

**ФУНДАМЕНТАЛ ВА  
КЛИНИК ТИББИЁТ  
АХБОРОТНОМАСИ**

**BULLETIN OF FUNDAMENTAL  
AND CLINIC MEDICINE**

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**BULLETIN OF FUNDAMENTAL  
AND CLINIC MEDICINE**

**ФУНДАМЕНТАЛ ВА КЛИНИК  
ТИББИЁТ АХБОРОТНОМАСИ  
ВЕСТНИК ФУНДАМЕНТАЛЬНОЙ И  
КЛИНИЧЕСКОЙ МЕДИЦИНЫ**

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## MORPHOMETRIC CHARACTERISTICS OF THE RAT NEPHRON IN NORMAL CONDITIONS AND DURING CORRECTION AGAINST THE BACKGROUND OF CHRONIC RADIATION SICKNESS

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**Resume.** In the experiment on rats, a comparison was made of the morphological changes in parts of rat kidney nephron normal and under the influence of ASD fraction 2 against the background of chronic radiation sickness. To establish the dynamics of changes in morphometric parameters of the area of the renal corpuscle, proximal and distal convoluted tubules of the kidneys of 6-month-old rats in normal conditions and under the influence of ASD fraction 2 against the background of chronic radiation sickness. The effect of tissue drug ASD-2 as correctors can be explained by the fact that this drug reduces the production of free oxygen radicals, which have damaging effects on biological membranes of cells, proteins, nuclear chromatin, and also disrupt the stability of ion channels and receptors.

**Key words:** nephron, proximal convoluted tubule, distal convoluted tubule, chronic radiation sickness, ASD-f2.

## МЕЪЁРДА ВА СУРУНКАЛИ НУР КАСАЛЛИГИ ФОНИДА КОРРЕКЦИЯДА КАЛАМУШ НЕФРОНЛАРИНИНГ МОРФОМЕТРИК ХУСУСИЯТЛАРИ

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**Резюме.** Каламушларда ўтказилган тажрибада каламушлар буйраги нефрони қисмларининг морфометрик ўзгаришларининг хусусиятлари ва сурункали нур касаллигида АСД-2 фракцияси таъсиридаги ўзгаришлари солиштирилди. 6 ойлик каламушларнинг сурункали нур касаллиги фонида буйрак таначалари, буйрақлар проксимал ва дистал эгри-бугри каналчалар меъёрда ва АСД-2 таъсирида морфометрик параметрларининг ўзгариши динамикасини аниқланди. АСД-2 тўқималарнинг тикланишига ёрдамлашувчи дори-воситаси сифатида таъсири ушбу дори воситаси ҳужайралар, оқсиллар, ядро хроматинларининг биологик мембраналарига зарарли таъсир кўрсатадиган, шунингдек, ион каналлари ва рецепторлари барқарорлигини бузадиган эркин кислород радикаллари ишлаб чиқаришни камайтириши билан изоҳланиши мумкин.

**Калит сўзлар:** нефрон, проксимал эгри-бугри каналчалар, дистал эгри-бугри каналчалар, сурункали нур касаллиги, АСД-2 фракцияси.

## МОРФОМЕТРИЧЕСКИЕ ХАРАКТЕРИСТИКИ НЕФРОНА КРЫСЫ В НОРМЕ И ПРИ КОРРЕКЦИИ НА ФОНЕ ХРОНИЧЕСКОГО ЛУЧЕВОЙ БОЛЕЗНИ

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**Резюме.** В эксперименте на крысах проведено сопоставление морфологических изменений частей нефрона почек крыс в норме и при воздействии АСД фракции 2 на фоне хронической лучевой болезни. Установить динамику изменений морфометрических параметров площадь почечного тельца, проксимальных и дистальных извитых канальцев почек крыс 6 месячного возраста в норме и при воздействии АСД фракции 2 на фоне хронической лучевой болезни. Эффект тканевой лекарственно-го препарата АСД-2 в качестве корректоров можно объяснить тем, что данный препарат снижает продукцию свободных радикалов кислорода, которые оказывает повреждающие действия на биологические мембраны клеток, белки, хроматин ядра, а также нарушают стабильность ионных каналов и рецепторов.

