STRESS-INDUCED SUBCLINICAL REACTIVATION OF VARICELLA-ZOSTER VIRUS (VZV) IN ASTRONAUTS

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Background: The reactivation of latent herpesviruses will increase health risks for crewmembers on ambitious long-duration NASA missions, such as those on the International Space Station and planetary exploration missions. Spaceflight conditions—stress and decreased cellular immunity—favor reactivation of herpesviruses. We previously reported that reactivation of Epstein-Barr virus (EBV) in crewmembers was associated with spaceflight. The number of copies of EBV DNA from samples taken during space shuttle flights was about 10-fold higher than before and after spaceflight. These studies, performed on short-term spaceflights (~12 days), also supplied evidence that EBV reactivation progresses as the duration of flight increases. We have also shown increased reactivation and shedding of cytomegalovirus (CMV) in astronauts during flight. These conditions may increase the risk that the virus will be transmitted to crewmembers who do not have antibodies to it and could develop an active CMV infection. Recent data from our laboratory have shown reactivation of varicella-zoster herpesvirus (VZV) in astronauts during short-term spaceflights. Primary VZV infection (chickenpox, or varicella) leads to latent infection in cranial nerve, dorsal root, and autonomic ganglia, from which the virus can reactivate to produce shingles (zoster). VZV reactivation during spaceflight thus poses a significant health risk to crewmembers. VZV reactivation after orofacial surgery has been seen clinically as delayed facial palsy (Furuta et al., J. Med. Virol. 62:42, 2000) and detected in the laboratory as virus DNA in saliva or as an increased antibody response (Kameyama et al., J. Oral Pathol. 17:478, 1988). We report here the first detection of VZV DNA in saliva from healthy individuals during nonsurgical stress.

Methods: A total of 312 saliva samples were taken from 8 astronauts: 112 samples taken 265 to 234 days before flight, 82 samples taken during spaceflight (days 2 through 13), and 118 samples obtained 1 to 15 days after flight. DNA was extracted and coded for blinded polymerase chain reaction (PCR) analysis for VZV using real-time PCR.

Results: Before flight, no saliva sample taken from these 8 astronauts was positive for VZV DNA. During flight, saliva from 5 of the 8 astronauts was positive for VZV DNA. After flight, saliva from 4 of the 8 astronauts was positive for VZV DNA. No VZV DNA was detected in any of the 88 saliva samples collected from 10 normal healthy controls. The average anti-VZV IgG index was >3-fold greater for astronauts during spaceflight collection periods (which included 10 days before flight and landing day) than for matched controls.

Conclusions: These results suggest that VZV can reactivate in healthy individuals during acute stress.