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MORPHOGENESIS OF URINARY BLADDER OF RATS IN EARLY POSTNATAL PERIOD

Abstract. *The actual problem of practical medicine is the treatment of diseases of the lower part of the urinary system and about 20% of this pathology accounts for the bladder pathology. The purpose of this research was to study the morphological characteristics of the bladder of rats in the period of early postnatal ontogenesis. A histological survey of the bladders of 40 rats was conducted. Quantitative analysis of the results of the morphometric study was carried out using methods of variation statistics using Excel and STATISTICA. The aim of the study was to determine the average thickness of the lamina propria, the average number of microvessels in the unit of area, the number of lymphocytic cells. During the early stage of postnatal ontogenesis (up to 90th day of life of rats), the following changes in the structure of the bladder were observed: an increase in the thickness of the bladder mucous membrane; an increase of cells of the immunomorphological complex (lymphocytes, macrophages, and lymphocytic cell clusters), changes in their quantitative aspect and in the diversity of the cellular composition; an increase in the number of blood vessels in the microcirculatory bed. These changes occurred progressively, with maximum expressiveness on the 30th day of life and subsequent stabilization of indicators. This may be caused by a change in the diet of rats, since from 14th to 21st day there was a transition from dairy to natural nutrition. It is planned to conduct an investigation of the effect of antigenic stimulation on the structure of the wall of the bladder in the future.*

Key words: *postnatal ontogenesis, bladder, lymphocytes, microcirculatory channel.*

Introduction. Currently, the actual problem of practical medicine is the treatment of diseases of the lower urinary system, and about 20%^[1] of this pathology accounts for the bladder. Our studies are devoted to the normal morphology of the rat bladder and the morphofunctional changes of this organ in the period of early postnatal ontogenesis.

Objective: to study the morphological features of the bladder of rats in the period of early postnatal ontogenesis.

Materials and methods. The material for the study was the bladder of "Vistar" rats aged 1, 14, 30, 60, 90 days. In each age group, 8 animals were

studied. After euthanasia the bladders were fixed in 10% neutral formalin and embedded in paraffin according to the standard technique. A number of microsections were made with a thickness of 5-6 microns. Coloring was performed with hematoxylin and eosin, alcian blue^[2]. Morphometric studies and photomicrography were carried out using a ZEISS microscope with an Axiocam 105 color digital microplotter^[3]. For the analysis, the methods of variation statistics were used using Excel and STATISTICA^[4,5]. The average thickness of the lamina propria of the mucosa, the average number of microvascular vessels, lymphocyte cells and lymphocyte accumulations

per 5000 μm^2 were determined.

Results of the study. Obtained the data is presented in Table 1 below.

Discussion. At the age of one day, the three-layer structure of the bladder wall is noticeable: mucous membrane, muscle membrane and serous (adventitial) membrane. The average

thickness of the mucosa is 3.78 microns. It is represented by areolar tissue. The microcirculatory bed of the mucous membrane is represented by arterioles in the amount of 1.19 (per 5000 μm^2 , as well as all cell quantities given below), venules in the amount of 2.29 and capillaries in the amount of 9.71.

Table 1.

Morphometric indicators of the structure of the bladder wall of rats in the early prenatal period

Age, days	Height of the areolar tissue, μm	Arterioles in mucosa	Venules in mucosa	Capillaries in mucosa	Lymphocytes	Lympho-cytic cell clusters
1	3,78±0,64	1,19±0,26	2,29±0,52	9,71±0,70	1,25±0,28	
14	18,1±1,00	2,20±0,71	1,92±0,46	10,62±4,98	1,45±0,31	
30	29,52±1,19	7,29±1,59	7,24±2,40	24,87±6,95	8,08±0,83	0,50±0,47
60	34,80±2,87	4,96±3,73	6,46±4,12	27,92±2,99	8,62±1,83	0,08±0,15
90	25,35±1,91	1,82±1,00	2,36±1,23	15,20±7,69	4,26±0,51	0,10±0,16

