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PARAMETERS OF BLOOD VESSELS OF TESTES OF OUTBRED RATS

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Resume: Articles provides information about structure of blood vessels of rats during postnatal ontogenesis

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Introduction. The study of human reproductive function is one of the topical issues of the modern scientific world [8]. Therefore, the problem of male infertility has been the focus of attention of various specialists for many years. First of all, this is a medical problem, the issues of which relate to the effectiveness of the treatment of male infertility and require further development of new methods [3]. On the other hand, the social side of this problem is also very important, since the "male factor" is the cause of more than 50% of infertile marriages [7,9].

The literature data lists many causes (factors) of male infertility [1,2,4,5,6,10,11,12,13,14,15]. In recent years, the effect of these factors, among which physical and chemical factors predominate, has been intensified as a result of anthropogenic activities. Therefore, WHO is developing many programs to study this problem. And to study the pathogenesis of male infertility, one of the main methods remains the morphological method, supplemented by experimental studies (which are usually carried out on rats).

It has been proven that under the influence of various factors, the morphological parameters of the testicles are violated. And the basis of all these changes is a violation in varying degrees of their blood supply. Based on this, the purpose of our study is to study the vascularization of the testes of outbred rats in postnatal ontogenesis.

Materials and research methods. An experimental study was carried out on material taken from the testes of 69 white non-linear rats from the moment of birth to 12 months of age, which were kept in vivarium conditions with a 12-hour light regimen, with a standard diet and free access to water. At the beginning of the experiment, all sexually mature rats were quarantined for a week, and after the exclusion of somatic or infectious diseases, they were transferred to the usual mode of the vivarium. Animals were slaughtered at the appropriate time in the morning, on an empty stomach by means of instantaneous decapitation under ether anesthesia. After opening the abdominal cavity, the testicles were removed. The extracted testes were fixed in Bouin's solution. After passing through alcohols with an ascending concentration, they were embedded in hot paraffin, then sections were prepared from the testes with a standard thickness of 6–7 μm, which were oriented sagittally or frontally. Sections were stained with hematoxylin and eosin according to van Gieson. Finished histological preparations were examined under an NLCD-307B binocular microscope (Novel, China). The research materials were subjected to statistical processing using the methods of parametric and non-parametric analysis. Accumulation, correction, systematization of initial information and visualization of the obtained results were carried out in Microsoft Office Excel 2010 spreadsheets. Statistical analysis was carried out using the IBM SPSS Statistics v.23 program (developer - IBM Corporation).

Results and discussions. In newborn rats, subthecal vessels are located under the albuginea of the testicles. The diameter of the arterioles is 32.32x32.32 and 66.65x66.65 μm (average 45.8±2.523 μm). The wall thickness is 11.55-15.24 μm (average 13.2±0.322 μm). In most cases, these intrathecal arterioles, the number of which ranges from 5 to 10, are located on the opposite wall from the epididymis. The intrathecal arterioles are the largest vessels of the testes. The wall of arterioles consists of 3 membranes: internal, middle and external. The inner shell is formed by a single layer of endothelial cells with an elongated dark nucleus. The middle shell is formed by 1-2 rows of spirally arranged smooth muscle cells. The outer shell consists of fibrous connective tissue structures. Infrathecal venules are located

mainly in the adnexal margin of the testis, with a diameter of 28.0 ± 0.342 μm, the average wall thickness is 4.5 ± 0.140. In the intertubular spaces, intertubular vessels are located, which are detected throughout the convoluted seminiferous tubules. Intertubular arterioles have a diameter of 13.51x13.51 to 19.15x19.15 μm, on average 16.4±0.361 μm. The wall of arterioles consists of 3 membranes. The inner shell is represented by one row of elongated endotheliocytes, outside of it is a convoluted elastic membrane. The middle shell is formed by a single layer of smooth muscle cells arranged in a spiral. The outer shell consists of fibrous connective tissue structures. Intertubular venules accompany intertubular arterioles. In the wall of venules, one row of endothelial cells with elongated nuclei located at some distance from each other is determined. They have a size from 13.18x14.42 to 20.3x22.04 μm, on average 18.0±0.644 μm. The wall thickness is - 4.2±0.153 μm. The capillary walls are formed by a single layer of endothelial cells, which have a flattened nucleus and are located at a smaller distance from each other than in the venule wall. The lumen of the capillaries is 5.2±0.040 μm, and the wall thickness is 3.1±0.065 μm.

