INFLAMMATORY GROWTHS OF THE EPITHELIUM OF THE KIDNEYS WITH VITAMIN A DEFICIENCY

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The pathological anatomy of vitamin A deficiency has been adequately studied; the more or less uniform changes in man and animals have been described [1, 2, 3, 4, 5, 8, 7, 9, etc.]. With experimental vitamin A deficiency, the first thing to be noticed is disturbance of growth and regeneration of the tissues: the animal growth is retarded, there is loss of hair, and in various organs, atrophic changes take place [2, 9]. The healing of wounds is slowed down [9]. A sharp fall in the reaction of the organism to pathogenic stimuli is observed. As the most characteristic sign of vitamin A deficiency, one notes metaplasia of the epithelium, particularly of the higher respiratory passages, more seldom of the epithelium of the pelvis of the kidney and urinal bladder, and also xerophthalmia [2, 3, 4, etc.]. V. G. Garshin considers vitamin A deficient metaplasia not a true metaplasia, but one of the stages of regeneration which arises with destruction of the differentiated cells in connection with their acute dystrophia. In the process of regeneration, in his opinion, restoration of normally prismatic epithelium does not occur, and it is degenerated in the multilayer flat epithelium. E. Ya. Gertsenberg and D. I. Golovin have recognized that the changes in epithelium during a manifestation of a particular avitaminized growth of this tissue are not associated with its regeneration nor with inflammation.

Almost all the authors consider inflammation with vitamin A deficiency as a secondary manifestation, connected with the decline in the defense reaction. As regards the influence of vitamin A deficiency on the inflammation, T. N. Suchkova clearly showed in her work that with vitamin A deficiency, the regenerative processes and healing of wounds are slowed down.

The aim of the present work was to trace the peculiarities of growth of epithelium in the conditions of focal aseptic inflammation and vitamin A deficiency. The object of our investigation was the kidney. It is known that in the kidney with local aseptic inflammation, there arises growth of the epithelium of the tubules and pelvises of a regenerative and inflammatory nature. With vitamin A deficiency, metaplasia of the epithelium is seen in the epithelium of the pelvis (Wolbach and Howe, etc), and is not encountered in the epithelium of the tubules. With simultaneous inflammation and vitamin A deficiency, the inflammatory and regenerative growths of the epithelium of the tubules and pelvis, will be somewhat different from normal conditions without avitaminosis.

EXPERIMENTAL METHODS

Our experiments were conducted on 33 young rats weighing 50 g each; 15 of them received for two months food deprived of vitamin A (diet according to the formula of the Leningrad Vitamin Institute); 18 rats (control group) received normal food. The characteristic signs of vitamin A deficiency started to appear at the end of the first month, and clearly grew toward the end of the second.

The focal aseptic inflammation in the kidney in those suffering from vitamin A deficiency and in the control rats, was induced by introduction of 0.1-0.2 ml tar in one kidney, the second serving as control.

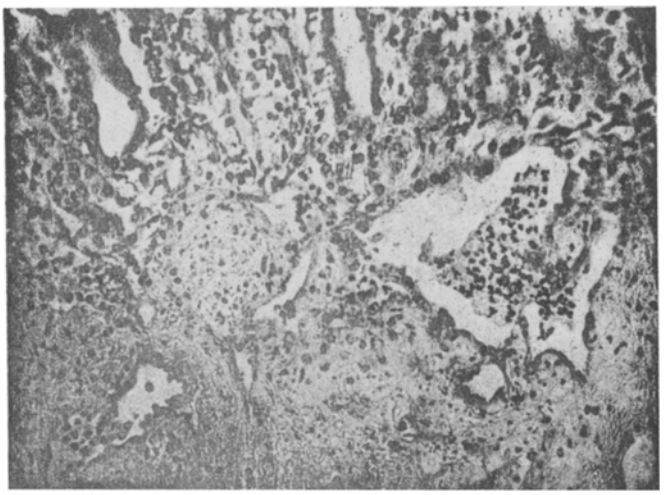

Fig. 1. Changes in the kidney of an adult rat on 2nd day after introduction of tar. Epithelisation of fine cysts and growth of rod-shaped epithelium.
Microphotography.

