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DEPARTMENT OF THE ARMY
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The Spread of Leptospirae in the Body and Antibody Formation in Experimentally Induced Leptospirosis in Irradiated Animals.

by R. V. Petrov


The marked increase of sensitivity of irradiated rabbits, white mice and guinea pigs to infection by the pathogen of Leptospirosis was mentioned in our preceding report. One of the reasons leading to this could be the suppression of antibody production after the irradiation of the animals (Taliaferro).

It is known that the disappearance of the pathogen from the blood of an animal sick with leptospirosis coincides with the appearance of agglutinins and lysins (Varfolomeeva), and is apparently dependent on them, because the immunity mechanism against the given infection is basically connected with the appearance of immune bodies (Aristovskii). Therefore the study of the antibody formation during the course of a leptospiiral infection in an irradiated organism and the parallel study of the leptospiiral spread in it can explain not only the details of the infection's course under the given conditions, but also several questions of its pathogenesis.

Besides that, the question of the time span in which the infection's pathogen is carried by irradiated animals, and also the question of antibody production in trend with the course of the infection in irradiated animals, have practically not been shown in the literature.

In this work we attempted to resolve, to some degree, the indicated questions, for example, of the leptospiiral infection in rabbits, white mice and guinea pigs.

The experiments were conducted on 27 rabbits (1.5-3 kg), 220 white mice (10-15 g) and 20 guinea pigs (200-250 g).

The irradiation of the animals was accomplished with sublethal X-ray doses: for the rabbits 500-600 r., for the mice 350 r., and for the guinea pigs 200 r. The mode of irradiation is outlined in a preceding work.

The strain (Hattus ramenka) of the pathogen of leptospirosis used for inoculation was received from the Mechnikov Institute in Moscow. By its antigenic characteristics, this strain is very close to L. canicola and is pathogenic for young guinea pigs weighing approximately 150 g. The causative agent was grown at 25° in double distilled water with 5% rabbit serum. Test cultures containing 80-100 leptospirae in the field of vision were selected for the experiment. The rabbits were intravenously inoculated with 1.5-2. ml of the culture. The mice and guinea pigs were intraperitoneally inoculated with 0.2 ml of the culture. The inoculation added the development of a concealed course of infection without lethal results.
The presence of the leptospiremic phase which lasts 4 or 5 days and
the subsequent insemination of the organs with a protracted occurrence of
leptospirae in the kidneys (for several months) is characteristic for lepton-
spirosis (Dal', Varfolomeeva, Nikiforova). In connection with this, the rab-
bits and guinea pigs were tested periodically for the agglutinin-titer of
the blood, and blood samples were taken daily for cultures to detect lepto-
spirae. Mice were killed at various times after their inoculation (2 to 7
mice at a time). Cultures were produced from their blood, and emulsions of
the livers and kidneys. The liver and kidney tissues were emulsified with
the aid of a special apparatus for the sterile grinding of these organs
(Petrov). The cultures survived in a thermostat for more than a month.

In table No 1 are shown the data of the examination of the white mice
at various periods after their inoculation which took place 96 hours after
irradiation. From table 1 it is apparent that after the inoculation of the
normal animals, leptospiremia was observed during the first 96 hours, but
after the inoculation of the irradiated animals, it was observed from 7 to
13 days. Leptospirae appeared in the control animals' kidneys during the
first five days and then again in the period between the 38th and the 90th
day. In the irradiated animals the pathogen appeared during the first 16
days and then again from the 38th through the 190th day. An examination
after 220 days showed the presence of leptospirae in the kidneys of both
groups of animals.

It is necessary to note that we, as did other investigators (Gorshan-
ova), observed a temporary disappearance of leptospirae from all tissues
subjected to examination. However, in the irradiated animals this period
was markedly shorter (from the 17th through the 25th day) than in the con-
trol animals (from the 6th through the 25th day).

The antibody formation and the simultaneous determination of the dur-
ation of the leptospiremic phase in the process of the infection's course
were investigated in the rabbits and guinea pigs. The results (Table 2)
indicate a suppression of antibody production in the irradiated rabbits.
This suppression was very small in the group of animals (Nos. 1, 3, 6 and
10) which were inoculated in the first hours after an irradiation of 600 r.
The start of the antibody formation was retarded 24 to 48 hours in the irr-
adiated animals as compared with the control animals. Leptospirae appeared
in the blood of the irradiated animals for 6 to 8 days, compared with a 3
to 5 day leptospiremia for the control animals.

Upon the inoculation of the rabbits (Nos 39 through 42) 24 hours after
irradiation, a sharp repression of antibody production was observed. The
titer of agglutinins in the irradiated animals' blood was 1:40-1:1600 com-
pared with the control groups titers attaining 1:400,000-1:1,600,000. The
beginning of the antibody formation was retarded 48 to 72 hours and the
leptospiremia lasted 9 to 10 days. An inoculation of rabbits 48 hours post
irradiation (600 r.) absolutely did not produce the appearance of antibod-
ies in the blood, and leptospirae appeared in the blood until the very
destruction of the animal.

The dynamics of the antibody formation and duration of leptospiremia

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In the rabbits of the control and experimental groups are shown on the following chart (See Incl 4).

Experiments on guinea pigs showed the same regularities. For illustration we will take the inoculatory results of two irradiated (200 r.) and two normal animals (Table 3).

By this we clearly see that the suppression and retardation of the antibody production process in experimentally induced leptospirosis in irradiated animals accompany a corresponding prolongation of the time of leptospires in the blood. This fact, from our point of view, is important not only as one of the moments explaining the more serious course of leptospirosis in irradiated animals. It indicates the specific antibodies' large role in the pathogenesis of leptospirosis, and particularly in the mechanism of freeing an organism from leptospires.

CONCLUSIONS

1. In the animals inoculated with the pathogen of leptospirosis 2 to 24 hours post irradiation by X-rays, the antibody production was suppressed, but upon inoculation 48 hours after irradiation, the formation of antibodies was completely absent.

2. The leptospiromic phase of the infection lasts longer in the irradiated animals than in the control animals. Thus, the longer the duration of the leptospiromia the more intensely the antibody formation is repressed.

3. The length of the occurrence of leptospires in the organs of the mice inoculated after irradiation is greater than in the control animals that were only inoculated.

REFERENCES

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Irradiation dose in Roentgens.

Time between irradiation and inoculation (in hours)

Duration of Leptospiremia (in days).

Table 3

Inoculation titers in the days after inoculation.
3-Rabbit No 4 (Inoculated 24 hours after irradiation)
2-Rabbit No 3 (Inoculated three hours after irradiation)
1-Rabbit No 2 (Inoculation control)

Days after inoculation

Titer of Leprosy sera: Titer of antibodies and duration of Leprosy sera in rabbits inoculated with Pathogens