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READAPTATION TO UPRIGHT POSTURE FOLLOWING HEAD-DOWN BED REST IN OLDER ADULTS

Abstract

Prolonged exposure to microgravity or to ground-based analogs including head-down bed rest (HDBR) impairs the ability of the blood pressure regulatory system to maintain arterial pressure on returning to upright posture. A consequence of lower blood pressure is impaired cerebral blood flow (CBF) and oxygen delivery which is associated with light-headedness, weakness and sometimes syncope, symptoms of orthostatic intolerance (OI). Two common methods to characterize OI are the tilt table test and the quiet stand test. The Guidelines for Standardization of Bed Rest Studies states “The tilt test is performed on Recovery Day 0 and is usually the first test on that day that brings the subject upright.” There is merit in this standard protocol to assess the magnitude of the impact of bed rest. However, this immediate movement from HDBR to upright tilt has little relevance to the real-world of astronauts or hospitalized bed rest patients who can gradually adapt to upright posture. Indeed, protocols to gradually introduce patients to a return to upright posture are currently advocated. We therefore evaluated twenty-two older adults (11 female, 59 ± 3 years) who participated in a 14-day 6 HDBR study, with half randomized to perform three exercise sessions per day as a countermeasure intervention. Exercises included resistance, aerobic and high-intensity interval training for a total of one hour per day. Each participant underwent tilt-table testing and stand-testing before and after HDBR; meanwhile, the stand test occurred approximately 5-hours after HDBR participants were allowed to return to upright posture. During these 5-hours participants took part in other research projects and were given brief rest periods between activities, and importantly, they walked to the stand test prior to instrumentation for the study. We found that completion of the tilt test immediately following HDBR was completely predictive for completion of stand test later that same day. Following a few hours reambulation and readaptation to upright posture, half of the tilt test non-finishers completed 8-minutes of unaided standing. Finishers of the stand test exhibited greater mean arterial pressures with small increases in total peripheral resistance and in stroke volume that could reflect some degree of intravascular fluid replenishment. Stand tests after reambulation therefore enable detailed investigations of the mechanisms involved in the adaptation to upright posture which is relevant to the development of countermeasures against OI in astronauts.