MORPHOLOGICAL CHANGES IN THE LYMPHATIC GLANDS AND SPLEEN OF GUINEA PIGS REPEATEDLY INOCULATED WITH Rickettsia burneti (THE MORPHOLOGY OF IMMUNITY)

A. M. Igonin

(Presented by Active Member AMN SSSR, P. F. Zdrodovskii)
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From their studies of the conditions and laws of inhibition of immunological activity, P. F. Zdrodovskii [1, 2] and workers in his laboratory [4] have concluded that as a result of immunizational overexcitation with an antigenic stimulus of excessive strength, a state of reactive depression develops, which they associate with a varying degree of exhaustion of the reactivity of the recipient. Manifestations of immunological depression are also regularly reproduced, according to their findings, in all cases when one immunizing stimulus is significantly or highly predominant over others, especially when reacting successively with each other. The morphological reactions of these phenomena have not been studied.

The present investigation is an attempt to determine the character of the morphological changes in the lymphatic glands and spleen of guinea pigs during superinfection.

METHOD

Experiments were carried out on 40 guinea pigs weighing 250-300 g. The animals were preliminarily inoculated subcutaneously in the left inguinal region with a strain of Rickettsia burneti of low virulence (strain BD-2520, Gudima O. S., 1956) in a dose of 10,000 conventional guinea pig units. Thirty days later the animals were again inoculated subcutaneously in the right inguinal region with a highly virulent strain of R. burneti (Italo-Greek strain) in a dose of 100,000 conventional guinea pig units. Guinea pigs were sacrificed (two at a time) for morphological investigation on the 2nd, 4th, 6th, 8th, 10th, 12th, 14th, 16th, 20th, 25th, 30th, 40th, 50th, and 60th days after the second inoculation. As a preliminary measure 2 ml of blood was taken from the heart of all the animals for serological investigation. The regional and common mesenteric lymphatic glands and spleen were examined. These organs were fixed in Zenker's formol and embedded in paraffin wax—celloidin. Sections were cut to a thickness of 5 μ and stained with azure II—eosin.

RESULTS

Macroscopically, at the site of the second injection, from the eighth to the 14th days isolated petechiae were seen in the connective tissue layer of the skin and the adjacent subcutaneous connective tissue. The regional lymphatic glands were enlarged, especially during the first six days after the injection; after 14 days they could no longer be seen to be enlarged. The spleen was firm, and slightly enlarged on the first few days; after 10-14 days it was normal in size.

Microscopically, in the lymphatic glands, especially the regional glands, large numbers of transitional cells [3] and plasmoblasts could be seen on the second day after inoculation (see figure, b). These cells were particularly numerous in the cortical zone of the lymphatic glands and in the lymphatic follicles. The cells of the reticular tissue were swollen, and many of them were in a state of mitosis. Another characteristic feature was the
Morphological changes in the organs of the guinea pig after two inoculations with Rickettsia burneti. a) spleen on the second day (large numbers of plasmoblasts and immature plasma cells are seen); b) regional lymphatic gland on the second day (transitional cells and plasmoblasts are seen); c) regional lymphatic gland on the 16th day after the second inoculation (atrophy of the medullary cords of the medullary zone). Photomicrograph. Ocular 20x, objective 20x. Stained with azure II–eosin.

The presence of numerous mitotic divisions of immature plasma cells. The sinuses of the cortical zone of the lymphatic glands were firmly packed with large lymphocytes and plasmoblasts. Hardly any small lymphocytes were encountered here.

The same picture was observed on the fourth day also, although the mitotic activity of the reticulum cells was appreciably reduced.

On the sixth day, at the sites of accumulation of transitional cells and plasmoblasts, large numbers of adult plasma cells were seen, and these became predominant. The cortical zone of the lymphatic gland was appreciably thinned, the sinuses of the medullary zone were dilated and empty, and the medullary cords were tightly packed with plasma cells.

After the 8th-10th day the number of transitional cells and plasmoblasts fell sharply. The predominant cells became adult plasma cells and their degenerative forms. The number of reticulum cells also fell considerably and hardly any of these cells showed mitotic division.

After the 12th-14th day the comparatively rapid disappearance of all forms of plasma cells from the lymphatic glands was seen, especially in the regional glands. This was observed most clearly in the medullary cords of the medullary zone; on the 16th day all the plasma cells here had disappeared almost completely. As a result the medullary cords were largely atrophic, and appeared as fibrous structures with a comparatively small number of weakly stained reticulum cells (see figure, c). These morphological changes in the lymphatic glands were observed in all successive times of investigation until the 50th day. On the 60th day the medullary cords of the medullary zone of the lymphatic glands were almost normal, i.e., contained many reticulum and plasma cells, but there were comparatively few lymphocytes.

Roughly the same changes were observed in the spleen. On the second day after the second inoculation the entire red pulp of the spleen was diffusely packed with transitional cells and plasmoblasts (see figure, a), among which many mitoses were visible. On the sixth day, however, at the site of the previous accumulations of these cells mainly adult plasma cells were present, arranged more or less in nodes around the trabeculae and lymphoid follicles and under the capsule of the spleen.

On the 12th day comparatively few plasma cells were observed in the red pulp, but the nodal nature of their distribution was even more pronounced. Subsequently, until the 60th day, no changes whatever could be seen. By its morphological structure, the spleen at this time showed no particular difference from the spleen of control, uninoculated animals.

At the moment of the second inoculation, the mean titers of complement-fixing antibodies in the serum of the experimental animals was 1:60. After the second inoculation an increase in the antibody titers took place on the sixth day (1:180), reaching its maximum on the 12th day (1:320). A gradual fall in the antibody titers then gradually supervened; on the 40th and 50th days their level was 1:30, and on the 60th day it had risen to 1:120.