

Radiobiological studies on Vacuum Insulated Tandem Accelerator (VITA) for BNCT.

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In the experiments we were studied the radiobiological effects of neutron irradiation in different periods of observation and with BSH injection at animals. The studies were conducted on core accelerator-based epithermal neutron source constructed in the Budker Institute of Nuclear Physics in Novosibirsk Science City (Russia). The proton beam current with energy of 2 MeV on the neutron-generating target amounted to 1.8 mA, 90 mA/hour. The number of neutrons registered in the detector was equaled 190 million. Studies were conducted on immunodeficient mice SCID. One group was injected by BSH at a dose of 200 mg/kg intraperitoneally and was irradiated; a second group was irradiated without introduction of BSH. The radiation dose of mice that were injected by BSH did not exceed 5.7 Gy-Eq and without injection of BSH – 4 Gy-Eq. The tissue (femur, small intestine, kidneys, liver, brain, heart, spleen) picking was held on the 2nd and 9th day after irradiation. At high doses of irradiation were evaluated changes in the proliferative pool of the bone marrow. On the second day of irradiation in the bone marrow was noted its plethora with a large number of immature cellular forms and megakaryocytes. On the 9th day after irradiation were observed the reversible changes with restoration of the usual view of the bone marrow. In the small intestine was observed the devastation of the villi and crypts that occurs because of apoptosis of stem cells. It is noted that in the early phase is defined a stromal edema, increasing the number of mirabiliandia and stromal lymphocytes, proliferation of the epithelium's base of the villi that is more typical for acute diffuse ileitis; the presence of acute ulcers of the mucous membranes, a degenerative phase. In the later phase is visualized the proliferation of the epithelium of the base of the villi - the reparative phase; it is marked a stromal fibrosis and shortening of the villi – the moderate atrophic changes. In the late period in the tubules and glomeruli of the kidney are marked the changes typical for the consequences of acute renal failure. In brain we found paresis of the capillary bed with blood stasis, perivascular and paracellular edema. It is observed in the liver a congestion of the vessels of the portal tracts that is more specific for disorders of blood circulation which decreased in the later phase. The result of the experiment shows that the therapeutic dose received by healthy tissues of immunodeficient mice during the irradiation time is tolerant and pathological structural changes in the studied tissues that have been exposed to radiation is not detected. However, at high doses of irradiation, reversible changes in tissues, most pronounced in the small intestine and bone marrow, were revealed. Experimental data on animals show that a dose of up to 4 Gy-Eq is optimal for carrying out BNCT.

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