DEVELOPMENT OF AN ALTITUDE DECOMPRESSION SICKNESS MODEL. T.E. Scopling*, E.P. Ripley, E.L. Bauer, and A.A. Pilmanis*. Armstrong Laboratory, Brooks AFB TX 78235-5000 and KRIUG Life Sciences, San Antonio TX.

INTRODUCTION. Availability of a computer model which could accurately predict decompression sickness (DCS) for any given hypobaric exposure would be a great improvement over current assessment methods because of the planned mission profile data from previous, often dissimilar exposures. METHODS. Equations for perfusion-limited inert gas 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 for a ventilation rate (Vm) and bubble growth coefficient at onset of DCS (Vo), 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 whereas 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 computer-based method for predicting altitude DCS risk. Refinement of the algorithms based on additional experimental data should improve the validity of the models.


INTRODUCTION. A model which assesses the risk of decompression sickness (DCS) associated with altitude exposures of various pressure altitudes 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 5000. They were monitored with the Hewlett Packard Sonos 1000 echo imaging system at two monitoring sites, the heart and the aortic arch (IVA) as viewed through the liver. Consequently, the hepatic veins and bile duct system were also observed. RESULTS. Bubble 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 floation 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. Selection of the lowest safe pressure for an extravehicular activity (EVA) suit which maintains the requirement for prebreathing depends on demonstrating an acceptable risk of decompression sickness. METHODS. Two male subjects wore an N95 mask, prebreathed oxygen, and decompression sickness (DCS) was induced. The EVA suit target pressure of 8.3 psia was set by NASA several years ago based on results of breathing 100% oxygen and 50% nitrogen during zero-prebreath exposures. RESULTS: Mortality was equal in both treatment groups (TR; 7%, n = 43; Vm: 36%, n = 39), though similar to that observed in untreated animals in a pilot study. CONCLUSION. Survival field monitoring showed no differences in distance travelled, time resting or ambulating, and number of small movements, though PPO-treated rats spent less time in "stereotypic" movements. CONCLUSIONS. Although interpretation is limited by technical difficulties, the efficacies of intravenous perfluorocarbon emulsion and hyperbaric oxygen were comparable. A more concentrated fluorocarbon preparation may be more effective, since it would decrease the fluid volume required to achieve a given fluorocrit.

VARIABILITY IN HOFFMANN AND TENDON REFLEXES IN HEALTHY MALE SUBJECTS. E. Good, S. Do, and M. Jacew*. 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 O-G exposure and subsequently an increase in the amplitude of the H-reflex 2-4 hrs after return to 1-G environment. These alterations have been attributed to adaptation of the peripheral nervous system to gravity. The Hoffmann reflex (H-reflex) is an acknowledged method to determine the integrity of the monosynaptic arc. However, deep tendon reflexes (DTTs or T-reflexes), elicited by striking the tendon also utilize 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. Thirty healthy male subjects, 27-43 years in age, 161-175 cm in height plus 60-86 Kg in weight, underwent weekly testing during O-G exposures. RESULTS: No cases of DCS or VGE risk levels compared to an 8.3 psia suit environment could be established at 7.3 psia and maintain pressure with a 50% oxygen:50% nitrogen environment. CONCLUSION. A2 OF POOR QUALITY
POSTURAL EQUILIBRIUM TESTING OF AVIATORS: NORMATIVE SCORES AND ADAPTATION EFFECTS

INTRODUCTION. An estimated 29% of aviators experience symptoms of Simulator Sickness (SS) following simulator training. Highly sensitive measures are required to assess the aftereffects of simulator training on balance and coordination, and the impact on performance and safety. The Neurocom EquiTest 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 EquiTest 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 suggest previous research establishing similar differences in reaction time. The learning effects from repeated SOT tests, which could be the effectiveness of this device to assess A3 aftereffects in pre- and post-simulator testing, may be minimized with random-order trials.


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 Vestibuloocular reflex (VOR) and the optokinetic nystagmus (OKN) to evaluate Cn’s effects on the eye movement control mechanisms. METHODS. The VOR parameters were evaluated using the Smooth Harmonic Acceleration Test (SHAT) at 5 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 SHAT 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.

THE PSYCHOPHYSICAL FUNCTION FOR PERCEIVED GRAVITATIONAL-INERTIAL FORCE DOES NOT DEPEND ON THE ORIENTATION OF THE OTOLITH ORGANS. M. Cohen, S. Welch, and C. DaRifH*.

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 Gz force and the elevator illusion as a function of the applied force and the orientation of subject’s head. METHODS. Each of eleven male subjects was seated upright in a swivel chair mounted in the Ames 20-G Human Centrifuge while he set a visual target to his left. RESULTS. The results of the experiment suggest that the perceived intensity of Gz force and the elevator illusion as a function of head orientation {F (6,60)= 7.56; p<0.001)}, the perceived intensity of Gz was essentially the same for both orientations of the head {F(6,60)= 0.61; p>0.50}. CONCLUSIONS. The data suggest that the vestibular end organs, as does the elevator illusion, In this study, we examine the psychological activity depression which could complicate 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.

HEMODYNAMIC MEASUREMENTS DURING PARABOLIC FLIGHT. A. Miyamoto*, S. Nagasaki, K. Suzuki, S. Kaneko, S. Watanabe*, S. Ushio, I. Nakayama, K. Kojima

THE CHOICE OF TREATMENT. L.A. Nichols*, A. Olior, Institute for biomedical Problems, Moscow, USSR.

INTRODUCTION. In spite of successful treatment motion sickness (MS) episodes during space flights, this problem remains actual until new effective drug will appear. METHODS. More than 100 various susceptible to laboratory induced MS male volunteers were examined by electro-physiological and radiimmune assay methods for the presence of a vestibular mechanism (VMS) and blood concentration of pituitary-adrenal, thyroid, pancreatic, and vasoreactive hormones. Some of the used electroclinical substances (EMS) were determined in brain structures during MS simulating animal experiments. Various drugs have been used for MS treatment. RESULTS. MS induced reactors expressed stress-associated hormones blood level in the blood, 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.

USE OF INJECTABLE PROMETHAZINE TO DECREASE SYMPTOM SCORES OF SPACE MOTION SICKNESS. B.G. Beck, M.D.* A.J. Notscogian, M.D.* Neurological Operations Branch, NASA-JSC, Houston, TX 77058

Introduction. Space Motion Sickness (SMS) has been a problem affecting approximately 74% of first-time Shuttle flyers. Promethazine injections have been used for 29 cases of SMS to decrease the severity of their illness. Although it was one of the first drugs to be effective in reducing symptoms in 27 of the 29 cases, there has been no proof of its efficacy. Methods. Retrospective analyses of Medical Debribs examining the symptom scores for nausea, vomiting, sweating, and stomach awareness were performed. Each symptom is rated on a mild–1, moderate=2, severe=3 system for each flight day. Crewmember scores from the first three flights were compared. No significant changes were found. Promethazine had not been used before to compare to scores in a later flight in which the promethazine was utilized. Scores were compared in a similar group when it did not use promethazine. Results. There was a decrease in median scores for all symptoms except nausea; however, it was significant (p=0.014) only for the vomiting score. This significant decrease was not seen in the control group. Conclusions. Injectable promethazine has been associated with a significant decrease in vomiting compared to earlier flights in which injectable promethazine was not used.