heidex, 2004) [11, 16].

Material for electron microscopic examination of testicular structures was collected according to generally accepted rules [8]. Ultrathin sections were examined in a TEM-125 K electron microscope at magnifications of 6000 to 16000 times.

The Medical Ethics Commission of the Vasyl Stefanyk Precarpathian National University found no violations of ethical norms during the study.

Computer data processing was performed using the statistical package Stat. Soft, inc. Tusla, OK, USA; Statistica 6. Statistical changes were considered reliable when the achieved level of statistical significance was $p<0.05$.

The study was carried out in accordance with the scientific work plan of the Vasyl Stefanyk Precarpathian National University and is part of the scientific research work of the Department of Human and Animal Anatomy and Physiology "Morphofunctional state of the prostate gland and testicles in men of reproductive age in normal and pathological conditions" state registration number (0109U008162).

Research results and discussion. In microscopic examination of histological preparations from testicular biopsies of infertile men with a history of hydrocele, the average diameter of the convoluted seminiferous tubules is (110.51±4.85) μm versus (218.72±1.56) μm in the control [15,17].

In 16.8% of the convoluted seminiferous tubules, spermatogenic epithelial cells are absent, in 32.1% of the seminiferous tubules a severe degree of cell damage was determined, the own membrane of the convoluted seminiferous tubules is significantly thickened due to the growth of connective tissue elements and deformed (Fig. 1).

In some of them, its integrity is violated. One or two layers of spermatogonia and spermatocytes, single supporting epithelial cells with a slightly deformed hyperchromic nucleus and granular cytoplasm are adjacent to it.

Cellular detritus is present in the lumen of other tu-

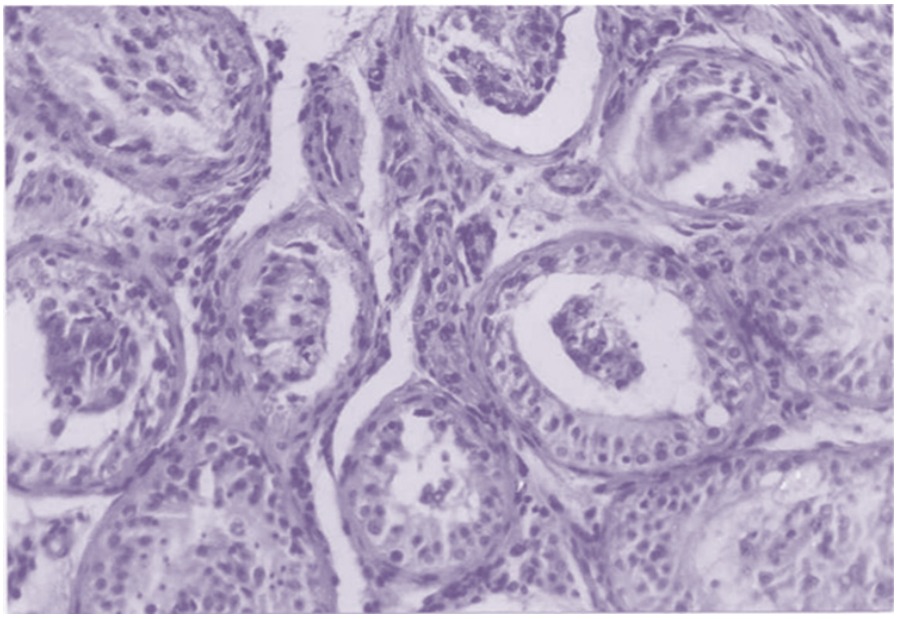

Fig. 1. Deformation of the convoluted seminiferous tubules and reduction of the spermatogenic epithelial cell layers in them in the testicle of a 27-year-old man with dropsy. Section stained with hematoxylin and eosin. Magnification: ×200.

bules. In the preserved convoluted seminiferous tubules, the number of spermatogonia decreased to 48.22±2.61, spermatocytes to 65.95±2.67 and spermatids to 176.68±4.55 compared to 72.18±1.55, 164.35±6.04 and 370.84±7.81 in the control (P<0.05).

The convoluted seminiferous tubules are separated by significant layers of interstitial connective tissue with proliferation of fibroblasts. Along the course of the blood vessels, single or small groups of interstitial endocrinocytes with a deformed and hyperchromic nucleus were found, the volume of which decreased to (72.88±0.86) μm3 versus (97.57±1.60) μm3 in the control [10,13].

According to electron microscopy, pronounced changes in the membrane of the convoluted seminiferous tubules were found in hydrocele of the testis. The basal membrane of the spermatogenic epithelium is unevenly thickened, of different electron density along its length. The number of bundles of collagen fibers in it increases, their fragmentation and swelling. The membrane is twisted along its length. The nucleus of myoid cells is wrinkled, hyperchromic, chromatin is located near the nucleolemma. The cytoplasm is clear, vacuolated. The cytoplasmic membrane is thickened in places (Fig. 2).

