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Effects of exposure to neutrons and protons on neurochemical parameters of brain monoamine metabolism, behavioral and cognitive capacities of Sprague Dawley rats

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Radiation damage to the central nervous system (CNS) has become an intriguing health problem of the last decades, largely due to the issues of radiation hazard of human deep-space flights and brain radiation therapy issues. In spite of recent intensive research in this field, the fundamental properties of regulatory pathways associated with radiation-induced CNS impairments remain mostly unclear. The complex assessment of multiple brain metabolic systems is of utmost importance in this regard. Another issue mainly related to the space radiation exposure is the combined effect induced in CNS by composition of different radiation modalities. Given the gap of knowledge regarding such exposures, we evaluated the effects of exposure both to neutrons and protons in order to probe a mixed outcome evaluated through the analysis of neurochemical parameters and cognitive functions in Sprague Dawley rats. Animals were exposed to a single dose of 1 Gy of neutrons or protons separately or 0.5 and 0.5 Gy of neutrons and protons sequentially to get a combined effect. Measurements of neuromodulator concentrations were performed in the prefrontal cortex, nucleus accumbens, hypothalamus, hippocampus, striatum, pituitary gland and cerebellum. The concentrations of the substances were measured with the LC304T high-performance liquid chromatography (HPLC) system. The data sets were taken 30 and 90 days after exposure. The animals' behavior was studied using the open field exploration test and elevated plus maze test, which enables assessment of novel environment exploration, general locomotor activity, and anxiety-like behavior in rodents. We observed differences in patterns of action of neutrons, protons and combined exposure. In particular, the prefrontal cortex demonstrated a more pronounced effect after proton irradiation compared to neutrons and a mixture of two radiation modalities. The talk will share the results of comparative analysis of neurochemical and behavioral data taken in the experiment.

Attendance Type

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