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Author: Mr. Andrew Robertson
University of Waterloo, Canada, ad2rober@uwaterloo.ca

Mrs. Danielle Greaves
University of Waterloo, Canada, dgreaves@uwaterloo.ca
Prof. Kevin Shoemaker
University of Western Ontario (UWO), Canada, kshoemak@uwo.ca
Dr. Philippe Arbeille
Centre Hospitalier Universitaire Trousseau, France, arbeille@med-univ-tours.fr
Dr. James Rush
Canada, jwerush@uwaterloo.ca
Dr. Richard Hughson
University of Waterloo, Canada, hughson@uwaterloo.ca

CAROTID DISTENSIBILITY FOLLOWING A LONG-DURATION STAY ON THE INTERNATIONAL SPACE STATION

Abstract

Two recent reports have indicated increased arterial stiffness in predominantly male astronauts returning from short- and long-duration missions. These results suggesting reduced arterial distensibility have widespread health implications. In addition to cushioning against the high pulsatile pressures from reaching the microcirculation and minimizing left ventricular work, the elastic nature of the aorta and carotid arteries is important for ensuring adequate coronary perfusion and for baroreflex-mediated regulation of sympathetic activity. The altered fluid distribution associated with microgravity affects arterial distending pressures, and can acutely decrease functional distensibility and potentially stimulate processes involved with vascular remodelling. PURPOSE: We are currently testing the hypothesis that long-duration exposure to microgravity is associated with reduced common carotid artery (CCA) distensibility on return to earth. METHODOLOGY: The first three participants included one man and two women. Each astronaut underwent a comprehensive vascular assessment before launch and one day after return to earth following six months aboard the International Space Station. Distensibility was assessed by ultrasonic imaging (M-mode) of the right CCA to examine rhythmic changes in vessel diameter, while simultaneously holding a pressure transducer on the left CCA. RESULTS: Contrary to our hypothesis, long duration exposure to microgravity was not associated with a reduction in distensibility (post-flight vs. pre-flight; 0.006 mmHg-1 vs. 0.004 mmHg-1). In addition, changes in secondary indicators of arterial stiffness, including carotid-ankle pulse wave transit time (PWTT) and carotid pulse pressure (cPP), were not indicative of arterial stiffening following spaceflight (PWTT: 151 ms vs. 138 ms; cPP: 48 mmHg vs. 60 mmHg). The likelihood of structural adaptation within these central arteries is not ruled out as noted by a small, but consistent increase in the diastolic cross-sectional area of the CCA lumen (0.27 cm2 vs. 0.25 cm2). CONCLUSIONS: The inability to detect signs of arterial stiffening following exposure to microgravity contrasts with earlier reports. These disparate findings, albeit by different methods, might be a consequence of the small sample number to date or the inclusion of women, who may be relatively protected from vascular change. Alternatively, it might be that current countermeasures, including daily exercise regimens, are sufficient to maintain central arterial distensibility during a six-month exposure to microgravity. Supported by Canadian Space Agency.