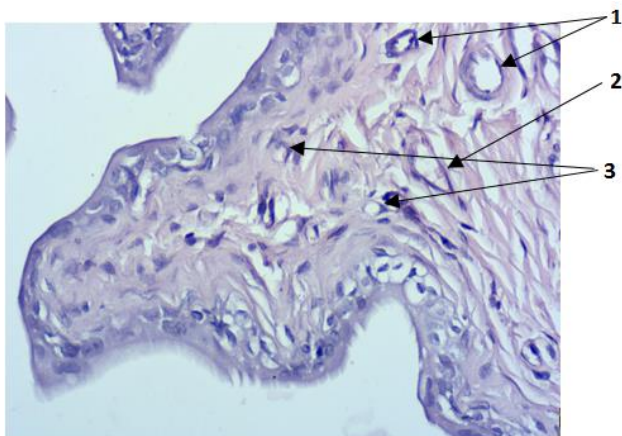
In the mucosa lymphoid cells are present. The diameter of these cells is 2-4 microns, these are small lymphocytes (in this work, we took lymphocytic cells as small with a diameter of 2-4 microns, as medium – 5-6 microns, as large – 7-8 microns). They are located mainly in perivascular region, rarely – in the subepithelial region. The average number of cells is 1.25.

During the period of ontogenesis, after 14 days, the rats begin to switch to a mixed diet and, during this period, the following structural changes in the bladder are observed. The loose fibrous connective tissue of the lamina propria of the mucous membrane has a thickness of 18.10 microns. A clear separation of the lamina propria and submucosa is not observed, however, there are isolated smooth myocytes in the lamina propria. The number of arterioles (2.33), venules (1.58), capillaries (8.04)(Picture 1).

Lymphocytic cells are located diffusely and perivascular, represented by small lymphocytes in the amount of 1.46. There are single macrophages in an amount of 0.25 and neutrophils 0.12, located perivascular.

When studying the structure of the urinary bladders of the 30 day old rats, mucosa is without a distinct muscle layer and is made of loose fibrous connective tissue. The thickness of its own submucosa plate is 29.92 microns. The mucous plate of its own contains arterioles (7.71), venules (5.83) and a large number of capillaries (27.39). There are diffuse and perivascular lymphoid cells and clusters in the mucosa^[6,7]. The average number of cells was: lymphocytes – 8.08, macrophages – 1.07, neutrophils – 0.70, plasma cells – 0.50, lymphoid clusters – 0.50, all located mainly perivascular. When studying the structure of the urinary bladders of the 60 day old rats, the lamina propria of the mucosa was without a clearly defined muscle layer and is made of loose fibrous connective tissue. The thickness is 34.80 μm . The mucosa contains arterioles (4.96), venules (6.46) and a large number of capillaries (27.92). There are diffuse and perivascular lymphoid cells and their clusters in the mucosa. The number of lymphocytes is 8.63, macrophages 0.83, neutrophils 0.12, plasma cells 0.08, lymphoid clusters 0.08, all located perivascular.

The loose fibrous connective tissue of the mucous membrane of 90 days old rats has a thickness of 25.35 microns. A clear separation of the lamina propria and tela submucosa was not



Picture 1. Mucosa of the 14 day old rat. Hematoxylin and eosin stain, $\times 40$. 1 – Arterioles; 2 – Venules; 3 – Capillaries

observed, however, there are isolated smooth myocytes in the lamina propria. The number of arterioles – 1.82, venules – 2.36, capillaries – 15.20. Lymphocytic cells are located diffusely and perivascular, represented by lymphocytes in an amount of 4.27, macrophages in an amount of 1.37. There are rare single lymphoid accumulations (0.1).

Conclusions. After studying the morphological changes that occur in the bladder of the rat in the early stage of postnatal ontogenesis, we came to the following conclusions:

1. Along with a pronounced thickening of the mucous membrane of the bladder, the number of microvasculature vessels increases, with a maximum increase observed on 30th day of life and subsequent stabilization of indicators. Moreover, a pronounced increase in performance is more typical for the capillary link;

2. An increase in numbers of the immunomorphological cells (lymphocytes, macrophages, as well as lymphocyte cell clusters), changes in quantitative terms and in the diversity of the cellular composition. All changes occur faster by the end of the first month of life.

Prospects of further studies. Considering the results of the data obtained, it is planned to conduct a study on the effect of antigenic stimulation on the structure of the bladder wall in the future. An unknown effect of dietary changes (namely changing dairy nutrition to natural one) that occurred in this study in 14th-21st day period also may warrant further investigations.

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