



MORPHOLOGICAL CHARACTERISTICS OF THE KIDNEYS DURING A LONG-TERM PERIOD OF MID-LENGTH SPINAL CORD INJURY

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Summary: This article presents information on the results of scientific research that allows us to evaluate and study the morphological features of the kidneys of 3-month-old rats after moderate to severe spinal cord injuries. Morphological analysis of the rat kidneys was performed on the 7th and 14th days after spinal cord injury.

Key words: spinal cord injury, kidneys, nephron, biopsy, Shumlyansky-Bowman capsule, vascular glomerulus.

Резюме: В данной статье представлены сведения о результатах научных исследований, позволяющих оценить и изучить морфологические особенности почек 3-месячных крыс после средне - тяжелых травм спинного мозга. Морфологический анализ почек крыс проводили на 7-е и 14-и сутки после травмы спинного мозга.

Ключевые слова: спинно-мозговая травма, почки, нефрон, биопсия, капсула Шумлянско-Боумена, сосудистый клубочек.

Abstract: In our country, many targeted measures are being implemented to radically improve the healthcare system and improve the quality of prompt and qualified medical care provided to the population [4,5,6,7,10,11,12,21,24]. At the same time, the study of renal complications, especially extra- and intraspinal complications after brain injury, which are considered one of the problems of modern nephrology, remains an urgent problem, as well as measures aimed at early diagnosis, prevention and treatment of the disease, and reducing mortality [3,8,9,13,14,15,22]. Unfortunately, there is very little information in the existing literature on the impact of various stages of spinal cord injury on renal morphology and function [1,2,16,17,18,19,23,25]. This situation requires further studies to determine the role of morphological changes in the kidneys as a result of spinal cord injury.

Materials and methods: Three-month-old white rats with an average weight of 150 g were used for this study. All laboratory animals were kept in a vivarium in plastic cages covered with wood chips at room temperature with a 12-hour light-dark cycle in accordance with the standards for the care of laboratory animals. The experimental group of animals was divided into 2 groups, namely, the first group included animals without spinal cord injury (control, n = 5), and the second group (experimental n = 5) included animals with moderate spinal cord injury. In the study, moderate spinal cord injury was inflicted on white rats using a specially developed model using the “road accident” method.

During this experiment, all animals received moderate to severe injuries. After the injury, the surviving animals were transferred to a special plastic cage and observed until the post-traumatic state was restored.

For histopathological comparison of the control and experimental groups, the kidneys of white rats were isolated on days 7 and 14 after moderate spinal cord injury, and samples were taken and preparations were prepared to determine the morphological changes occurring in the kidney tissues. All preparations prepared using standard histological methods were stained with hematoxylin and eosin.

Research results: Macroscopically, the kidneys of 3-month-old white rats of the experimental group were reddish-brown in appearance, bean-shaped, located in the lumbar region, covered with a smooth and shiny capsule on the outside, and no pathological changes were observed in them macroscopically. Only a slight swelling was detected.

Histological examination showed that on days 7 and 14 after moderate spinal cord injury, a number of characteristic changes were detected in the structure of the nephrons of the rat kidneys. It was found that the renal corpuscles, which retained their structure and were destroyed in the renal cortex nephrons, increased in size due to the expansion of the renal vascular ball, as well as the Shumlyansky-Bowman capsule of the renal corpuscle. This indicates a decrease in the filtration processes in it.

At the same time, changes were also observed in the proximal and distal convoluted tubules of the nephrons under the influence of moderate spinal cord injury.

Karyolysis of the proximal and distal convoluted tubule cells in the cortex and medulla nephrons of the 3-month-old white rat kidneys of the experimental group with moderately severe damage to the spinal cord, the presence of erythrocytes in the tubules, the presence of focal hemorrhage zones between the tubules, dimming of the venous blood vessels due to the erythrocyte mass, between the tissues the presence of interstitial edema was noted.

The morphological and morphometric parameters of the kidney of rats seven days after moderate severe spinal cord injury showed the following changes: absolute weight of kidneys - from 716.12 mg to 1218.28 mg, average weight - 925.78 ± 44.9 mg; kidney length - from 15.5 mm to 20.02 mm, average length - 18.79 ± 0.5 mm; width - from 6.24 mm to 10.9 mm, average width - 7.77 ± 0.5 mm; thickness - from 6.32 mm to 9.43 mm, average thickness - 7.76 ± 0.3 mm; It was noted that the volume of the kidney ranges from 386.89 mm³ to 803.46 mm³, and the average is 554.1 ± 34.89 mm³.