**Ключевые слова:** нефрон, проксимальный извитый каналец, дистальный извитый каналец, хроническая лучевая болезнь, АСД-ф2.

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**Relevance and problems.** The acceleration of civilization and the pollution of the environment with various radioactive substances leads to an increase in the incidence of the population due to various

morphological changes in organs and tissues [1]. The urinary system occupies a particularly important place in the relationship of the whole organism with the external environment. The kidneys, as the main excretory organ, are highly susceptible to the negative effects of radiation, which is one of the main components of radiation [2].

An important problem of morphology is the search for effective pharmacological drugs that can increase resistance and activate the body's defenses. One of these drugs, named tissue drug ASD-2, has a stimulating effect on biochemical processes, improves the functional state of natural resistance mechanisms, stimulates immunogenesis, enhances regeneration processes, as a result of which tissue resistance to adverse effects [3].

Radiation is one of the unfavorable factors. Influencing the body as a whole and its individual functions, radiation causes persistent changes in the urinary organs, the blood system, etc. [1,7].

In the study of the long-term effects of chronic irradiation, the parameters of the nephrons of the kidney in a more radiosensitive population decrease and, in parallel, the number of stromal elements in the most resistant to radiation increases [4]. These data indicate a decrease in the functional activity of the kidney nephrons after exposure to chronic radiation [5].

The tissue drug ASD-2 has a stimulating effect on biochemical processes, improves the functional state of the mechanisms of natural resistance, stimulates immunogenesis, enhances regeneration processes, as a result of which tissue resistance to adverse effects, including radiation, increases. [1.6].

A detailed study of the morphometric characteristics of kidney nephrons under chronic irradiation will make it possible to scientifically correct radiation injuries and rationally use ASD fraction 2 in the treatment of irradiated patients.

**The aim of the study:** to establish the dynamics of changes in morphometric parameters of the area of the renal corpuscle, proximal and distal convoluted tubules of the kidneys of 6-month-old rats in normal conditions and under the influence of ASD fraction 2 against the background of chronic radiation sickness.

**Materials and methods.** The study was carried out on 60 white rambred male rats, weighing from 210 to 320 g, kept in a vivarium with a standard diet, free access to water, and normal lighting. Animals were divided into 3 groups (n = 60): I - intact control (n = 20); II - irradiation without drug administration (n = 20); III - drug administration during irradiation (n = 20). To simulate chronic radiation sickness, rats were irradiated with a DTGT "AGAT R1" apparatus (Baltiets plant, Narva, Estonia) with a capacity of 25.006 cGy / min for 20 days at a dose of 0.2 Gy (the total dose was 4.0 Gy) up to 90 day age. ASD of fraction 2 was used as a preparation. Animals of the third group received 0.1 ml of pure ASD per 0.4 ml of distilled water during oral irradiation.

The severity of organopathology was assessed by morphological parameters (area of the renal corpuscle, outer diameter of the proximal and distal convoluted tubules, diameter of the lumen of the tubules and its percentage in the groups).

Changes in the renal nephron at the end of the experiment corresponded to chronic radiation sickness and biostimulant correction.

The animals were removed from the experiment after 3 months (at 180 days of age) from the moment of its beginning, by instant decapitation of the animals under ether anesthesia. The study received permission from the Ethics Committee of the Bukhara State Medical Institute named after Abu Ali ibn Sino.

For microscopic examination, the material was fixed in 10% formalin, passed through a battery of alcohols, and paraffin blocks were poured in accordance with generally accepted methods. Staining of sections with a thickness of 5-7 microns was performed with hematoxylin-eosin.

Mathematical processing was carried out directly from the general data matrix "Excel 7.0" on a personal computer Pentium-IV, the indices of the standard deviation and the error of representativeness were determined.

**Results and discussion.** In the morphological study of the parameters, the area of the renal corpuscle, the outer diameter of the proximal and distal convoluted tubules, and the diameter of the lumen of the renal tubules in rats of the 1st group showed a positive dynamics of changes in all parameters. During the observation period, the area of the renal corpuscle increased to  $3263 \pm 34$  mc<sup>2</sup>, the average outer diameter of the proximal convoluted tubule was  $22.08 \pm 0.12$  mcn, the diameter of the tubule lumen was  $13.12 \pm 0.09$  mcn, the outer diameter of the distal convoluted tubule was, on average,  $21.11 \pm 0.32$  mcn, the diameter of the tubule lumen  $12.04 \pm 0.1$  mcn.

