EFFECT OF SINGLE AND FRACTIONATED IRRADIATION ON ONSET OF PRECANCEROUS AND EARLY NEOPLASTIC PROCESSES IN MOUSE OVARIES

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The incidence of onset of ovarian tumors in albino mice during the first year after fractionated irradiation is lower than after single irradiation. The qualitative effect of single and fractionated irradiation is the same.

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We have previously shown that during the year after exposure to ionizing radiation mouse ovaries undergo changes in a series of stages. These changes (diffuse hyperplasia → nodular proliferation → tumor) correspond to the pattern of stages of carcinogenesis the details of which have been analyzed by L. M. Shabad [1].

In the present investigation our object was to compare the effects of single and fractionated irradiation on the development of precancerous and early neoplastic changes in mouse ovaries.

We could find no mention of earlier work of this character. So far as the incidence of onset of tumors is concerned, according to the available data [2] fractionation of the dose (690 R) increases the frequency of ovarian neoplasms by more than three times.

EXPERIMENTAL METHOD

Experiments were carried out on 775 noninbred albino mice (virgin females). The total dose of whole-body irradiation used was 200 R. Irradiation was given as a single dose (450 mice of series I) or fractionated (4 doses, each of 50 R, at weekly itervals, 177 mice of series II); the mice of series III (148) were not irradiated and served as controls. Irradiation was given with a GUT-Co-60-400 apparatus at a dose rate of 23 R/min. The weight of the mice at the time of irradiation was 18-20 g. Mice which died naturally and others sacrified from one month to one year after irradiation were studied. The effects of the two types of irradiation were compared in relation to the histological structure of the ovaries.

EXPERIMENTAL RESULTS

The results of the study of ovaries in mice receiving fractionated irradiation (50 R × 4) were indistinguishable qualitatively from changes caused by single irradiation. The only differences found were of a quantitative and temporal character, depending on the slower rates of structural changes in the organ. This difference in rate may be associated with the less severe damage to the ovary and, in particular, to its follicular apparatus. In the ovaries of some animals receiving fractionated doses of radiation, during the five months after irradiation persistent hollow follicles with necrotic oocytes and also follicular cysts with a fully viable granulosa, the individual cells of which contained mitotic figures, could be found. As regards the hyperplasia of the interfollicular stroma and its similarity to the granulosa, the rates of its growth were delayed, and did not attain a significant degree until the 5th month after irradiation. Lengthening of the latent period of development was also found with respect to the appearance of foci of nodular proliferation (6 months after irradiation), and also of the first tumor (9.5 months after). The total number of ovarian neoplasms in the period of investigation after fractionated irradiation was only $5 \pm 1.6\%$.

The hyperplastic changes in the ovaries of the mice irradiated in a single dose reached a significant degree 3.5 months after irradiation, foci of nodular proliferation appeared after 4 months, and the first

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tumor in the 5th month after irradiation; the total number of tumors appearing during the period of investigation after single irradiation was $9.7 \pm 1.3\%$.

The difference in incidence of ovarian tumors during the first year after fractionated and single irradiation is statistically significant ($P = 0.05$). The incidence of ovarian tumors in the control animals during the corresponding period of observation was $1.3 \pm 0.9\%$. Differences between the control and the experimental animals (single irradiation) in the incidence of ovarian tumors are statistically significant ($P = 0.05$).

LITERATURE CITED

1. L. M. Shabad, Vestn. Khir., No. 3, 6 (1954).
2. L. J. Cole, P. C. Nowell, and J. S. Arnold, Radiat. Res., 12, 173 (1960).