

INFLUENCE OF EXERCISE MODALITY ON CEREBRAL-OCULAR HEMODYNAMICS AND PRESSURES

J. Scott¹, D. Martin², B. Crowell³, E. Goetchius⁴, C. Seponski², R. Gonzales³, T. Matz³, R. Ploutz-Snyder¹, M. Stenger², L. Ploutz-Snyder¹

¹Universities Space Research Association, Houston, TX, ²Wyle Science, Technology and Engineering Group, Houston, TX, ³MEI Technologies, Houston, TX, ⁴University of Houston, Houston, TX

BACKGROUND: Moderate and high intensity aerobic or resistance exercise has clearly identified benefits for cardiac, muscle, and bone health. However, the impact of such exercise – either as a mitigating or an exacerbating factor – on the development of the visual impairment and intracranial pressure syndrome (VIIP) is unknown. Accordingly, our aim was to characterize the effect of an acute bout of resistance (RE), moderate-intensity continuous (CE), and high-intensity interval exercise (IE) during a cephalad fluid shift on cerebral-ocular hemodynamics and pressures. **METHODS:** 10 male subjects (36 ± 9 yr) completed 4 testing days in a 15° head down tilt (HDT): (1) assessment of VO_{2max} , (2) RE session (4 sets of 12 repetition maximum leg press exercise), (3) CE session (30 minutes of cycling at 60% VO_{2max}), and (4) IE session (4 \times 4-minute intervals of exercise at 85% VO_{2max} with 3-minute active rest periods). During each session, blood flow (Vivid-e, GE Healthcare) in extracranial arteries (common carotid artery, CCA; internal carotid artery, ICA; external carotid artery, ECA and vertebral artery, VA), and mean blood flow velocity in middle cerebral artery (MCA), internal jugular pressure (IJP; VeinPress), and intraocular pressure (IOP; Icare PRO) were measured at rest, at the end of each resistance or interval set, and every 5 minutes during continuous exercise. Translaminar pressure gradient (TLPG) was estimated by subtracting IJP from IOP. **RESULTS:** There were no differences across days in pre-exercise resting blood flows or pressures. IOP decreased slightly from HDT rest (20.2 ± 2.3 mmHg) to exercise (RE: 19.2 ± 2.8 mmHg; CE: 18.9 ± 3.2 mmHg; IE: 20.1 ± 2.8 mmHg), while IJP decreased during CE (31.6 ± 9.5 mmHg) and RE (32.0 ± 8.1 mmHg), and increased during IE (35.1 ± 9.5 mmHg) from HDT rest (33.3 ± 6.5 mmHg). Estimated TLPG was increased during IE only. Compared to RE and CE, IE resulted in the greatest increase in MCA blood flow velocity and extracranial artery blood flow. **CONCLUSIONS:** These preliminary results suggest that high-intensity IE acutely increases cerebral blood flow, IJP, and TLPG. Alterations in TLPG is one mechanism that may contribute to optic nerve sheath edema in astronauts. Accordingly, acutely raising IOP and/or orbital pressure during exercise could optimize cerebral-ocular pressures during spaceflight.