In the rats of the 2nd group, a decrease in morphometric parameters was observed compared with the animals of the 1st group. After the end of the exposure to the conditions of the 2nd group, the area of the renal corpuscle decreased to  $3018 \pm 4$  mc<sup>2</sup>,  $3056 \pm 7$  mc<sup>2</sup>,  $3126 \pm 6$  mc<sup>2</sup>,  $3131 \pm 5$  mc<sup>2</sup> (percentage - 7.21%, -6.32%, -4, 18%, -4.03%) the outer diameter of the proximal convoluted tubule decreased  $20.04 \pm 0.1$

micron,  $20.49 \pm 0.13$  micron,  $21.16 \pm 0.3$  micron,  $21.39 \pm 0.2$  micron (percentage -9.26%, -7.21%, -4.15%, -3.11%) the diameter of the tubule lumen at  $12.16 \pm 0.12$  micron,  $12.29 \pm 0.22$  micron,  $12.45 \pm 0.13$  micron,  $12.70 \pm 0.31$  micron (percentage -7.25%, -6.31%, -5.12%, -3.21%) the outer diameter of the distal convoluted tubule decreased  $18.59 \pm 0.1$  micron,  $18.68 \pm 0.23$  micron,  $18.86 \pm 0.12$  micron,  $19.24 \pm 0.33$  micron (percentage -7.54%, -7.09%, -6.22%, -4.34%) the diameter of the canaliculus lumen by  $11.42 \pm 0.11$  micron,  $11.43 \pm 0.14$  micron,  $11.60 \pm 0.23$  micron,  $11.67 \pm 0.12$  micron (percentage ratio -5.12%, -5.04%, -3.64%, -3.09%).

When comparing the morphometric parameters of the rats of the 3rd group with those of the 2nd group, a significant increase was found. The area of the renal corpuscle increased  $3430 \pm 71$   $\mu\text{m}^2$ ,  $3427 \pm 8$   $\mu\text{m}^2$ ,  $3367 \pm 0.8$   $\mu\text{m}^2$ ,  $3361 \pm 5$   $\mu\text{m}^2$  (percentage + 5.14%, + 5.05%, + 3.19%, + 3.02%), the outer diameter of the proximal convoluted tubule increased  $24.65 \pm 0.4$  micron,  $24.19 \pm 0.32$  micron,  $23.73 \pm 0.25$  micron,  $23.58 \pm 0.24$  micron (percentage + 8.13%, + 6.11%, + 4.08%, + 3.42%) the diameter of the canaliculus lumen by  $13.95 \pm 0.17$  micron,  $13.78 \pm 0.22$  micron,  $13.53 \pm 0.16$  micron,  $13.12 \pm 0.2$  micron (percentage ratio + 6.33%, + 5.09%, + 3.12%, + 3.08%) the outer diameter of the distal convoluted tubule increased  $22.61 \pm 0.21$  micron,  $22.18 \pm 0.13$  micron,  $22.17 \pm 0.32$  micron,  $22.05 \pm 0.18$  micron (percentage + 7.12%, + 5.07%, + 5.03%, + 4.48%) the diameter of the canaliculus lumen at  $12.58 \pm 0.13$  micron,  $12.52 \pm 0.21$  micron,  $12.41 \pm 0.17$  micron,  $12.32 \pm 0.31$  micron (percentage + 4.47%, + 4.04%, + 3.07%, + 2.31%).

The effect of tissue drug ASD-2 as correctors can be explained by the fact that this drug reduces the production of free oxygen radicals, which have damaging effects on biological membranes of cells, proteins, nuclear chromatin, and also disrupt the stability of ion channels and receptors.

**Conclusions.** When modeling chronic radiation sickness on the 180th day of the experiment, a significant decrease in the parameters of nephrons in irradiated rats was revealed as compared with those in intact animals. When correcting ASD with fraction 2, the morphometric parameters of the nephron are restored, and an increase in the number and parameter occurs, which was not observed in the irradiated group. These facts indirectly indicate a decrease in the indices of the renal nephron after exposure to chronic irradiation and approaching normal parameters under the influence of ASD - f 2.

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