HISTOLOGICAL CHANGES IN THE KIDNEYS OF ALBINO MICE INFESTED BY KLOSSIELLA MURIS

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The intracellular protozoan Klossiella muris, belonging to the class of Sporozoa, order Adeleida, family Klossiellidae, commonly parasitizes the kidneys of mice, including laboratory albino mice; according to Stevenson [10] 40% of mice harbor this parasite, which was first described by Smith and Johnson [8], and subsequently by a number of other authors [7, 9, 10, 11]. Fiebiger [3] remarks that the presence of exudates in the kidneys of the affected mice testifies to the pathogenic properties of the parasite. P. P. Sakharov [1] also reports presence of exudates in the kidneys, lungs, and other organs.

The published histological descriptions of the condition do not give a clear picture of the changes taking place in the kidneys of mice parasitized by Klossiella muris. Evidently, it is because of this, as well as because of the contradictory reports found in the literature that pathologists have given mistaken interpretations of the histological picture found in the kidneys of laboratory mice used in experiments. Thus Luger and Silberstein [4], for example, took the intracellular form of Klossiella muris to be a special case of phagocytosis, for which they coined the term "isophagocytosis". Seemann [6] describes a variety of nephrosis of albino mice, characterized by lysis of the cells of the convoluted tubules. We have seen no more recent references in the literature to this parasite, although the number of mice used yearly in laboratory experiments in the Soviet Union must amount to tens of thousands. It is reasonable to believe that in many cases the presence of the parasite has not been recognized, and that the histological changes in the kidney, which are often more readily perceived than is the parasite itself, have been erroneously ascribed to the particular experimental conditions used, and have been incorrectly interpreted.

The object of this paper is to make research workers more widely cognizant of the more important forms of histological changes in which it is possible to discern the parasites which are the cause of these pathological changes in the kidneys of white mice.

Our experimental material consisted of the kidneys of 230 white mice, used for various experimental purposes in our laboratory. The kidneys were fixed in 10% formalin, and embedded in celloidin; sections 8 μ thick were stained with iron hemotoxylin (Weigert), and counterstained with eosin or picrofuchsin (according to Van Gieson).

The kidneys of mice infested by Klossiella muris often differ from those of healthy animals in being of a paler color, and in the slightly granular appearance of their external surfaces. These macroscopic changes are of different degrees of intensity, and are not always perceptible.

In one group of 200 mice we found 15 cases of infestation, and, in another group of 30, 9 cases. It is evident from this that the incidence of infestation can vary within wide limits in different groups.

The various stages of development of the parasite described in the literature were recognized in the glomeruli (Fig. 1) and convoluted tubules (Fig. 2) of the kidney. Additionally, round bodies, diameter 10-12 μ, staining bright lemon-yellow with picric acid, are not infrequently found in the convoluted tubules. These bodies (evidently

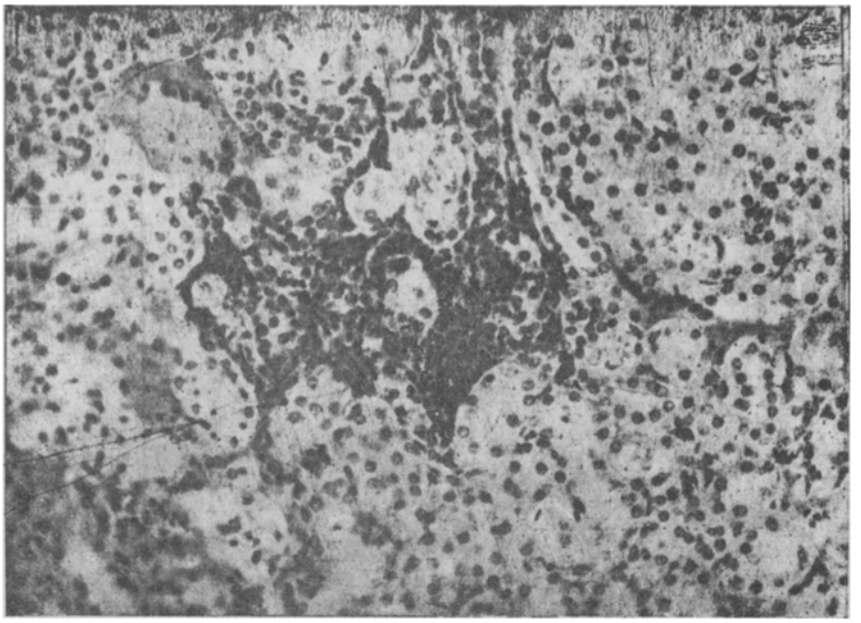

Fig. 1. Schizogony of the parasite in a glomerulus of the kidney of a white mouse. Stained hemotoxylin-picrofuchsin. Photomicrograph, magnification x 600.

