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MORPHOLOGICAL FEATURES OF BLOOD VESSELS IN THE RENAL MEDULLA

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Abstract. Protein is an important component in the functioning of the body. But for those who have kidney disease, excessive protein intake leads to the opposite effect. Since the glomeruli of blood vessels cannot fully filter the blood, toxic substances accumulate in the body. This leads to disease of other organs. Therefore, the topic is important for research. The main goal of the work is to study the morphological changes in the structures of the tubular and vascular systems of the kidneys with protein load. Regulation of protein homeostasis is provided by structural and functional systems, and can be accompanied by proteinuria.

Keywords: protein loads, glomerular filtration rate, kidneys, art.

INTRODUCTION

The life of an organism is a wide range of genetically programmed continuous restructuring in response to the action of various factors of the external and internal environments, changes in homeostasis parameters arising as a result of the dynamism of constantly ongoing metabolic processes. Formed as a result of evolution, adaptive reactions are realized in ontogenesis as genetically programmed, and with all their diversity are divided into those realized relatively quickly (fractions of a second, seconds) and slowly (days, months, years) [1].

MATERIALS AND METHODS

The experiments were performed on mature mongrel white rats weighing 140-160 g. The first group of rats (15) underwent protein loading of the kidneys by single and multiple parenteral administration of albumin protein. The second group of rats (15) were subjected to protein starvation, without limiting access to water. The third group of rats (15) served as a control. In all series of the experiment, the right kidney was cut through the middle from the convex surface to the hilum area. Then, a 1.5 mm thick plate was cut parallel to the plane of the cut and the cortex was separated from the medulla. Subsequently, the cortex of the kidney was cut into three equal parts: internal, intermediate and superficial. Kidney tissue corresponding to superficial and juxtamedullary nephrons was fixed in 2.5% buffered glutaraldehyde acid solution. The process of preparing sections of the tissue under study was performed on an ultramicrotome using the general method used in electron microscopy. The sections were mounted on a glass slide, dried at room temperature and stained with two basic dyes - methylene blue and basic fuchsin. Microscopic photographs were taken on a light microscope equipped with a digital camera.

RESULTS AND DISCUSSION

The results showed that on the first day of protein loading, there is an expansion of the afferent and a narrowing of the efferent arterioles, an increase in the proportion of glomeruli with a greater degree of opening of blood capillaries (GOCC) and activation of the cells of the juxtaglomerular apparatus (JGA) [2].

The structure of the cells of the proximal tubules did not change. It is characterized by a light homogeneous cytoplasm with basally located nuclei. The mesangial matrix is present in an insignificant amount, in which only single mesangiocytes were detected.

After three days, with the normalization of the JGA structure, the degree of GOCC of both superficial and juxtamedullary nephrons exceeds the indicators of control animals.

The cells of the macula densa are cleared, the length of the basal and lateral parts of their outer membrane is increased. Juxtavascular cells are hypertrophied and contain secretory granules. Mesangiocytes become larger and acquire an irregular shape under protein loading.

During starvation, after 3 days, the degree of SUCC is increased, however, activation of JGA is not observed [3]. After 7 days, SUCC remains high only in juxtamedullary nephrons [4].

Light-optically, regular morphological changes were detected in various parts of the nephron. An increase in the size of the glomeruli with expansion of the urinary space of Bowman's capsule, expansion of the mesangial matrix with a moderate increase in the number of mesangiocytes, adhesions of capillary loops to the walls of the capsule, as well as compression of the capillary loops are observed. In addition, focal sclerosis of the capsule and sclerosis of the capillary loops were detected in individual glomeruli. Significant changes were found in the proximal tubules. Among them, one can note an increase in the content of secretory granules in the cytoplasm of the cells, bulging of the apical part of the cytoplasmic membrane of the tubular cells into the lumen, as well as the apical and intermediate position of the nuclei in a significant number of cells.

Thus, under different physiological conditions, there are regular changes in the cells of the JGA and glomerular capillaries, superficial tubules and juxtamedullary nephrons, which are aimed at increasing the functional reserve of the kidneys [2]. In control animals, the juxtaglomerular cells of the afferent arteriole are the main renin-producing component of the juxtaglomerular apparatus of the kidneys [3]. They are polygonal in shape and contain numerous organelles: rough reticulum profiles, which are evenly distributed throughout the cytoplasm, closely interact with round, moderate-sized mitochondria; the Golgi complex is localized near the nucleus. Secretory granules (SG) are moderate in quantity, round, with high electron density, and evenly distributed throughout the cytoplasm. These data indicate their moderate functional activity [1].

CONCLUSION

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The obtained data indicate that a single protein load is accompanied by activation of the juxtaglomerular complex and changes in the functioning of nephrons. Morphological data characterize relatively early stages of development of experimental chronic renal dysfunction (renal dysfunction), since, along with obvious morphological signs of changes in glomerular hemodynamics and dystrophic changes in the tubules, only initial evidence of the formation of nephrosclerosis was found.

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