The nucleus of supporting epithelial cells is irregular in shape with deep invaginations and uniform distribution of chromatin.

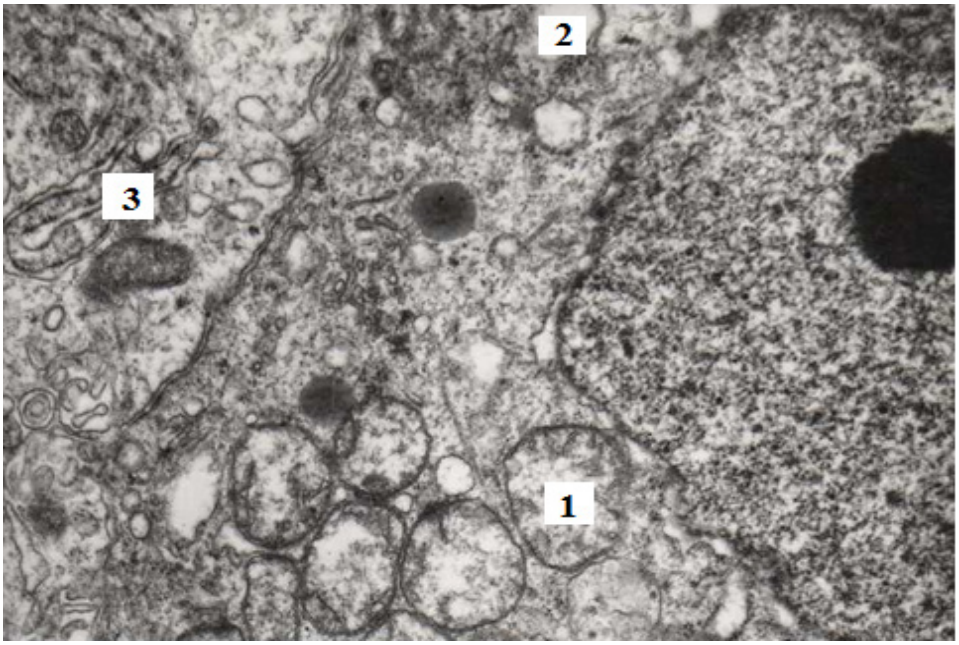

Fig. 2. Homogenization of mitochondrial cristae (1), vacuolization of spermatocyte cytoplasm (2) and deformation of the structure of the connecting apparatus (3) of the supporting epithelial cells of the testis of a 30-year-old man with dropsy. Magnification: ×16000

The cytoplasm of the cells is clear, with a significant number of fatty inclusions, lysosomes and vesicles of various sizes. The components of the Golgi complex and the canals of the endoplasmic reticulum are expanded. In most mitochondria, the cristae are reduced, the matrix is vacuolated. In the connecting apparatus of the supporting epithelial cells, the cytolemmas are close together, the microfilaments are reduced, the canals of the endoplasmic reticulum are expanded. In spermatogonia, spermatocytes and spermatids, the cristae of the mitochondria are homogenized, the matrix is clear, the cytoplasm is vacuolated, the canals of the endoplasmic reticulum are expanded. In spermatocytes, there is an uneven expansion of the subacrosomal space [8, 12].

The nuclei of interstitial endocrinocytes are irregular in shape, with invaginations of the nucleolemma and peripheral condensation of chromatin. Mitochondria are deformed, matrix is vacuolated, cristae are fragmented, endoplasmic reticulum channels are dilated, number of fatty inclusions is insignificant.

In blood capillaries of testis there is edema of cytoplasm of endothelial cells, micropinocytosis, contours of cytolemma are uneven, nuclei are irregular in shape with deep invaginations, karyoplasm is illuminated.

In addition, the fluid exerts a certain hydrostatic pressure on the parenchyma and blood vessels of the testicle, which can have a traumatic effect. On the side of the dropsy, there is an increase in temperature by 2º, which also negatively affects spermatogenesis [5, 9, 10]. Thus, according to our data, the diameter of the convoluted seminiferous tubules decreased to (110.51±4.83) μm3, 18.6% of which are empty, and in 32.1% of the tubules a severe degree of damage to the cells of the spermatogenic epithelium is determined with a significant decrease in the number of spermatocytes and spermatids, as well as a decrease

in the volume of the nuclei of interstitial endocrinocytes to (72.88±0.86) μm3, which disrupts their hormonal function. The significant changes we have found in the components of the hematotesticular barrier also negatively affect spermatogenesis [7, 11] in connection with the development of autoimmune orchitis.