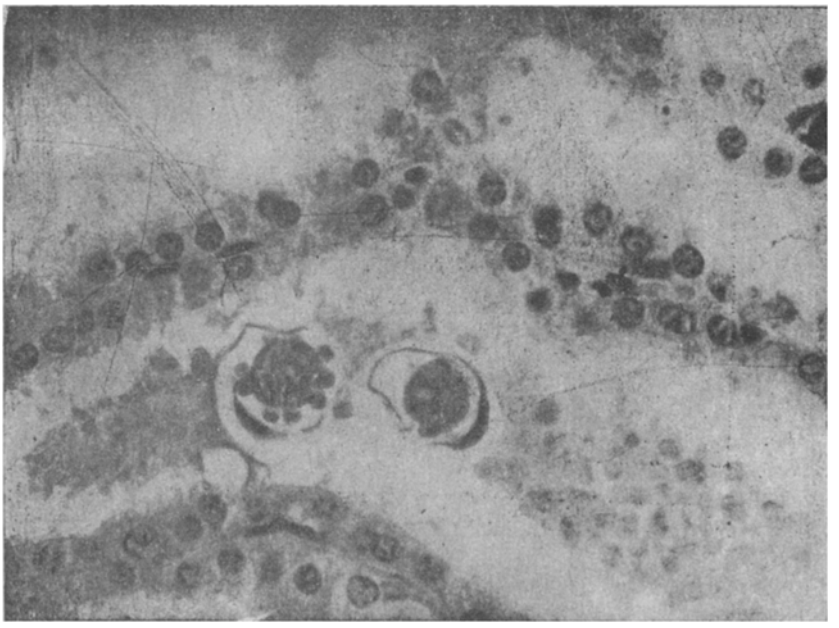

Fig. 2. Sporocysts in the budding stage, in cells of a convoluted tubule. Stained hemotoxylin-picrofuchsin. Photomicrograph, magnification x 600.

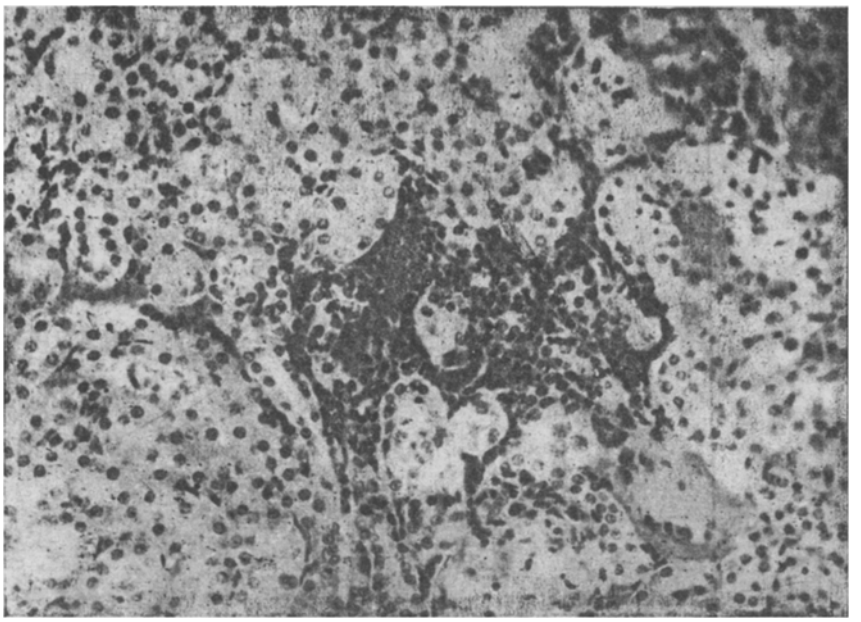

Fig. 3. Focal exudate of the plasmocytary type in the renal cortex. Individual parasites are to be seen in the tubules. Stained hemotoxylin-eosin. Photomicrograph, magnification × 250.

sporocysts) are somewhat larger than erythrocytes, and stain a different shade (more orange). They are encountered singly or in groups of up to five in some of the tubules, where their bright, scintillating appearance often attracts attention.

