Final

Immune System Dysregulation and Herpesvirus Reactivation Persist during Long-Duration Spaceflight

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Background: Immunity, latent herpesvirus reactivation, physiological stress and circadian rhythms were assessed during six month spaceflight onboard ISS. Blood and saliva samples were collected early, mid and late in-flight and returned for immediate analysis. Mid-point study data (10 of 17 planned subjects) will be presented.

Results: Some shifts in leukocyte distribution occurred during flight, including alterations in CD8+ T cell maturation. General T cell function was consistently reduced early in-flight. Levels CD8+/IFNg+ producing T cells were depressed early in-flight, and immediately upon landing. Persistent mitogen-dependant reductions were observed in IFNg, IL-17a, IL-10, TNFa and IL-6 production. Monocyte production of IL-10 was reduced, whereas IL-8 levels were increased. Levels of mRNA for the TNFa, IL-6 and IFNg were transiently elevated early in-flight, and the dynamics of TNF and IL-6 gene expression were somewhat antagonistic to their corresponding receptors during flight. The number of virus-specific CD8+ T-cells was measured using MHC tetramers, while their function was measured using intracellular cytokine analysis following peptide stimulation. Both the number and function of EBV-specific cells decreased during flight as compared to preflight levels. The number of CMV-specific T-cells generally increased as the mission progressed while their function was variable. Viral (EBV) load in blood was elevated postflight. Anti-EBV VCA antibodies were significantly elevated by R+0; anti-EA antibodies were not significantly elevated at landing; and anti-CMV antibodies were somewhat elevated during flight. Higher levels of salivary EBV DNA were found during flight. VZV DNA reactivation occurred in ~50 % of astronauts during flight, continuing for up to 30 days post-flight. CMV was shed in 35 % the in-flight and 30% of postflight urine samples of the crewmembers. There was generally a higher level of cortisol as measured in urine and saliva in the astronauts during flight, but plasma cortisol was relatively unchanged during flight. Circadian rhythm of salivary cortisol was altered during flight.

Conclusion. Some alterations in immunity do not resolve during six month spaceflight, consequentially resulting in persistent herpesvirus reactivation. Ongoing immune dysregulation may represent specific clinical risks for exploration-class space missions.