Paper ID: 27273
oral

SPACE LIFE SCIENCES SYMPOSIUM (A1)
Medical Care for Humans in Space (3)

Author: Mr. Michael R. Greene
University of Calgary, Canada

Dr. Douglas R. Hamilton
University of Calgary, Canada

OPHTHALMIC CHANGES IN SPACEFLIGHT: THE EVIDENCE, ETIOLOGICAL THEORIES, AND IMPLICATIONS FOR THE FUTURE OF HUMAN SPACE EXPLORATION

Abstract

Visual acuity shifts have been described in reports dating back several decades of human spaceflight. These, often anecdotal accounts, were regularly minor, transient, and not accompanied by other significant clinical findings. As such they were previously thought to be associated with presbyopia, hyperopic shifts attributed to age or fatigue. No formal testing was previously implemented to evaluate potential pathophysiological mechanisms.

Recent indications suggest that these vision changes are more common than previously anticipated, and are often accompanied by a myriad of findings. Evidence of spaceflight-induced ophthalmic changes has been documented. These changes include optic disc edema, globe flattening, choroidal folds, optic nerve sheath distension, and retinal changes such as cotton wool spots. Evidence also indicates an elevation in intracranial pressure (ICP) in some astronauts, measured postflight. These discoveries have stimulated research and ongoing efforts to determine the direct mechanism and contributing factors involved in spaceflight-induced ophthalmic changes. Although consensus is yet to be attained, microgravity-induced cephalad fluid shift - causing raised ICP - is commonly accepted as the primary precipitated factor. Proposed contributing factors include spacecraft cabin carbon dioxide levels, strenuous on-orbit exercise programs, and nutritional factors such high sodium diets. A recent study also suggests a potential relationship between radiation exposure and elevated ICP, exacerbating these effects. It is likely that the etiology is multifactorial, as opposed to being the result of one of the aforementioned; however alterations in cardiovascular, ocular and cerebrospinal fluid dynamics are suspected to be causative.

The incidence of ophthalmic changes is estimated to be on the order of 40

This paper investigates spaceflight-induced ophthalmic changes, providing a review of the evidence, current level of understanding, ongoing areas of research, and a discussion of the implications to the future human spaceflight.