
INTRODUCTION: Availability of a computer model which could accurately predict the decompression sickness (DCS) risk given hypobaric exposure would be a great improvement over current risk assessment methods based on comparison of the planned mission profile with data from previous, often dissimilar exposures. METHODS: Equation for perfluorcarbon (PFC) bubble exchange and bubble growth were used to compute tissue ratio (TR) and bubble volume data for 12 exposure profiles between 9,000 and 30,000 ft for which experimental DCS incidence data from 395 subjects had been previously collected. Three parameters, TR, maximum bubble volume (Vm) and bubble growth time (Tg) were linked with observed DCS incidence using the Hill equation with coefficients determined by non-linear regression analysis. RESULTS: The TR and Vm models both predicted no DCS correctly in 96% of the cases while the Vo model correctly predicted 80%. The positive predictive capabilities were lower with the TR and Vm models predicting 74% and the Vo model predicting 67% of the DCS cases correctly. CONCLUSIONS: This approach promises as an objective microgravity method for predicting altitude DCS risk. Refinement of the algorithms based on additional experimental data should improve the validity of the models.

USE OF ECHO IMAGING IN DECOMPRESSION MODEL DEVELOPMENT. J. E. Willingham, D. J. Molinaro, and T. J. Muller. KRUG Life Sciences, San Antonio, TX 78229-0644 and Brooks Air Force Base, TX 78235-5000.

INTRODUCTION: A model which assesses the risk of decompression sickness (DCS) associated with altitude exposures of various pressure profiles is needed. This paper describes how echo imaging techniques can provide critical measurements, such as bubble size, to support the development of a decompression model. METHODS: Three healthy male subjects were exposed to a simulated altitude of 29,500 ft. They were monitored with the Hewlett Packard SONOS 1000 ultrasound echo imaging system at two monitoring sites, the heart and the liver. RESULTS: Buble size was found to be between 5 and 100 micra both in the IVC and in the hepatic veins. The upper size limit was established by IVC microbubble flotation rates. Size confirmation was provided by observation of pressure-induced right ventricular bubble resolution. Microbubbles were visualized in the gall bladder and hepatic veins but not in the liver itself. Therefore hepatic tissue bubbles, if they exist, are smaller than intravascular bubbles. This size range was incorporated into the ongoing development of a decompression model. CONCLUSIONS: Echo imaging is a powerful tool for DCS research and model development.


INTRODUCTION: The lowest safe pressure for an extravehicular activity (EVA) suit which eliminates the requirement for prebreathing depends on demonstrating an acceptable risk of decompression sickness. METHODS: The EVA suit target pressure of 8.3 psia was set by NASA based on results of a study of decompression sickness (DCS) in 98 rats.RESULTS: Since 36% of the rats had DCS, the target pressure for the EVA suit was increased to 8.3 psia. CONCLUSIONS: The EVA suit pressure of 8.3 psia is safe for EVA.

VARIABILITY IN HOFFMANN AND TENDON REFLEXES IN HEALTHY MALE SUBJECTS. E. Good, S. Do, and M. Jaruzelski. Humana Hospital, Webster, TX; Baylor College of Medicine, Houston, TX; and NASA Johnson Space Center, Biomedical Operations & Research Branch, Houston, TX.

INTRODUCTION: There is a time dependent decrease in amplitude of H- and T-reflexes during O2 exposure and subsequently an increase in the amplitude of the H-reflex 2-4 hrs after return to 1G environment. These alterations have been attributed to adaptation of the central neuromotor system to gravity. The Hoffmann reflex (H-reflex) is an acknowledged method to determine the integrity of the monosynaptic reflex arc. However, deep tendon reflexes (DTTs or T-reflexes), elicited by striking the tendon also utilizes the entire reflex arc. The objective of this study was to compare the variability in latency and amplitude of the two reflexes in healthy subjects. METHODS: Group of 16 healthy male subjects, 27-43 years in age, 161-175 cm in height plus 60-86 Kg in weight, underwent weekly testing while breathing 100% oxygen. METHODS: Thirty male human subjects were exposed to a simulated altitude of 27-43 years in age, 161-175 cm in height plus 60-86 Kg in weight, underwent weekly testing while breathing 100% oxygen. RESULTS: H-reflex amplitudes were reduced by 20% (p < 0.05) and T-reflex amplitudes were reduced by 10% (p < 0.05) while breathing 100% oxygen. CONCLUSIONS: H-reflex amplitudes showed a significant decrease while T-reflex amplitudes remained unchanged during O2 exposure.

INTRODUCTION. An estimated 29% of aviators experience symptoms of Simulator Sickness (SS) following simulator training. Highly sensitive measures are required to assess the affects of simulator training on balance and coordination, and the impact on performance and safety. The Neurocom Equistest System is a clinical device that examines the interaction of vestibular, visual and proprioceptive inputs on the balancing ability of subjects. The purposes of this study were to develop a normative aviator database as compared to clinical norms, and to determine learning effects from repeated test sessions. METHODS. Fifty-three male and 33 female aviators were tested on an initial day using an Equistest System. Repeat testing was completed on 19 males and 11 females on four additional days.

