Association Between Cardiovascular and Intraocular Pressure Changes in a 14-day 6º Head Down Tilt (HDT) Bed Rest Study: Possible Implications in Retinal Anatomy

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BACKGROUND

• History of visual impairment among astronauts with microgravity exposure.
• Numerous signs comprise the Visual Impairment/Intracranial Pressure (VIIP) syndrome. (below)

CHOROIDAL FOLDS
OPTIC DISC EDEMA
GLOBE FLATTENING

• Lack of data and analog studies have hindered development of preventive countermeasures.
• Current theory on VIIP etiology involves interaction of increased intracranial pressure (ICP), intracranial pressure (ICP), and genetic susceptibility.

PURPOSE

• Characterize HDT BR as possible VIIP syndrome model.
• Investigate association between ocular/cardiovascular parameters.

METHOD

• 14 day 6º HDT bed rest (+14 days pre-bed rest & +7 days post-bed rest).

Nomenclature:

- BR-13 - BR-1 Pre-bed rest phase
- BR1 - BR14 In-bed rest phase
- BR0 - BR6 Post-bed rest phase
- 16 subjects: normotensive, non-smoker, normal weight/EMI
- Male: 12
- Female: 4

Statistical modeling performed using mixed effects linear regression model with random intercepts for subject and eye (L/R) to account for the within subjects experimental design (software package: Stata/IC 12.1).

RESULTS

• Mean IOP at BR3 increased over baseline values from BR-3 (p < 0.01).
• Mean IOP at BR10 remained higher than baseline values from BR-3 (p < 0.01).
• Mean IOP approached baseline values by BR+2 and was no longer elevated at a statistically significant level (p < 0.47).
• Although mean IOP increased during the 6 HDT in-bed phase, it remained within the normal limits for subject safety.

• Analysis of RNFL Thickness with Cirrus HD-OC showed no statistically significant changes (p < 0.48).
• Central subfield (macula) thickness decreased from an average of 260.31 µm at BR-10 to an average of 258.44 µm at BR+2 with statistical significance (p < 0.01).

CONCLUSIONS

• Mean IOP significantly increased while at 6º HDT and returned towards pre-bed rest values upon leaving bed rest.
• While mean IOP increased during bed rest, it remained within the normal limits for subject safety.
• Diuretic shift and cardiovascular deconditioning occurs during in-bed rest, as expected.
• There was no demonstrable correlation between the largest change in IOP (pre/post) and cardiovascular measure changes (pre/post).
• Additional mixed effects linear regression modeling may reveal some subclinical physiological changes that might assist in describing the VIIP syndrome pathophysiology.

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DISCLOSURE

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