Thoracic Impedance as a Potential Indicator of Presyncope

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 riding 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 yr, 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 2.5 m. Protocol D: Same as B but at 8.3 m. RESULTS: The 6 subjects who completed all protocols, increased heart rate (HR) from control by: A: 5, B: 11, C: 15, D: 8 bpm. Our data support the concept that thoracic impedance can detect inability to return adequate fluid to the heart, thereby predicting presyncope. Supported by NASA EPSCoR WKU52611 and Ames Res. Center.

METHODS: Subjects: 12 healthy men (age 35 ± 9 yrs, wt 82.8 ± 7.9 kg). Instrumentation: 3-lead ECG (Colin Rest), Continuous Blood Pressure (Portapres), 4 Segment Bio-Impedance (Thorax, Abdomen, Upper Leg, Lower Leg) (LIT THRM), Calf Circumference (Hikansen), High-fidelity 12-lead ECG (CardioSoft). Blood Draws: Blood was drawn before and after each centrifuge run. The following blood analyses were measured: Hemocrit, Vasopressin, Plasma Renin Activity, Aldosterone, ACTH, Cortisol, Dopamine, Norepinephrine, Epinephrine, Prolactin and Growth Hormone.

RESULTS: PRELIMINARY RESULTS cont.: Protocol D Thorax Fluid Shift

-800 -600 -400 -200 0 200 400 600 800 1000 1200 1400 1600 mL

Heart Rate Short Radius (HR) bpm

Pre-Fam LE1G LE1.25G LE1G LE1.25G

0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 76 80 84 88 92 96 100 104 108 112 116 120 124 128 132 136 140 144 148 152 156 160 164 168 172 176 180 184 188 192 196 200

PRELIMINARY RESULTS cont.: Protocol D Thoracic Fluid Shift

-2500 -2000 -1500 -1000 -500 0 500 1000 1500 mL

Heart Rate Long Radius (HR) bpm

0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 76 80 84 88 92 96 100 104 108 112 116 120 124 128 132 136 140 144 148 152 156 160 164 168 172 176 180 184 188 192 196 200

PRELIMINARY CONCLUSION: Thoracic impedance shows promise as a potential indicator of Gz-induced presyncope. To accompany the larger shifts in thoracic volume were increased heart rates among the 4 subjects. In our data set, 4 helps show how and why some subjects exhibited classical type presyncope symptoms. Thoracic impedance may prove to be a useful measurement in medical monitoring of astronauts undergoing artificial gravity training during spaceflight.

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

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