Intraocular Pressure during Spaceflight and Risk of Glaucomatous Damage in Prolonged Microgravity

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Microgravity introduces diverse pathological and various physiological changes to the human body, including intraocular pressure. Astronauts may develop a constellation of symptoms and signs including optic disc edema, choroidal folds, and a hyperopic shift from the flattening of the globe. These ocular findings have been collectively termed spaceflight-associated neuro-ocular syndrome (SANS). SANS is a condition that is unique to long-duration spaceflight. The precise pathogenesis of SANS remains ill-defined, but several hypotheses have been proposed that may be influenced by intraocular pressure. Countermeasures for SANS research also include techniques that impact intraocular pressure. In this article, we discuss intraocular pressure during spaceflight, the translaminar pressure gradient, SANS and potential SANS countermeasures, and the potential for glaucomatous damage during spaceflight.

intraocular pressure | glaucoma | microgravity | space medicine

Astronauts during space flight and microgravity face a range of physiological and pathological challenges that include variations in intraocular pressure (IOP). Prior research has documented an initial elevation in IOP during space travel and thus it is a theoretic risk factor for the development of or progression of glaucoma [1]. Glaucoma is a very common terrestrial ocular disease defined by a degeneration of retinal ganglion cells, structural optic nerve damage, and subsequent functional reduction in the visual field [2]. In addition, astronauts after long-duration spaceflight may develop optic disc edema, choroidal folds, and a hyperopic shift from the flattening of the globe. These findings have collectively been termed SANS. The precise etiology of SANS is not completely understood; however, several proposed hypotheses include orbital and cephalad fluid shifts during microgravity. These potential mechanisms have implications for the possible role of IOP in the pathogenesis of SANS. The objective of this article is to investigate the relationship among alterations in IOP during space travel, the significance of the trans-laminar pressure gradient, the risk for development of or progression of glaucoma, and potential countermeasures.

References

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