Space Flight-Induced Intracranial Hypertension: An Ophthalmic Review

C. Robert Gibson, O.D.; Thomas H. Mader, M.D.

Background: Although physiologic and pathologic changes associated with microgravity exposure have been studied extensively, the effect of this environment on the eye is largely unknown. Over the last several years, NASA's Space Medicine Division has documented astronauts presenting with varying degrees of disc edema, globe flattening, choroidal folds, cotton wool spots, and hyperopic shifts after long-duration space flight.

Methods: Before and after long-duration space flight, six astronauts underwent complete eye examinations to include cycloplegic and/or manifest refraction and fundus photography. Five of these astronauts had Optical Coherence Tomography (OCT) and Magnetic Resonance Imaging (MRI) performed following their missions.

Results: Following exposure to space flight of approximately 6-months duration, six astronauts had neuro-ophthalmic findings. These consisted of disc edema in four astronauts, globe flattening in four astronauts, choroidal folds in four astronauts, cotton wool spots in three astronauts, nerve fiber layer thickening by OCT in five astronauts, and decreased near vision in five astronauts. Four of the astronauts with near vision complaints had a hyperopic shift equal to or greater than + 0.50D between pre- and post-mission spherical equivalent refraction in one or both eyes (range +0.50D to +1.50D). These same four had globe flattening by MRI.

Conclusions: The findings we describe may have resulted from a rise in intracranial pressure caused by microgravity fluid shifts, and could represent parts of a spectrum of ocular and cerebral responses to extended microgravity.