In 90-day-old male rats, under the testis capsule, there are intrathecal arterioles, in an amount from 7 to 12, with a size of 120.53x120.53 and 136.7x136.7 microns (average - 129.4 ± 1.069 microns). The wall thickness is 14.58-25.96 μm (average 20.5±0.656 μm). From 355 to 762 microns, the distance between the arterioles is calculated. In addition to these arterioles, there are single venules with a diameter of 36.12x37.71 to 39.83x58.66 microns, on average - 46.1 ± 1.250 microns, the average wall thickness is 5.3 ± 0.082 microns. In the intertubular spaces are the accompanying intertubular arterioles, venules, capillaries and Leydig cells. One seminiferous tubule is accompanied by 3-6 vessels. The diameter of the arterioles is 27.22x27.22 and 36.99x36.99 μm (average 31.6±0.672 μm), the average wall thickness is 9.8±0.151 μm. The diameter of the lumen of the venules varies from 22.82x24.51 to 28.5x32.99 μm, on average 28.6±0.566 μm, and the wall thickness is 5.2±0.121 μm. Capillaries are formed by one row of somewhat flattened endotheliocytes, the distance between the nuclei of which is less than in venules.

The wall thickness of the capillaries is on average 4.2±0.099 μm, and the lumen diameter is 5.7±0.133 μm.

In 180-day-old rats, subthecal vessels, consisting of arterioles and venules, are located under the albuginea of the testis. It should be emphasized that these vessels are directed transversely and are located opposite the adnexal margin of the testis. Their number is 10 - 14, with a size from 136.1x136.1 to 144.21x144.21 microns, on average - 140.3 ± 0.693 microns. The walls of arterioles have a thickness that ranges from 21.33 to 30.32 μm, averaging 26.2±0.685 μm. The distance between these arterioles varies from 374 to 783 μm. The subcapsular arterioles are the largest vessels of the testes. The wall of arterioles consists of 3 shells: inner, middle and outer. The inner shell consists of a single layer of endothelial cells with an elongated dark nucleus. Outside of it, a clearly defined folded elastic membrane is revealed. The middle shell is formed by 1-2 rows of spirally arranged smooth muscle cells. The outer shell is formed from fibrous connective tissue structures. The number of venules is 2 times less than the accompanying subcapsular arterioles. The diameter of the venules ranges from 26.4x38.5 to 42.3x60.02 μm, on average 58.5±0.241 μm. In addition to these cells, arterioles and venules are also located in the intertubular spaces, which accompany the convoluted seminiferous tubules, as well as capillaries. The wall of intertubular arterioles has an average thickness of 10.1±0.226 μm, and their lumen ranges from 31.51x31.51 to 36.91x36.91 μm, on average 34.3±0.444 μm. The wall of arterioles consists of 3 membranes. The inner shell is represented by one row of elongated endotheliocytes, outside of it is a single convoluted elastic membrane. The middle shell is formed by a single layer of smooth muscle cells arranged in a spiral. The outer shell consists of fibrous connective tissue structures. Intertubular venules accompany intertubular arterioles. In the wall of venules, one row of endothelial cells with elongated nuclei located at some distance from each other is determined. The wall thickness of the venules is on average 5.8±0.130 μm, and the lumen is 31.2±0.480 μm, with diameter fluctuations from 27.38x28.43 to 32.3x34.22 μm. The wall of the intertubular capillaries is formed by a single layer of endothelial cells with a flattened nucleus and located at a close

distance from each other than in the venule wall. The lumen of the capillaries is on average 6.1±0.146 μm, and the wall thickness is 4.6±0.177 μm.

