LEARNING MORPHOLOGICAL CHANGES IN WARM ISCHEMIA EXPERIMENT

Pulat Sultanov
Center for the Development of Professional Qualifications for Medical Workers
Muhammadaziz Aliev
Republican Research Center of Emergency Medicine, Tashkent, Uzbekistan.

Background. Warm ischemia to the kidneys is unavoidable during certain surgical operations, such as transplantation. In this work, we investigated morphological changes in kidney during warm ischemia experiment.
Objective: to evaluate the morphological changes in the kidney over time, occurring as a result of warm ischemia of varying duration in the experiment.

Materials and methods. The experimental study involved 78 white rats. 4 experimental groups, with 18 rats each, were created. Each group was divided into three subgroups of 6 rats, which were killed respectively on the 3rd, 7th and 14th days after the experiment. There was also an intact group of 6 rats. After euthanization of the animals by decapitation, kidney pieces were fixed in 10% neutral formalin solution for 48 hours, then washed in running water for 2-4 hours. Histological sections obtained on a sled microtome after deparaffinization of the general morphological state of the tissues were stained with hematoxylin-eosin: paraffin sections were deparaffinized in chloroform and washed in distilled water, then a hematoxylin solution was poured onto the sections for 3 minutes, then washed in tap water for 10 minutes and the sections were stained with eosin from 0.2 to 3 minutes depending on the thickness of the sections.

Results. The macroscopic picture of renal thermal ischemia was manifested by tissue edema with a change in the color of the kidney to a dark purple color from the first minute after the ligature was applied to the renal hilum. After the ligature was removed, the swelling and color of the kidney were completely restored at 12 and 24 minutes of thermal ischemia, whereas at 36 and 48 minutes of ischemia, the swelling persisted and there were small-point hemorrhages in the renal parenchyma. During the euthanization of rats on days 3, 7 and 14 after 12 and 24 minutes of ischemia, no special macroscopic changes in the kidneys were observed compared to the control group, however, there was swelling of the kidney with a change in color with a purple tint on the 3rd day, followed by blanching of the color of the kidney parenchyma on the 3rd day. 7 days and its decrease in size on the 14th day, which were less pronounced at 36 minutes and more pronounced at 48 minutes of warm ischemia.

Conclusions:

1) With 12 minutes of thermal ischemia, circulatory and edematous changes in the stromal-vascular components and superficial dystrophic changes in the form of small-drop vacuolar dystrophy of the epithelium of the convoluted tubules develop in the kidney tissue, which stabilizes by the 14th day after ischemia without any residual pathological changes.

2) With 24-minute thermal ischemia in the kidney tissue on the 3rd day of the experiment, the development of non-circulatory, edematous and dystrophic phenomena is noted, which are normalized on the 14th day. At the same time, signs of dystrophic changes in the cytoplasm and nucleus of the epithelium completely disappeared.

3) During 36-minute warm ischemia of the kidneys, dystrophic and destructive changes in the form of wrinkling and apoptosis are observed in individual epithelial cells of the convoluted tubules. The majority of the convoluted tubules acquire normal histostructures without signs of pathology.

4) At 48 minutes of warm ischemia of kidneys, development of irreversible destructive-necrobiotic changes is noted from the early stages of the experiment. At the same time, fibrinoid necrosis of fibrous structures, disintegration and fragmentation of cellular elements of connective tissue are determined from the stromal elements. Epithelium of convoluted tubules is subjected to ischemic destruction and necrobiosis.

References:

1. S.V. Gauthier, Immunosuppression in solid organ transplantation, 2nd edition. 2011y.
2. N.A. Onishchenko, S.S. Meshcherin, I.M. Ilyinsky, V.I. Sevastianov. Influence of Bone Marrow Mscs on The Development of Posttransplant Changes in Kidneys 2016;18(1):45-52. DOI: 10.15825/1995-1191-2016-1-45-52
3. Farhod Khadjibaev, Visolat Sharipova, Pulat Sultanov, Khikmat Anvarov, Dilshod Ergashev, Malika Ruzibakieva. The First Successful Kidney Transplantation of a Child with the Abnormality of the Urinary Tract in Uzbekistan (Case report). Experimental and Clinical Transplantation. 2020, Vol. 18, Suppl.1, P.44-46. DOI: 10.6002/ect.TOND-TDTD2019.O22. PMID: 32008493
4. First Russian Experience Of Liver And Kidneys Transplantation Obtained From The Donor With Out-Of-Hospital Irreversible Cardiac Arrest A.E. Skvortsov , S.F. Bagnenko, S.S. Komedev, V.M. Teplov , I.I. Kolachev , A.Yu. Shchurov, A.L. Merkulov, V.P. Filatov, A.A. Boykov, O.N. Reznik 2019;21(1):88-95. https://doi.org/10.15825/1995-1191-2019-1-88-95
5. F. Reyna-Sepúlveda, A. Ponce-Escobedo, A. Guevara-Charles, M. Escobedo-Villarreal, E. Pérez-Rodríguez, G. Muñoz-Maldonado, and M. Hernández-Guedea. Outcomes and Surgical Complications in Kidney Transplantation / Int J Organ Transplant Med. - 2017 .- - 8 (2). - P.78–84
6. Weight SC, Furness PN, Nicholson ML. A new model of renal warm ischemia-reperfusion injury for comparative functional, morphological, and pathophysiological studies. Br J Surg 1998;85:1669e73.
7. L. W. Ernest van Heurn, David Talbot, Michael L. Nicholson, Mohammed Z. Akhtar, Ana I. Sanchez-Fructuoso, Laurent Weekers, Benoit Barrou. Recommendations for donation after circulatory death kidney transplantation in Europe Transplant International. 2016; 29: 780–789.
8. Gill J, Rose C, Lesage J, Joffres Y, Gill J, O'Connor K. Use and Outcomes of Kidneys from Donation after Circulatory Death Donors in the United States. J Am Soc Nephrol. 2017 Dec;28(12):3647-3657. doi: 10.1681/ASN.2017030238. Epub 2017 Oct 5. PMID: 28982695; PMCID: PMC5698075.