

Exploring Endothelial Function Risk Factors and Optic Disc Edema Changes During Strict 6° Head-Down Tilt Bed Rest

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Approximately 20% of astronauts on International Space Station missions experience ophthalmic pathologies including optic disc edema, part of what is characterized as Spaceflight Associated Neuro-ocular Syndrome (SANS). While the cause of SANS is unknown, there are likely multiple contributing factors, including genetics, that may affect the response to spaceflight in affected individuals. B-vitamin status and the presence of specific one-carbon pathway single nucleotide polymorphism (SNP) alleles predicted the incidence of SANS pathologies in astronauts and in bed rest subjects.

There are several hypotheses for how genetic variants could lead to SANS, specifically related to endothelial function. The biochemical pathway to which these genes are associated is intimately involved in maintaining endothelial function via nitric oxide synthase (eNOS) coupling and nitric oxide (NO) production. Furthermore, eNOS uncoupling can impair the functional status of the endothelial glycocalyx, which lines the entirety of the vascular lumen and affects endothelial function. Vascular distension, stasis and altered shear forces, which are associated with headward fluid shifts, may also contribute to glycocalyx dysfunction and shedding, resulting in endothelial dysfunction and increased vascular permeability and tissue edema, potentially contributing to optic nerve and optic disc edema in affected individuals.

Given the findings relating genetics and the risk of optic disc edema in astronauts during flight and subjects during bed rest, further investigation is warranted. In this study, we will assess the same genetic variants in another bed rest study: AGBRESA. Some of the AGBRESA subjects developed optic disc edema, but their genetics have not been studied. Furthermore, we will test available urine samples from prior bed rest studies (VaPER and AGBRESA) for markers of glycocalyx degradation to expand our understanding of factors contributing to SANS.