The area of kidney bodies is from 2279.3 μ m² to 2401.2 μ m², the average is 2297.19 ± 21.1 μ m²; the area of the vascular ball - from 1778.4 μ m² to 2094.6 μ m², average - 1915.28 ± 24.0 μ m²; the area of the capsule cavity ranged from 317.41 μ m² to 379.66 μ m², the average value was 351.87 ± 5.5 μ m².

The diameter of the proximal convoluted tubules ranged from 25.51 to 40.27 μ m, the average was 36.105 ± 1.2 μ m, the diameter of the tubular cavity was from 16.98 to 19.75 μ m, the average was 19.33 ± 0.3 μ m.

The diameter of the distal convoluted tubules is from 26.54 to 35.87 μ m.

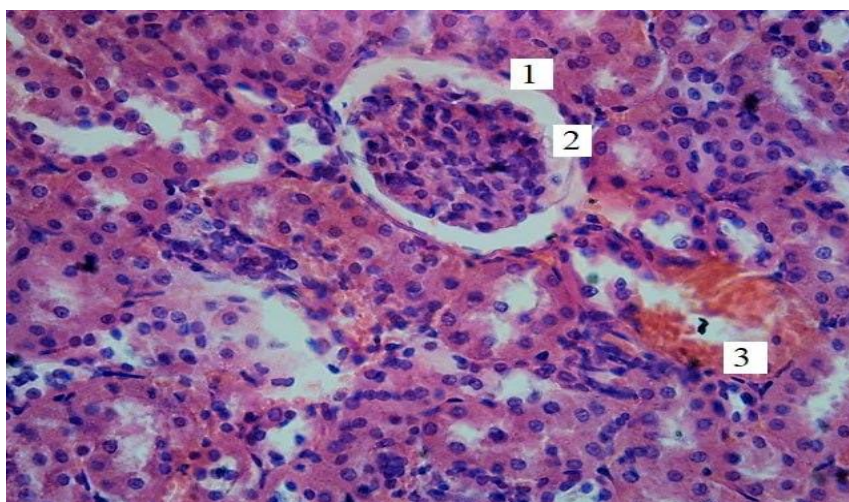


Fig. 1. Kidney cortex of 3-month-old white rats with moderate spinal cord injury of the study group (stained with Hematoxylin-eosin. OC 10 x OB 40. 1-renal capsule, 2-expansion of Shumlyansky-Bowman capsule, 3-zone of focal hemorrhage)

The area of the kidney body is from 2019.2 m² to 2333.83 m², average - 2278.32±23.0 m²; the area of the vascular ball - from 1729 μm² to 1987 μm², the average value - 1813.62±24.1 μm²; it was determined that the area of the capsule cavity is 342.2 to 354.2 μm², the average is 337.76±1.16 μm². The diameter of the proximal convoluted tubules is from 29.84 μm to 40.6 μm, the average is 34.28±0.58 μm, the diameter of the tubule space is from 14.2 μm to 24.5 μm, the average is 18, It was 61±0.67 μm.

The diameter of the distal convoluted tubules is from 26.1 to 37.8 μm, the average is 34.3 ± 0.8 μm, the diameter of the tubular cavity is from 13.21 to 19.92 μm, the average is 16 was 26±0.5 μm.

The results of morphometric analysis showed that on the 14th day after moderate spinal cord injury, the renal corpuscle area, renal corpuscle area, Shumlyansky-Bowman capsule area, proximal and distal convoluted tubule diameter, and tubular lumen diameter in renal nephrons increased to a critical level, which was confirmed by histomorphometric parameters.

Conclusion: Thus, as a result of macroscopic, histological, and histomorphometric studies, a number of morphological changes were detected in the kidneys of 3-month-old white rats with moderate-severe spinal cord injury in the experimental group. In particular, the maximum changes were observed in the structure of kidney nephrons of the white rats with moderate brain damage of the experimental group, and statistically significant differences were found in all studied indicators compared to the indicators of the control group animals.

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