

MORPHOLOGICAL AND FUNCTIONAL STATE OF THE OVARIES IN RATS AFTER A SINGLE EXPOSURE TO ACCELERATION

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The action of acceleration on the living organism is one of the most serious adverse factors of cosmic flight. The morphological changes produced by exposure to acceleration in the organs have been inadequately investigated, and the reaction of the female reproductive system has remained almost completely unstudied. Yet this problem is one of the greatest importance in relation to the wider biological approach to the study of the penetration of space by man and other living beings.

The object of the present investigation was to study the functional and morphological changes in the ovaries of rats exposed to acceleration on one occasion only.

EXPERIMENTAL METHOD

Experiments were carried out on sexually mature female August and Wistar rats weighing 100-120 g. Altogether 60 animals were used, with 10 rats in each series. The experimental rats (40) were exposed to accelerations of 5 and 20 g for 5-6 minutes on a large laboratory centrifuge (radius 36 cm). One animal at a time was placed in the jar of the centrifuge, the capacity of which was 1.5 liter.

After the rats had been spun on the centrifuge the character of their sex cycles was investigated by means of daily microscopic examination of vaginal smears. Similar animals not exposed to acceleration acted as controls.

EXPERIMENTAL RESULTS

After exposure to acceleration of moderate intensity (5 g) as a rule a temporary (1-2 weeks) disturbance of the sex cycles was observed, in the form of lengthening of the resting phase. The normal sex cycles were restored after 2 weeks. After exposure to more intensive accelerations (20 g) the phase of estrus was prolonged to 2-3 weeks.

A morphological study of the ovaries of the experimental and control animals revealed intensification of the processes leading to atresia of the follicles (especially the primary follicles) of the rats exposed to acceleration of 5 g, while in those exposed to 20 g these changes were accompanied by cystic hyperplasia of the follicles (see Figure 1).

At necropsy on the animals exposed to acceleration of 20 g, marked congestion of the lungs, liver, kidneys, large intestine, peritoneum covering the uterus, and the brain was observed. The chambers of the heart, the vanae cavae, and the veins of the neck and mesentery were dilated. The pelvic organs, especially the uterus, were of normal size but pale, and on section petechial hemorrhages were seen. In some cases hemorrhages into the wall of the follicles were present.

Because of these morphological changes in the ovaries, it was interesting to investigate the possibility of regeneration of the ovary after partial resection, and to examine the special features distinguishing the course of such regeneration. Special series of experiments were accordingly carried out. Rats of two groups (10 in each group) were exposed to accelerations of 5 and 20 g. Two weeks later the whole of the right ovary and half the left ovary were removed (75% of the total ovarian tissue) from these animals. The

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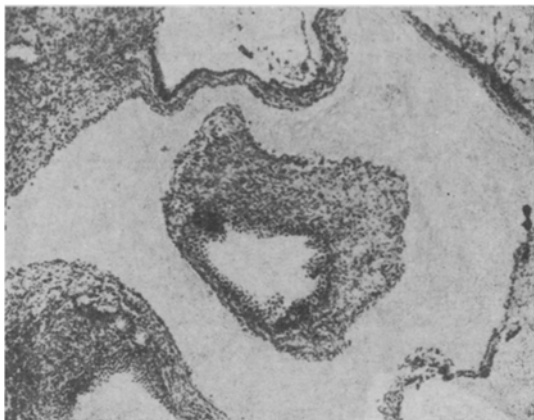


Fig. 1. Cystic hyperplasia of the follicles in ovaries of rats exposed to acceleration of 20 g.

controls for these experimental animals were two groups of rats (10 in each group) exposed to the action of similar acceleration but without the subsequent operation. A third group of 10 control animals underwent the operation (removal of half of one ovary and the whole of the other ovary in one stage) without preliminary exposure to acceleration. The control animals of the next group (10), of the same age, were subjected to neither procedure.

Six months after the operation all the animals (experimental and control) were sacrificed. The ovaries were weighed and examined histologically.

Six months after exposure to acceleration most animals had a regular rhythm of their sex cycles and remained capable of fertilization, normal pregnancy, and the production of offspring. Only in a few cases were the sex cycles disturbed, and histological examination of the ovaries of these animals revealed intensive processes of atresia of the follicles, with cystic degenerative changes in them in some cases.

In the animals undergoing the operation, the resected ovary was completely restored, so that its weight was equal to, or slightly greater than, the weight of one ovary of the control rats not undergoing the operation. No significant difference could be found between the course of the postoperative regeneration in the experimental (exposed to acceleration) and control (not exposed to acceleration) animals. The course of regeneration in the resected ovary likewise was indistinguishable from that in the ovaries of the rats studied by the authors previously [1, 2].

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