

Morphological Features of the Kidneys after Drug Correction of Mild Cranio-Brain Injury

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Annotation. This article contains information about the results of a scientific study, the purpose of which is to evaluate and study the morphological features of the kidneys of 3-month-old rats that suffered a mild traumatic brain injury after drug treatment. Morphological analysis of rat kidneys was performed on the 1st and 3rd days after brain injury.

Keywords: traumatic brain injury, nephron, morphological features, biopsy, Shumlyansky-Bowman's capsule

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Relevance: Among all types of injuries, first of all, traumatic brain injury "at the end of the 20th century became one of the most urgent problems not only in the healthcare system, but also in any social system" [3,4,5,6,7,8,11]. In this regard, the diagnosis and effectiveness of treatment of traumatic brain injury is the most urgent problems of modern medical science around the world [2].

An important method for studying the state of the renal tissue in traumatic brain injury is the morphological study of kidney biopsy specimens. Today, the analysis of structural changes in various departments of nephrons in traumatic brain injury is one of the most important problems of modern nephrology [1,9,10,12,13,14].

Material and methods: For research, laboratory white outbred rats were used: 20 males and 10 females, three months old. Under experimental rats, they were kept in a vivarium with a standard diet, free access to water, and a normal lighting regime; work with laboratory animals was carried out in compliance with the basic regulatory and ethical requirements for laboratory and other experiments involving experimental animals of different species. All animals were anesthetized under light ether anesthesia and divided into 2 groups. The first of them consisted of animals that were fixed in the installation, but did not cause injury (control, n=10). The second (experimental, n=20) - animals that were subjected to TBI with medical correction. The "traffic accident" model was used to inflict injuries on animals. In this experiment, rats were fastened to a vehicle and accelerated at speed while hitting the frontal part of their head against a wooden barrier. After injury, the animals were transferred to a special plastic cage and observed until normal behavior was restored. During the recovery period, asphyxia, convulsions, bleeding, etc. were observed in rats. 30 minutes after the injury, the surviving animals returned to a normal lifestyle and diet.

Treatment with the drug was carried out one day after the brain injury, the drugs were administered intramuscularly, based on the average weight of the animals. Piracetam 5 ml of the solution was dissolved in 45 ml of isotonic sodium chloride solution and 0.3 ml of the resulting mixture was injected intramuscularly, 5 ml of a 25% magnesium sulfate solution was dissolved in 45 ml of isotonic sodium chloride solution and 0.6 ml of the resulting mixture was injected intramuscularly, 4 ml of the solution neuroxon was dissolved in 196 ml of isotonic sodium chloride solution and the resulting mixture was injected intramuscularly 0.4 ml. The drug was administered intramuscularly at the same time for 10 days after the 1st day of traumatic brain injury. After 10 days, the animals were examined in the prescribed manner to identify morphological changes in the kidney tissue after drug treatment.

During the experiment, these animals were decapitated on the first and third days, the abdominal cavity was opened, and the kidneys were removed. For histopathological comparison, samples were taken 1, 3 days after treatment. These slides were prepared using standard histological techniques and stained with hematoxylin and eosin. Microscopy of preparations in transmitted light was carried out using a trinocular microscope with a microscope magnification $\times 60$, $\times 80$. Histological images were captured using a microscope camera. The obtained images were analyzed using specialized software for medicine.

Results: In a 3-month-old white outbred rats in the study of the kidneys after a mild traumatic brain injury in the treatment of drugs, the following data were obtained:

Features of morphological and morphometric parameters of rat kidneys one day after mild traumatic brain injury:

The absolute weight of the kidney is from 708.14 to 1009.82 mg, the average weight is 858.82 ± 37.95 mg, the length of the right kidney is from 14.5 to 20.36 mm, the average length is 17.61 ± 0.67 mm, the width is from 6.2 mm to 8.7 mm, average - 7.48 ± 0.31 mm, thickness - from 7.68 mm to 9.6 mm, average thickness - 7.48 ± 0.2 mm, volume of the right kidney from 372.65 mm³ to 838.57 mm³, with an average of 586.62 ± 50.4 mm³.

The area of the renal corpuscles ranged from 1920.8 μm^2 to 2221.61 μm^2 with an average area of 2033.17 ± 35.35 μm^2 , and the area of the vascular glomerulus ranged from 1612.82 μm^2 to 1814.12 μm^2 with an average value of $1731.56 \pm 25, 26$ μm^2 , the area of the capsule cavity ranged from 285.32 μm^2 to 344.76 μm^2 with an average value of 309.86 ± 7.31 μm^2 .

The diameter of the proximal sections of the curved tubules ranged from 27.9 μm to 35.81 μm with an average value of 31.84 ± 1.03 μm , and the diameter of the cavity of the curved tubules ranged from 15.1 μm to 19.03 μm with an average value of 17.46 ± 0.41 μm .

