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SPACE FLIGHT AND CENTRAL NERVOUS SYSTEM: FRIENDS OR ENEMIES? CHALLENGES AND OPPORTUNITIES FOR NEUROSCIENCE AND NEURONCOLOGY

Abstract

Space environment provides many challenges to pilots, astronauts and space scientists, which are constantly subjected to unique conditions, including microgravity, radiations, hypoxic condition, absence of the day and night cycle, etc. These stressful stimuli have the potential to affect many human physiological systems, triggering physical and biological adaptive changes to re-establish the homeostatic state. A particular concern regards the risks for the effects of spaceflight on central nervous system (CNS), as several evidence reported a great impact on neuroplasticity, cognitive functions, neurovestibular system, short-term memory, cephalic fluid shift, reduction in motor function and psychological disturbances, especially during long-term missions. Apart these potential detrimental effects, the other side of the coin reflects the potential benefit of applicating space-related conditions on Earth-based life sciences, as cancer research. Here, we aim to focus on examining the effect of real and simulated microgravity on CNS functions, both in humans and in cellular models, browsing the different techniques to experience or mime microgravity on-ground. Increasing evidence demonstrate that cancer cells, and brain cancer cells in particular, are negatively affected by microgravity, in terms of alteration of cell morphology, proliferation, invasion, migration and apoptosis, representing an advancing novel side of space-based investigations. Overall, deeper understandings about the mechanisms by which space environment influence CNS and tumor biology, may be promisingly translated into many clinical fields, ranging from aerospace medicine to neuroscience and oncology, representing an enormous pool of knowledge for the implementation of countermeasures and therapeutic applications.