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

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Summary: 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 moderate-severe traumatic brain injury after drug treatment. Morphological analysis of rat kidneys was performed on the 1st and 3 rd days after brain injury.

Key words: traumatic brain injury, nephron, morphological features, biopsy, Shumlyansky-Bowman's capsule.

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" [3,4.5,6,7,8,11,15,16,17]. 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 [2,18,19,24,25,26].

An important method for studying the state of the renal tissue in traumatic brain injury is the morphological study of kidney biopsy specimens [27,28,29,30,31]. 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 [1,9,10,12,13,14,20,21,22,23].

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 ×60, ×80. Histological images were captured using a microscope camera. The obtained images were analyzed using specialized software for medicine.

Results: Features of the morphological and morphometric parameters of the kidneys of rats one day after moderate-severe brain injury:

Absolute kidney weight 965.2 mg to 1213.2 mg, mean weight 1081,185 ± 27.42 mg, right kidney length 16.02 to 21.2 mm, mean length 18.88 ± 0.58 mm, width - from 6.5 mm to 9.78 mm, average - 7.98 ± 0.58 mm, thickness - from 7.2 mm to 9.6 mm, average thickness - 8.42 ± 0.27 mm, right kidney volume ranged from 392.11 mm3 to 1040.99 mm3, with an average of 680.88 ± 65.91 mm3.

The area of the renal corpuscles ranges from 1918.5 μ2 to 2297.8 μm2, the average 2013.7 ± 33.6 μm2, the area of the vascular ball from 1682.4 μ2 to 1899.2 μm2, the average value of 1793.66 ± 24.18 μm2, the area of the capsule cavity ranged from 364.6 μm2 to 396.76 μm2, with an average value of 377,535 ± 3.64 μm2.

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The diameter of the proximal curved tubules ranged from 30.65 μm to 40.6 μm, with an average of 38.02 ± 0.86 μm, and the diameter of the curved tubular cavity ranged from 21.4 μm to 23.89 μm, with an average value of 22.9 ± 0. , 26 mkm ga teng.

The diameter of the distal tubules ranged from 32.45 μm to 34.84 μm, with an average value of 33.76 ± 0.26 μm, and the diameter of the curved tubular cavity ranged from 17.62 μm to 19.8 μm, with an average value of 18.91 ± 0. , 22 mkm3 ga teng.

Features of the morphological and morphometric parameters of the kidneys of rats three days after moderate-severe brain injury:

Absolute kidney weight was 998.7 mg to 1217.8 mg, mean weight was 1126.36 ± 26.56 mg, right kidney length was 16.02 mm to 19.65 mm, mean length was 18.19 ± 0.44 mm, width - from 6.8 mm to 9.3 mm, average - 8.1 ± 0.28 mm, thickness - from 7.4 mm to 9.87 mm, average thickness - 8.61 ± 0.28 mm, right kidney volume ranged from 427.3 mm3 to 925.1 mm3, with an average of 671 ± 48.54 mm3.

The area of the renal corpuscles ranged from 1925.5 μm2 to 2222.8 μm2, with an average area of 2052.3 ± 34.11 μm2, the area of the vascular ball ranged from 1682.4 μm2 to 1890 μm2, and the average value ranged from 1781.99 ± 21.15 μm2. area from 364.6 μm2 to 410 μm2, with an average value of 392.82 ± 4.55 μm2.

The diameter of the proximal curved tubules ranged from 38.43 μm to 39.5 μm, with an average of 38.98 ± 0.13 μm, and the diameter of the curved tubular cavity ranged from 18.64 μm to 22.33 μm, with an average value of 19.8 ± 0. , 36 mkm ga teng.

The diameter of the distal tubules ranged from 30.58 μm to 33.2 μm, with an average value of 32.01 ± 0.27 μm, and the diameter of the curved tubular cavity ranged from 18.3 μm to 20.8 μm, with an average value of 19.3 ± 0. , 22 mkm3 ga teng.

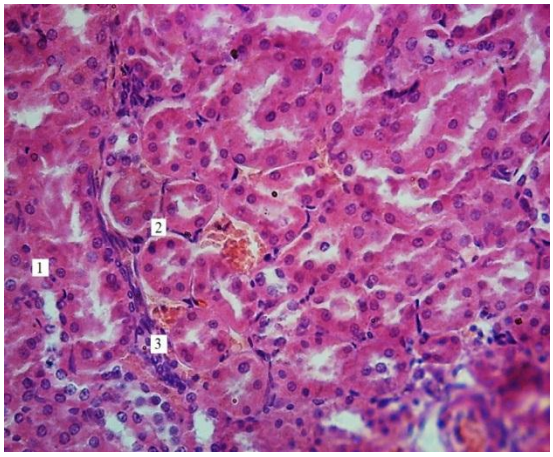

Figure 1. Kidney cortex of 3-month-old rats with mild traumatic brain injury after drug treatment of the experimental group. Hematoxylin-eosin staining. OK 10 x OB 40. 1-proximal channel, 2-distal channel, 3-zone of inter-channel focal hemorrhage.

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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