52.10 Thoracic Impedance as a Potential Indicator of Presyncope

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ABSTRACT: We investigated fluid shifts and regulatory responses to variations of posture, exercise, Gz level and radius of rotation in subjects residing NASA Ames 20G centrifuge. Results are from 4 protocols that address radius and exercise effects only. Protocol A: After 10 min supine control, 12 healthy men (35 ± 9 yrs, 82.8 ± 7.9 kg) were exposed to rotational 1 Gz (2.5 m radius) for 2 min followed by 20 min alternating between 1 and 1.25 Gz. Blood samples were taken pre and post spin. Protocol B: Same as A, but lower limb exercise (70% VO2max) preceded ramps to 1.25 Gz. Protocol C: Same as A but radius of rotation 8.3 m. Protocol D: Same as B but at 8.3 m. RESULTS: The 8 subjects who completed all protocols, increased heart rate (HR) from control by: A: 5, B: 39, C: 11, D: 44 bpm; and the 4 who did not: A: 6, B: 35, C: 20, D: 50 bpm. For thoracic fluid volume, increased heart rate (HR) from control by: A: 5, B: 39, C: 11, D: 44 bpm; and the 4 who did not: A: 6, B: 35, C: 20, D: 50 bpm. The data was separated accordingly with respect to all four protocols. 1.25G (2 min) 1.25G (2 min) 1.25G (2 min) 1.25G (2 min)

METHODS: Subjects: 12 healthy men (age 35 ± 9 yrs, wt 82.8 ± 7.9 kg)

Instruments: 3-lead ECG (Colilin Pilot), Continuous Blood Pressure (Portapres), 4 Segment Bio-Impedance [Thorax, Abdomen, Upper Leg, Lower Leg] (LIT THRM), Calf Circumference (Hickman), High-fidelity 12-lead ECG (Cardiosoft)

Blood Draws: Blood was drawn before and after each centrifuge run. The following blood analyses were measured: Hematocrit, Vasopressin, Plasma Renin Activity, Aldosterone, ACTH, Cortisol, Dopamine, Norepinephrine, Epinephrine, Progesterin and Growth Hormone.

Primary centrifuge protocols (+Gz at the feet): 1.252G (2 min) 1.25G (2 min) 1.25G (2 min) 1.25G (4 min)

Additional centrifuge protocols (+Gz at the feet): 1.25G (2 min) 1.25G (2 min) 1.25G (2 min) 1.25G (4 min)

Background: Cardiovascular deconditioning is a persistent problem associated with spaceflight. Artificial gravity (AG) training has potential to provide a multi-system countermeasure to the deleterious effects of spaceflight. However, for AG to be an effective countermeasure the device must be as small as possible with time and intensity of application optimized. The purpose of this study was to conduct basic experiments to determine cardiovascular responses to changes in centrifuge parameters and to the influence of exercise. Findings from this study may serve as a guide for new experiments of artificial gravity as a countermeasure.

Hypotheses: As an effective countermeasure, the greater the lower body fluid pooling and resulting regulatory responses the better, of course within safe limits. Therefore, we hypothesized that fluid pooling and regulatory responses induced by low radius centrifugation will be greater than short radius centrifugation and fluid pooling and regulatory responses induced by centrifugation following bouts of exercise will be greater than centrifugation with no exercise.

Primary centrifuge protocols (+Gz at the feet): 1.252G (2 min) 1.25G (2 min) 1.25G (2 min) 1.25G (4 min)

PRELIMINARY RESULTS: Data were averaged over each segment. Results are presented from Protocols A, B, C, and D only. Eight subjects completed the full duration of all four protocols whereas four subjects did not complete Protocol D. The data was separated accordingly with respect to all four protocols.

Protocol A: Thoracic 4 All

Protocol B: Same as A, but radius of rotation 8.3 m.

Protocol C: Same as B but at 8.3 m.

Protocol D: Same as B but at 8.3 m.

Future perspective: Find ways of statistically testing these findings. Also, use thoracic impedance as a measurement in future artificial gravity and orthostatic intolerance studies.

Acknowledgements: The authors would like to greatly thank the centrifuge facility support staff at NASA Ames in the conduct of the study and Helena Truszczynska (University of Kentucky) for ongoing statistical consultation. This study was supported by NASA EPSCoR WKU52611 and NASA Ames Research Center.

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