Thus, our results confirm the literature data that dropsy of the testicle is one of the characteristic lesions of the scrotum. Normally, the cavity of the serous membrane contains several drops of fluid, the filtration of which occurs in the capillaries, and the resorption is carried out mainly by lymphatic vessels. When the balance of these processes is disturbed due to lymphostasis and venous stasis, serous fluid accumulates in the vaginal slit, its pressure increases, and changes develop in the seminiferous tubules and in the stroma of the testicle [3, 8].

Conclusions.

1. Hydrocele of the testicle causes its pronounced atrophy with a halving of the diameter of the convoluted seminiferous tubules, sclerosis of its own membrane and reduction of the layers of spermatogenic epithelium cells with a decrease in the number of spermatocytes by 58.0% and spermatids by 53% compared to the control.

2. Transferred hydrocele of the testicle leads to deep ultrastructural changes in the own membrane of the convoluted seminiferous tubules, supporting epithelial cells, spermatogenic epithelial cells, the wall of blood capillaries and interstitial endocrinocytes.

The prospects for further research are that the data obtained will serve as a basis for studying the ejaculate in hydrocele of the testicle.

Conflict of interest. The authors declare that they have no conflict of interest in relation to this research, including financial, personal, authorship or other nature, which could affect the research and its results presented in this article.

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Author contributions: I.Y. Ivasiuk a) conception and design; c) provision of materials for the study; V.B. Hrytsuliak d) collection and synthesis of data; B.V. Hrytsuliak e) analysis and interpretation of results; S.P. Nakonechna f) writing of the manuscript; b) administrative support; L.M. Sheremeta g) editing of the manuscript;

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ГІСТОЛОГІЧНІ ТА УЛЬТРАСТРУКТУРНІ ЗМІНИ У ЗВИВИСТИХ СІМ'ЯНИХ ТРУБОЧКАХ ЯЄЧКА ЧОЛОВІКІВ ФЕРТИЛЬНОГО ВІКУ ПРИ ВОДЯНЦІ

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Резюме. Як відомо, гідроцеле є наслідком бактеріального запалення мошонки, зокрема орхіту, що представляє запальний процес у яєчках, або епідидиміту – запалення чоловічого придатка яєчка, яке часто супроводжується болем.

Провокуючими факторами опортуністичних інфекцій є часті переохолодження в промежині, наявність хронічної інфекції в органах сечостатевої системи, такої як простатит, уретрит, попередні хірургічні втручання в мошонці та захворювання органів малого тазу. Спочатку може спостерігатися захворювання одного яєчка, а пізніше запальний процес охоплює обидва яєчка.

Мета дослідження — визначити характер структурних та функціональних змін яєчка під час його водянки.

За допомогою гістологічного й електронномікроскопічного методів досліджували 20 біоптатів яєчка чоловіків віком 22-35 років, у 15 з яких в анамнезі перенесена водянка, що призвела до неплідності. На гістологічних препаратах, які були забарвлені гематоксиліном й еозином, при збільшенні мікроскопу ×400 і ×900 з використанням окуляр-мікрометра визначали діаметр звивистих сім'яних трубочок в мкм, ступінь пошкодження клітин сперматогенного епітелію в них у відсотках, кількість клітин сперматогенного епітелію, які зустрічаються на III стадії циклу, об'єм ядер інтерстиціальних ендокриноцитів в мкм^3.

Результати. Встановлено, що після перенесеної водянки спостерігається атрофія яєчка у 60-80% випадків, при цьому спостерігається зменшення удвоє діаметру звивистих сім'яних трубочок, потовщується їх оболонка, вірогідно зменшується кількість сперматогоній, сперматоцитів і сперматид та об'єм ядер інтерстиційних ендокриноцитів. У певній частині звивистих сім'яних трубочок клітини сперматогенного епітелію відсутні, або в більшій частині з них визначається важкий ступінь пошкодження клітин, власна оболонка яких значно потовщена через розростання сполучнотканинних елементів та деформована. У деяких із них спостерігається порушення її цілісності. Ультраструктурно у підтримувальних епітеліоцитах і сперматидах спостерігаються значні зміни в мітохондріях, ендоплазматичній сітці і комплексі Гольджі. У гемокапілярах яєчка – деформація ядер ендотеліоцитів, мікроклазматоз та деформація цитоплазматичних органел.

Висновки. Водянка яєчка викликає його виражену атрофію зі зменшенням удвічі діаметру звивистих сім'яних трубочок, склерозу її власної оболонки і редукції шарів клітин сперматогенного епітелію зі зменшенням кількості сперматоцитів на 58,0 % і сперматид – на 53%, порівняно з контролем.

Ключові слова: яєчко, водянка, орхід, сперматогенез, гістологічний метод, електронномікроскопічний метод, комплекс Гольджі, ендотеліоцити, мікроклазматоз, морфологічні зміни.

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