RESULTS. Sensory Organization Test (SOT) equilibrium scores for the aviators were significantly higher than clinical norms. Equilibrium scores on the first trial were significantly lower than on the two subsequent trials. Differences between males and females existed in a correlation between equilibrium and strategy scores. A significant learning effect existed for equilibrium, with a plateau reached after 3 days. Motor Coordination Test latency scores for male aviators were significantly faster than for females. CONCLUSIONS. The high aviator scores demonstrate the importance of establishing population-specific norms for balance research. Gender differences among the aviators on latency scores support previous research establishing similar differences in reaction time. The learning effects from repeated SOT tests, which could the effectiveness of this device to assess SS affects in pre- and post-simulator testing, may be minimized with random-order trials.


INTRODUCTION. It has generally been believed that the perceived intensity of a gravitational-inertial force depends on both the magnitude and orientation of the force with respect to the otolith organs, as does the elevator illusion. In this study, we examine the perceived intensity of Grz and the elevator illusion as a Function of the applied force and the orientation of S's head. METHODS. Each of eleven male Ss was seated upright in a swinging chair mounted in the Ames 20-G Human Chamber. The S was exposed to 0.250-G, 1.000-G and 2.500-G forces with a 30-second ramp to plateau which was used in all cases, and the duration of exposure at each plateau was 120 seconds. All measures were obtained with both S's head erect and pitched forward 30 degrees. RESULTS. Although the elevation illusion changed with head orientation (F(6,60) = 7.56; p < 0.001), the perceived intensity of Grz was essentially the same at all orientations of the head (F(6,60) = 0.61; p > 0.50). CONCLUSIONS. The results of this experiment suggest that the perceived intensity of gravitational-inertial force does not depend on otolith or somatosensory inputs in the same way as does the elevator illusion and that somatosensory, vestibular and other proprioceptive inputs are important for the psychophysical function.

THE VESTIBULO-Ocular REFLEX AND OPTOKINETIC NYSTAGMUS UNDER THE INFLUENCE OF CINNARIZINE. I. Domack*, A. Shupak, O. Spitzer, Y. Malamud and C.R. Gordon*. Motion Sickness and Human Performance Laboratory, Haifa, ISRAEL.

INTRODUCTION. Cinnarizine (Cn) is an antihistaminic agent with specific vestibular Ca++ channel blocking capacity which has been found effective as an anti-motion sickness drug. We used the Vestibulo-ocular reflex (VOR) and the optokinetic nystagmus (OKN) to evaluate Cn's effects on the eye movement control mechanism. METHODS. The VOR parameter was evaluated using the Smooth Harmonic Acceleration Test (SHAT) at 3 frequencies: 0.01-0.04 Hz. The study was conducted on 16 healthy subjects aged 18-22. The effects of Cn 50 mg vs placebo were compared using a double-blind, randomized, crossover design 2 hours after drug administration. All 16 subjects underwent the SHA test, but only 12 completed the OKN test. RESULTS. Under the influence of Cn 50 mg, VOR gain at 0.04 Hz and phase lead at 0.16 Hz were significantly lower while on the OKN test, phase lead values were higher at 0.01 Hz. CONCLUSIONS. Cn 50 mg partially affects both VOR and OKN parameters. The drug's influence on the OKN's phase parameter suggests that Cn affects the oculomotor pathways as well as the vestibular end organ.

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INTRODUCTION. A parabolic flight is a useful method as a simulation of weightlessness to study cardiovascular deconditioning, even though the available time is very short.

METHODS. Cardiac output and blood pressure were continuously monitored during parabolic flights performed by a small rear-sitting aircraft (Masa-3). A male subject, 28 years old, took 9 to 11 parabolic flights a day for 6 days. Two accelerating patterns, 2.5-G and 1.3-G level, were used. Cardiac output was measured by a non-invasive and blood pressure was measured by a finger pressure cuff method. The positions of the subject were sitting up straight and sitting reclined.

RESULTS. Heart rate increased by 25% at 2.3-G accelerating period and decreased by 10% during low G period in the sitting up position. Stroke volume decreased by 30% at 2.5-G entry and increased by 30% during low G period. These changes became less in the 1.3-G pattern and in the sitting reclined position too. Diastolic blood pressure decreased during low G period. The heart rate increased in the latter parabolas in the same day.

CONCLUSION. These results suggest that the hemodynamic changes in the parabolic flight would be modified by the pattern of acceleration and adaptation of the subject.


INTRODUCTION. In spite of successful treated motion sickness (MS) episodes during space flights, this problem remains actual until the very moment of landing. The MS is a multifactorial disease as it depends on its etiological factors (aerodynamic) and the environment factors (cabin pressure, etc.). METHODS. More than 100 various susceptible to laboratory induced MS male volunteers were examined by electro-physiological and radiimmune assay methods for establishing a correlation between vestibular system (VVS) activity and blood concentration of pituitary-adrenal, thyroid, pancreatic, and vasoactive hormones. Some individual hormones subvolumes (VVSs) were determined in brain structures during MS simulating animal experiments. Various drugs have been used for MS treatment. RESULTS. MS induced reactions expressed stress-associated hormones blood excess followed CNS excitation, and blood EMS increase for its easy delivery to brain structures. All drugs while being effective in MS treatment, significantly decreased CNS activity, accompanied with reduced endocrine and metabolic changes. CONCLUSION. Our data evidence that any effective pharmacological MS treatment probably would result in physical and psychological activity depression which could complicate flight program success. Therefore, no-drug MS countermeasures, or drug-induced adaptive reactions increase would be preferred.