Acute Effects of Solar Particle Event Radiation

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A major solar particle event (SPE) may place astronauts at significant risk for the acute radiation syndrome (ARS), which may be exacerbated when combined with other space flight stressors, such that the mission or crew health may be compromised. The National Space Biomedical Research Institute (NSBRI) Center of Acute Radiation Research (CARR) is focused on the assessment of risks of adverse biological effects related to the ARS in animals exposed to space flight stressors combined with the types of radiation expected during an SPE.

The CARR studies are focused on the adverse biological effects resulting from exposure to the types of radiation, at the appropriate energies, doses and dose-rates, present during an SPE (and standard reference radiations, gamma rays or electrons). The ARS often includes vomiting and fatigue. Other acute adverse biologic effects of concern are the loss of hematopoietic cells, which can result in compromised bone marrow and immune cell functions. There is also concern for skin damage from high SPE radiation doses, including burns, and resulting immune system dysfunction. Using 3 separate animal model systems (ferrets, mice and pigs), the major ARS biologic endpoints being evaluated are: 1) vomiting/retching and fatigue, 2) hematologic changes (with focus on white blood cells) and immune system changes, resulting from SPE radiation with and without reduced weightbearing conditions, and 3) skin injury and related immune system functions. In most of these areas of research, statistically significant adverse health effects have been observed in animals exposed to SPE-like radiation. Relative Biological Effectiveness (RBE) values have been calculated for the various biologic endpoints evaluated for SPE like radiation compared to a reference radiation; RBE values vary according to the dose and dose-rate utilized, species and biologic endpoint evaluated. Countermeasures for the management of ARS symptoms are being evaluated. New research findings from the past grant year will be discussed.

References/Recent Publications:

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