Challenges of Life Support/Medical Support for Human Missions (8)
Challenges of Life Support/Medical Support for Human Missions (3) (3)

Author: Dr. Alexander Van Heerden
UK NHS Trust, United Kingdom

HUMAN HEART DOES NOT YEARN TO BE FREE FROM GRAVITY: A REVIEW OF CARDIOVASCULAR HEALTH IN SPACE

Abstract

The coming decade will prove to be an ambitious year in space exploration, with both governmental agencies and private firms looking to expand their reach to the Moon and beyond. The effects of microgravity and cosmic rays raise health concerns about deep-space exploration. The likelihood of a real medical emergency has been estimated, for a crew of six on a 900-day mission to Mars, to be at least one event per 2.8 years.

This review focuses on cardiovascular risk and available risk mitigation strategies. This was done by conducting a literature search of existing data to provide secondary data that was then used to make recommendations for future research areas. Also presented are historical accounts of actual cardiac related incidents that have occurred in space and how they were treated.

Spaceflight has numerous physiological effects on the cardiovascular system. Most common change is orthostatic intolerance which also persists post-flight causing tachycardia and syncope. This is due to the removal of the normal loading effect of gravity and redistribution of interstitial fluid. Other changes include reduction in circulatory blood volumes, endothelial stiffening, reduced sensitivity of the carotid-cardiac baroreflex, and reduced left ventricular size. Previous studies show increased cardiovascular related death in astronauts who travelled to deep space compared to those with low-Earth orbit flights or never flown to space. A major factor contributing to this difference is deep-space radiation. Potentially serious arrhythmias (supraventricular/ventricular tachycardia) have also occurred: bigeminy with syncope occurred in Apollo 15 mission, 5-beat VT during Skylab mission and longer 14-beat VT on Russian MIR.

The Bellagio Report offers some potential countermeasures that include artificial gravity, physical fitness, dietary interventions, and radiation shielding. Additionally, they have presented priority rating for cardiovascular risk to spaceflight and research for two different scenarios (career astronauts and space-tourism). This could be used in present research work to explore more time-effective countermeasures for reducing cardiovascular risk in space.