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SPACE FLIGHT ASSOCIATED NEURO-OCULAR SYNDROME (SANS) AND LOWER BODY NEGATIVE PRESSURE: SYSTEMATIC REVIEW AND META-ANALYSIS

Abstract

Background: Neuro-ocular findings including optic disc edema, globe flattening, cotton wool patches, choroidal folds, and hyperopic refractive error shift have been described after long-duration space flight (LDSF). Those findings were termed, Space Flight Associated Neuro-ocular Syndrome (SANS). SANS can affect the vision or mission safety and quality especially during future long-duration missions, such as a manned mission to Mars. If we want to mitigate the risk of SANS symptoms effectively, we have to determine the possible pathophysiology mechanism that causes SANS and the effective countermeasures. Therefore, we conducted a systematic review and meta-analysis of the available literature to date for SANS to assess the efficacy of using lower body negative pressure (LBNP) on specific neuro-ocular signs in SANS over time.

Methods: We searched PubMed, Scopus and WOS using broad terms of SANS. R software was used in the statistical analysis; We pooled the available published mean differences (with a 95% Confidence interval) pre- and post-flight for the internal jugular vein (IJV) and intracranial pressure (ICP); and conducted a qualitative binary assessment of SANS signs pre- and post- spaceflight, and before and after using lower body negative pressure.

Results: After screening by title, abstract and full-text, 19 papers met our inclusion criteria (population size = 294 astronauts). Our results showed that the cross-sectional area of internal jugular vein decreased by (75%) after the intervention, followed by Intracranial blood pressure changes by (67%). Pre and post-flight LBNP analysis showed a significant improvement in SANS signs during spaceflight.

Conclusion: Astronauts develop unusual changes of neuro-ocular findings called SANS. We found after using LBNP in astronauts based upon measurements of IJV and ICP, the signs of SANS decrease during spaceflight. We hope that our work will guide future case definitions for SANS to be modified to account for the efficacy of presented countermeasures.