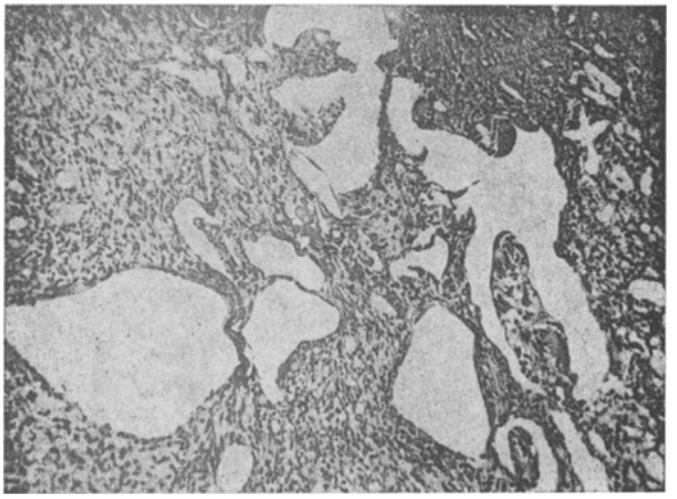

Fig. 2. Changes in kidney of adult rat on 10th day after introduction of tar. Numerous cysts lined with depressed epithelium. In the wall of the cysts small amounts of connective tissue and multi-nuclear giant cells.
Microphotography

Rats were killed after injection every day for the first 10 days and then every 2-4 days up to the 18th day. Some avitamized rats were killed on the 30-40th day, and the control on the 50-70th day. For the histological investigation, we made microscopic sections through the entire kidney with a frontal cut. The preparation was set into paraffin and stained according to Van Huyson, with hematoxylin-eosin, and treated with silver according to foot.

EXPERIMENTAL RESULTS

M. A. Zakharevska has described the inflammatory changes in the kidneys in rabbits with introduction of tar [6]. We shall only note the peculiarities of the inflammatory changes in the control rats, and give a description

Fig. 3. Changes in kidney of a rabbit with vitamin A deficiency on 12th day after introduction of tar. Fibrose tissue and fine cysts at the site of lesion in the border zone of the cortical layer of the kidney.
Microphotography.

of the inflammatory changes in the rats suffering from vitamin A deficiency.

In the rats of the control group, after administration of tar on the first day, we observed a focus of lesion with fresh hemorrhages and necrosis. At the periphery of the focus, was situated a zone of leucocytes and nuclear decomposition, and here and there separate protuberances of tubule epithelium in necrotic masses. On the second day (Fig. 1), around the focus of damage, a fulminating reaction developed, principally on the part of the tubules. In the cells of the epithelium, many mitoses appeared. Epithelium in the form of rods often grew deep in the center of the focus. In places, it grew on the tissues in strata, surrounding the necrotic masses with the formation of cysts. In places where the necrotic focus was in the mucosa of the pelvises, we saw growth of the epithelium of the pelvises: growing epithelium surrounded the necrotic masses, and drew them into the cavity of the pelvises. With this, the surface of the mucosa of the pelvises became uneven.

In the cells of the epithelium were found vacuoles, and in places, drops of tar. On the third day, the necrotic masses from the small focus almost completely disappeared; the growth of the epithelium slackened, but there was a large growth in fibroblasts. With treatment according to Foot at the periphery of the focus, a thick network of argyrophil fibers was observed.

On the 4th day, the growth of the epithelium usually waned, and in the focus, we found growth chiefly of the fibroblasts, and also, not only of argyrophili but a small quantity of collagenic fibers. Subsequently, about the 6th and 7th day, at the site of the focus of damage, fibrose scarred tissue remained. This was particularly evident in the border zone of the cortical layer. In the connective tissue, there usually remained immured narrow rods and tubes of the indifferent epithelium. With the presence of large foci of damage, and their localization in the sub-capsular zone of the cortical layer, in particular in the papilliferous blasts of the pyramid, where the stroma of the kidneys is poor in connective tissue and large vessels, the inflammatory process was usually drawn out and the reaction on the part of the connective tissue was weakly expressed. Often the necrotic masses remained surrounded with a narrow connective tissue capsule, and the focus did not heal with a scar. In connection with this, in the papilliferous zone of the pyramid very often cysts were recorded. In the early stage of purification, in the cavity the cysts contained usually necrotic masses and leucocytes (Fig. 1). The epithelium of the wall was usually cubic, and poorly differentiated; the wall of the cyst was uneven. In the late stages among the fibrose tissue were found cysts of a queer shape, lined with depressed epithelium (Fig. 2). Not infrequently, in the connective tissue of the focus, and in the wall of the cysts, multi-nuclear giant cells were observed.