The histological findings in mice suffering from klossiellosis are:

1. Exudative changes: these vary in extent and magnitude, depending on the gravity of the condition and the number of parasites present in the kidney. The cellular elements of the exudate include: (a) lymphohistiocytes, (b) plasmocytes, and (c) both (a) and (b) together. They may be diffusely distributed, or concentrated in compact foci (Fig. 3); they frequently have a perivascular distribution, being directly in contact with the adventitia.

2. Sclerotic changes: these are often evident at low magnification, as foci of consolidation of kidney tissue, with atrophy of the tubules. Such foci can extend over a space containing several tens of tubules.

Amyloid changes are sometimes seen; these occur on a background of generalized amyloidosis.

The histological findings point to the conclusion that Klossiella muris is pathogenic to mice.

The tissue changes observed by us are in all cases of the nature of a chronic inflammation without suppuration. The tissue reactions cannot be considered to be specific.

Amyloidosis is less characteristic of klossiellosis in mice than are the other changes. Both amyloidosis and the presence of the parasites were more frequently encountered in mice suffering from any generalized pathological condition involving destruction of tissues with suppuration (infected necrotic ulcers of the skin, chronic peritonitis with hepatic necrosis, etc.).

There may be a connection between invasion of the kidney by Klossiella muris and other pathological processes in mice.

Maisin [5] found Klossiella in the kidneys of a number of mice following application of tar to their skin, and he expressed the view that infestation is favored by the development of cancer. Bonne [2] also found the parasites in the kidneys of mice similarly treated with coal tar, but he did not believe that any connection exists between development of cancer and klossiellosis.

Our experimental mice were subjected to a variety of conditions. The skin of some of them was treated for prolonged periods of time (5-6 months) with products of distillation of shale, leading to formation of extensive infected necrotic ulcers or of malignant tumors. Others were infected intraperitoneally with pure cultures of Trichomonas vaginalis, giving rise to a generalized suppurative-fibrinous peritonitis, sometimes in a chronic form involving formation of severe necrotic lesions, mostly of the liver.

It may be concluded from the above that generalized pathological processes (mostly suppurative-necrotic and malignant ones) create favorable conditions for invasion of the kidney by Klossiella, and for the extensive lesions resulting therefrom. This should be taken into consideration by research workers using white mice as their experimental material.

We would, in conclusion, emphasize that when exudates or foci of condensation (and also amyloidosis) are found in the kidneys of white mice, it is essential to make a thorough examination of the convoluted tubules, so as not to overlook the presence of the parasite, and not to ascribe the inflammatory changes in the kidneys to the particular experimental conditions applied. In making this examination it should be remembered that the parasites cannot be identified at magnifications lower than × 200. It should also be borne in mind that the distribution of the lesions is far from uniform; we have on more than one occasion been able to find the parasites only in single tubules in any particular part of the kidney.

The pathogenicity of the parasite is further shown by the observation that in nearly every case where we found exudates or foci of consolidation we were also able to find Klossiella muris, in some cases, however, only after a long and very thorough search. This does not, of course, exclude the possibility that the inflammatory processes observed may have arisen from other causes (metastatic abscesses, etc.).

LITERATURE CITED

[1] P. P. Sakharov, Laboratory Animals (In Russian) (Moscow-Leningrad, 1937).

[2] C. Bonne, Compt. rend. soc. biol., Vol. 92, pp. 1190-1192 (1925).

[3] J. Fiebiger, in Anatomie und Pathologie der Spontanerkrankungen der kleinen Laboratoriumtiere (Editor R. Jaffe) (Berlin, 1931), pp. 708-709.

[4] A. Luger, and E. Silberstein, Z. ges. exptl. Med. 1925, 47, 545.

[5] J. Maisin, Compt. rend. soc. biol. Vol. 88, pp. 1219-1221 (1923).

[6] G. Seemann, Ziegler's Beiträge, 1927, 78, 526-543.

[7] G. Sangiorgi, Centr. Bakteriol. Parasitenk. 1911, I, 60, 523-526.

[8] Th. Smith, and H. Johnson, J. Exptl. Med. Vol. 6, pp. 303 (1902). (cited in Sternberg).

[9] C. Sternberg, Wiener klin. Wochschr. 1929, Vol. 5, 14, 419-421.

[10] A. C. Stevenson, Quart. J. Microscop. Sci., New Series, Vol. 61, pp. 127-135 (1915).

[11] H. M. Woodck, Quart. J. Microscop. Sci., New Series, Vol. 48, pp. 153-163 (1905).