The diameter of the distal curved tubules ranged from 26.12 μm to 29.01 μm with a mean value of 27.47 ± 0.41 μm , and the diameter of the cavity of the curved tubules ranged from 14.64 μm to 17.6 μm with a mean value of 16.4 ± 0.4 μm .

Characteristics of the morphological and morphometric parameters of the kidneys of rats three days after a mild traumatic brain injury:

The absolute weight of the kidney is from 704.34 mg to 1005.38 mg, the average weight is 858.04 ± 32.71 mg, the length of the right kidney is from 14.41 to 20.31 mm, the average length is 17.84 ± 0.75 mm, the width - from 5.94 mm to 8.86 mm, average - 7.31 ± 0.36 mm, thickness - from 7.68 mm to 8.64 mm to, average thickness - 8.11 ± 0.11 , volume of the right kidneys - from 343.81 mm³ to 813.13. mm³, on average 566.54 ± 9.47 mm³.

The area of the renal corpuscle is from 1912.6 μm^2 to 2187.67 μm^2 , on average 1993.28 ± 24.14 μm^2 , the area of the vascular glomerulus is from 1608.7 μm^2 to 1789.18 μm^2 , the average value is

1711.63±23.2 μm^2 , the area of the capsule cavity ranged from 286.94 μm^2 to 360.2 μm^2 , on average 337.52±8.04 μm^2 .

The diameter of the distal curved tubules ranged from 35.76 μm to 39.2 μm with a mean value of 37.55±0.35 μm , and the diameter of the tubular cavity ranged from 17.8 μm to 21.6 μm with a mean value of 19.84±0.44 μm .

The diameter of the proximal curved tubules ranged from 27.1 μm to 32.8 μm with a mean value of 29.91 ± 0.57 μm , and the diameter of the tubular cavity ranged from 16.6 μm to 19.2 μm with a mean value of 17.6 ± 0.57 μm^2 . Thus, histological, morphometric and microscopic studies after 1-day therapy with the drug revealed morphological changes in the kidneys of 3-month-old rats subjected to mild traumatic brain injury of the experimental group.

Figure 1. Topographic location of the kidneys of 3-month-old rats in the control group. 1-stomach, 2-liver, 3-spleen, 4-kidneys, 5-small intestine.

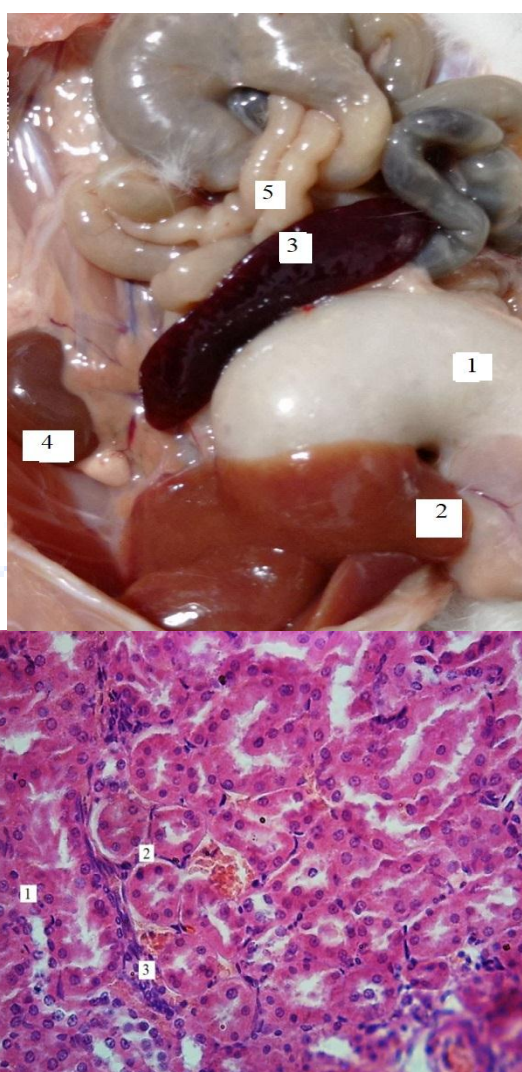


Figure 2. Kidney cortex of 3-month-old rats with mild traumatic brain injury after drug treatment of the experimental group. Hematoxylin-eosin staining. OK 10 x OB 40. 1-proximal channel, 2-distal channel, 3-zone of inter-channel focal hemorrhage.

On the macroscopic side, there were no significant changes under the influence of mild brain injury after drug treatment. A study of histological preparations of kidneys in rats after the first day of a mild

traumatic brain injury showed that there were pronounced changes in blood flow and structural changes in the kidney parenchyma, in particular, expansion of capillaries, veins and focal hemorrhage in the renal glomeruli, tubules.

Conclusion: The results of morphological changes in the kidneys in rats that occur in response to mechanical trauma after three days of treatment with drugs from the experimental group showed that the diameter of the Shumlyansky-Bowman capsule, the diameter of the proximal and distal curved tubules, as well as the diameter of the cavity approached the parameters of the control group 1.

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