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Effect of low doses of high-LET radiation on mice and their offspring in vivo

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In the present work we investigated the influence of low doses of high-LET radiation on the cytogenetic damage in bone marrow and thymus cells and solid tumor growth in mice and their offspring, using the radiosensitivity and "adaptive response"(AR) tests. Two-month-old SHK male mice were used. All groups of animals were exposed to doses of 0.17 –30.8 cGy (1 cGy/day) in the radiation field behind the concrete shield of the Serpukhov accelerator with 70 GeV proton energy, that simulates the spectral and component composition of radiation fields formed in the conditions of high-altitude flights. After that mice were additionally irradiated with X-radiation according to the scheme of AR: 0.1 Gy + 1.5 Gy. Adjuvants such as dibazole and calcium chloride were used as adaptogens. After 28 h, the animals of all groups were killed by the cervical dislocation. Bone marrow specimens for calculating micronuclei (MN) in polychromatic erythrocytes (PCE) were prepared by a conventional method. The weight of thymus was determined from the ratio of average weight of organ to average weight of animal in the group. The growth of solid tumor was estimated by measuring the size of the tumor at different times after inoculation of ascitic cells s.c. into the femur.
It was found that:
1) high-LET irradiation of mice with all doses leads to an increase in the level of cytogenetic damage compared with the level of spontaneous lesions; the levels of PCE with MN were similar in mice irradiated with all doses; radiosensitivity to the dose of 1.5 Gy of X-radiation does not differ from those of unirradiated animals.
2) low-doses of high-LET radiation do not induce cytogenetic AR in bone marrow and thymus cells as opposite to low doses of chronic X-radiation. The combined irradiation of mice with the dose of 0.2 and 0.3 Gy and adjuvants does not induce the AR as well.
3) the mean size of the tumor in mice depends on the dose value: the dose of 0.25 cGy decreases the tumor size but the dose of 30 cGy has no influence. However irradiation of mice with this dose in the presence of adjuvants increases the tumor growth.
4) in F1 generation from males irradiated in the presence or absence of adjuvants the level of cytogenetic damage, radiosensitivity to the dose of 1.5 Gy of X-rays and ability to induction of AR in bone marrow and thymus cells do not differ from that of unirradiated mice offspring; the mean size of the tumor depends on dose value and pretreatment of mice by adjuvants.

Primary author: Ms SOROKINA, Svetlana (ITEB RAS)

Co-authors: Mrs SMIRNOVA, Helena (ITEB RAS); Mrs ROZANOVA, Olga (ITEB RAS); Mr ROMANCHENKO, Sergey (ITEB RAS); Dr ZAICHKINA, Svetlana (ITEB RAS); Dr PELESHKO, Vladimir (Institute of High Energy Physics)

Presenter: Ms SOROKINA, Svetlana (ITEB RAS)

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