On day 270, in male rats, under the protein membrane of the testis, arterioles are located, which go from the free edge of the testis towards the edge where the epididymis is located. The number of intrathecal arterioles is 12-15 pieces. Diameter 149.29x149.29 and 154.11x154.11 microns (average 151.6±0.397 microns). The thickness of the walls of the intrathecal arterioles ranges from 23.99 to 33.64 microns, on average - 30.5±0.738 microns. Intrathecal arterioles are formed by three shells: inner, middle and outer. The inner lining consists of a single layer of endothelial cells. The average is represented by 1-2 layers of smooth muscle cells. The outer one consists of connective tissue and several spindle-shaped adventitial cells. Between the inner and middle shells is a sinuous inner elastic membrane. The distance between arterioles ranges from 380 μm to 795 μm. The number of venules accompanying these arterioles is 2 times less. The diameter of the venules ranges from 29.21x42.62 to 53.85x67.97 microns, on average 66.3±0.426 microns. The wall of the intrathecal venules consists of a single layer of endothelial cells, the nuclei of which are located at a small distance from each other. The wall thickness of the venules averages 5.9±0.06 μm. Reticular fibers in the intertubular spaces surround Leydig cells and intertubular vessels and form a looped network of various sizes. The intertubular arterioles have a diameter of 35.54x35.54 to 38.56x38.56 μm, on average 36.5±0.250 μm, and a wall thickness of 11.5±0.244 μm. Three membranes are defined in the walls of arterioles. The inner one is formed by oval endotheliocytes, outside of which lies a somewhat smoothed inner elastic membrane. In the middle layer there are 1-2 rows of spiral smooth muscle cells with an elongated nucleus. The outer shell is formed from loose connective tissue. The wall of intertubular venules contains one layer of endothelial cells, large nuclei of which are located at a great distance. The wall thickness is on average 6.4±0.387 μm. The diameter of the lumen of venules averages 33.6±0.631 μm. Capillaries are formed by one row of somewhat flattened endotheliocytes, the distance between the

nuclei of which is less than in venules. The wall thickness of the capillaries is on average 4.8±0.124 μm, and the lumen diameter is 6.6±0.251 μm.

On the 360th day of development in male rats, under the membrane of the testis, there are intrathecal arterioles, the diameter of which ranges from 156.62x156.62 to 161.06x161.06 μm, on average 158.7 ± 0.460 μm. The thickness of their walls is 32.33 - 38.29 microns, on average - 34.8 ± 0.560 microns. The wall of the subthecal arterioles consists of 3 layers: inner, middle and outer. The inner layer is formed by a single layer of endothelial cells. The middle shell is represented by 1-2 layers of spirally arranged smooth muscle cells. The internal elastic membrane is located between the inner and middle shells of the wall of arterioles and has a jagged appearance. The outer shell is formed from connective tissue structures. Arterioles go from the free edge of the testis to the side where the epididymis is located. The number of intrathecal arterioles of the testis varies from 14 to 16. In addition to arterioles, there are venules, the wall of which consists of a single layer of endothelial cells and have elongated nuclei. The wall thickness of the venules is on average 6.2±0.194 μm, and the lumen is 75.1±0.518 μm. Intertubular spaces contain accompanying arterioles, venules and capillaries. The diameter of arterioles ranges from 35.24x35.24 to 39.3x39.3 μm, on average 37.8±0.412 μm. The wall thickness of the intertubular arterioles is on average 12.7±0.104 μm. In the walls of arterioles, three sheaths are defined. The inner shell consists of oval-shaped endothelial cells, outside of which the inner elastic membrane is located. In the middle layer, smooth muscle cells are spirally arranged in 1-2 rows, have an elongated nucleus. The outer shell is formed from loose connective tissue. These intertubular arterioles accompany the venules. The wall of intertubular venules consists of a single layer of endothelial cells with large nuclei. The wall thickness of the venules is on average 6.8±0.232 μm. The diameter of the lumen of the venules was 36.4±0.508 μm. These vessels accompany the seminiferous tubules throughout. The average diameter of the capillary lumen is 7.2±0.168 μm, and the wall thickness is 5.1±0.321 μm.

Conclusion. The study of the angioarchitectonics of the testes of albino rats in postnatal ontogenesis showed that up to 90 days of age, the rate of increase in the

size of arterioles and venules is higher than in other age groups and the number of subthecal vessels increases gradually without any particular jumps.

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