In the rats of the avitamized group, the changes in the tissues after administration of tar were essentially identical with those of the rats of the control group. The difference between them was noted only in a quantitative sense. The inflammatory and regenerative processes under the conditions of vitamin A deficiency were more protracted than in normal conditions.

Thus, on the 2nd day in the control group, as pointed out above, we observed a fulminating growth of epithelium in the form of rods and strata, and in the avitamized group on the third day, only weak growth of epithelium in the form of rods at the periphery of the focus, and the whole of the center of the focus was formed of necrotic masses with leucocytic infiltration at the periphery. On treatment according to Foot at the site of the damage there was no visible growth of the argyrophil fibers. The fibers existing in the region of the focus were more coarse than outside it. Only on the 4th and 5th day did we find well developed epithelial rods and strata. On the 6th day, the growth of epithelium diminished, and both argyrophic and collagenic fibers began to develop, but in a small amount. Subsequently, the focus turned into a scar tissue, without any signs peculiar to vitamin A deficiency (Fig. 3).

Our experiments showed some peculiarities of the course of the inflammatory process in rats as compared with rabbits. It is clear from the descriptions of M. A. Zakharevska [6] that in rabbits in the kidney at the site of tar injection, the fibrose tissue is weakly developed; only with administration of formalized butter did one see large growths of the fibrose tissue. In our experiments in almost all the rats, a well marked fibrose tissue was noted.

In relation to the peculiarities of the inflammatory process under the conditions of vitamin A deficiency, our findings coincide with those of T. N. Suchokova. The morphological picture of the inflammatory process, both with and without vitamin A deficiency, was uniformly expressed. However, with vitamin A deficiency, the whole course of the process was delayed and weakened. One may recognize that there is a law governing delay of the regenerative processes with inflammation in conditions of vitamin A deficiency. It is known that with insufficiency of vitamin A in the organism, one sees a sharp fall in general reactivity and in the defense and compensatory adjustments. This explains why insufficiency of vitamin A is often accompanied by inflammation, and delay of the inflammatory and regenerative processes, both with a focus aseptic inflammation (our findings) and with induced skin wounds and ulcers (T. N. Suchkova).

LITERATURE CITED

[1] Garshin, V. G., Inflammatory Growth of Epithelium, its Biological Importance and Relationship to the Study of Cancer * (Moscow, 1939).

[2] V. G. Garshin, Alimentary Dystrophy and Avitaminosis * (Leningrad, 1944), pp. 18-21.

[3] Garshin, V. G., and Pigalev, I. A., Arkh. Biol. Nauk SSSR Vol. 31, No. 1, pp. 129-147 (1931).

[4] Gertsenberg, E. Ya., Arkhangelsky, V. N., and Fafius-Gordon, I. A., Sovet. Klin. Vol. 19, No. 528, pp. 638 645 (1933).

[5] Golovin, D. I., Metaplasia of the Epithelia, Dissertation *(Leningrad, 1953).

[6] Zakharyevskaya, M. A., Arkh. Biol. Nauk SSSR Vol. 51. No. 3, pp. 80-93 (1938).

[7] Suchkova, T. N., Influence of Vitamin A Deficiency on Suppurative Inflamations and on Regeneration of Skin Lesions, dissertation *(Moscow, 1952).

[8] Bloch, C. E., Am. J. Diseases Children Vol. 27, No. 2, pp. 139-148 (1924).

[9] Wolbach, B., and Howe, R. R., J. Exptl. Med. Vol. 42, No. 6, pp. 753-777 (1925).

* In Russian.