**A REVIEW OF ACCELERATION INJURIES ON HUMAN CENTRIFUGES IN THE UNITED STATES AND CANADA SINCE 1968.**

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**INTRODUCTION.** For the past seven years, the ACME Labs and Naval Air Development Center have been conducting acceleration injury research on human centrifuges in the United States and Canada. This study was performed to evaluate the prevalence of injuries experienced by flight trainees and to assess the accuracy of current selection criteria as they relate to injury prevention. METHODS. A total of 1263 active crew members ranging 40-60 years of age were examined using medical examination every 6 months since the inception of the flight training program. Laboratory variables were measured to determine their control status. RESULTS. Of the 1263 active crew members, 128 were diagnosed as NIDDM, 198 as IGT, 10 as renal glucose uria and the remaining 1018 were normal controls. Conclusion. The occurrence of NIDDM among cockpit crews was approximately 1/3 of those excluded. The utility of and need for enforcement of standard operating procedures was clearly demonstrated. Only 19 of 46 clearly met all three criteria. Contact lens users were too few to draw meaningful conclusions. The utility of and need for enforcement of standard operating procedures was clearly demonstrated. Only 19 of 46 clearly met all three criteria. Contact lens users were too few to draw meaningful conclusions.
INVESTIGATION OF A WINDBLAST DEFLECTOR CONCEPT FOR IMPROVED WINDBLAST PROTECTION DURING EMERGENCY ESCAPE

INTRODUCTION. The ability of open ejection seats is restricted by the occurrence of windblast injuries. These injuries, which include disruptions of the joints of the extremities, tearing of the conjunctivae of the eyes, lacerations, and skull, are directly attributable to the dynamic pressure of the airstream. A wind tunnel was constructed to investigate the ability of different windblast deflector configurations to reduce the windblast forces acting on the wind tunnel test section. A series of ejection seat mounted windblast deflector configurations were tested in the test section with variable wind angle, along with ejection seat attitude and wind tunnel dynamic pressure ranges established from research performed in the 45433-6573. The results of these tests showed that the deflector configuration with a high positive angle of attack significantly reduced the windblast forces acting on the ejection seats.

RESULTS. The results showed that the deflector configuration with a high positive angle of attack significantly reduced the windblast forces acting on the ejection seats. Furthermore, total aerodynamic seat man coefficients were also reduced. Load distribution was related to blast deflector size, location, and orientation with respect to the airstream. CONCLUSION. Deflettes subjected to emergency ejection undergo potentially injurious aerodynamic loading upon entering the airstream. The windblast deflector concept provides a lightweight, easily deployable alternative for improving the ejection system.

NEW HYPOTHESIS ABOUT 4G-INDUCED UNCONSCIOUSNESS

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INTRODUCTION. 4G−induced loss of consciousness (LOC) is considered an effect of suddenly reduction of cerebral blood flow as a result of blood shift to lower body. However, the pathophysiological mechanisms are poorly understood. I propose other pathophysiological alterations and special mechanical explanation is suggested. METHOD. I reviewed the literature about the anatomic relationship between the intracranial structures, the hemodynamic aspects related to cerebral hyperfusion, the effects of hypoxia− ischemia on neuronal function, and applied the laws of physics under 4G− effects in the intracranial compartment.

RESULTS and CONCLUSION. The laws of physics state that during the 4G−induced changes the cerebrospinal fluid (CSF) displaces downwards the axial subarachnoid space, the brain weight increases and displaces the CSF from the supratentorial basal space upwards the cranial convexity. The whole brain descends and the inferior and medial hemispheric structures are compressed against rigid base of the skull and tentorium. The vessels of the Circle of Willis are elonged or/and compressed against rigid base of the skull and tentorium, respectively. Moreover, by viscoelastic properties of the brain, distortion of the cerebral tissue can occur. The GC mainly expose critical brain areas (inferomedial surfaces of temporoparietal lobes, diencephalic structures and midbrain), and explain LOC clinical picture.

INVESTIGATION OF A HELMET LIFT REDUCTION CONCEPT FOR IMPROVED WINDBLAST PROTECTION DURING EMERGENCY ESCAPE


INTRODUCTION. The high speed performance of open ejection seats is restricted by the occurrence of windblast related injuries, including injuries to the crewmember's head and neck. As the ejection crewmember enters the airstream, the windblast forces act to lift or remove, the helmet from the head, transducing aerodynamic loads through the chin and nape straps to the crewmember. A wind tunnel was constructed to study the ability of open ejection seat helmets to reduce this loading. METHOD. Six helmet configurations were tested against the aerodynamic loading caused by a standard Air Force HGU-55/P flight helmet. All helmets were tested at various incident angles and dynamic pressure testing distances. Total head/neck loads were measured with an instrumented scale. RESULTS. Helmet lift and pressures acting between the helmet and head increased with increased positive angle of attack (nose up) and helmet separation distance. The vented helmets reduced these forces more than the non-ventilated helmets. CONCLUSION. Aircrew subjected to emergency ejection forces undergo potential liftoff injuries. The helmet design selected was based on vented helmet lift and pressure measurements made in the wind tunnel and in flight. Vented helmets reduce this loading and may provide a solution for reducing probability of windblast related head/neck injuries.
HYPERTENSION MANAGEMENT IN AVIATORS OF A COMMERCIAL AIRLINE. L.T. N. RIMOSAS, G. V. MASTRAKIS, E. THIAMBETOS, Hellenic Air Force Aerospace Medical Centre, Athens GREECE.

INTRODUCTION. Effective control of arterial hypertension in aviators still remains a problem. Drugs and (S)-blockers, adequately tested so far, are known to cause unfavourable effects on lipid and glucose metabolism. Yet diuretics cause electrolyte disturbances and (S)-blockers may restrain exercise capability and have sedative effects. Newer classes of antihypertensive agents such as Ca-antagonists and ACE inhibitors have been proved clinically safe and effective. They present no adverse metabolic effect, they do not cause orthostatic hypotension or sedative effects. On the contrary ACE inhibitors may increase alertness. Based on these considerations, these classes of drugs have been introduced in recent years in the treatment of hypertension in commercial aviators in Greece. The experience gained is presented in this paper. METHODS. By law, all commercial aviators in Greece are examined every six months. Whenever hypertension is detected the aviator is grounded. After clinical and laboratory investigation, a stepped care treatment of hypertension is started. RESULTS. Out of 490 aviators we found hypertensive (BP>150/95) 17 of them succeeded adequate control of BP only by salt restriction and life style modification. The remaining 36 received successfully drug therapy: (S)-blockers, Ca-antagonists, ACE inhibitors or diuretics as monotherapy or in combination. During the last five years, 5 pilots were permanently disqualified because of uncontrolled hypertension. CONCLUSION. New classes of antihypertensive drugs such as ACE inhibitors and Ca-antagonists have been effectively and safely used in civilian aviators.
**BLOOD VOLUME AND ORTHOSTATIC RESPONSES OF MEN AND WOMEN TO A 13-DAY BEDREST.** *S. Forney, T. Dricoll, L. Shalowitz, I. L. Bernstein, NASA Johnson Space Center, KRUG Life Sciences, and the Baylor College of Medicine.*

**INTRODUCTION.** Changes in blood volume during space flight are thought to contribute to decrements in postflight orthostatic function. The purpose of this study was to determine whether gender affects red cell mass and plasma volume during a short exposure to simulated microgravity, and whether gender differences in orthostatic responses could be explained by sex differences in red cell mass and plasma volume.

**RESULTS.** Plasma volume (% BV) and red cell mass (RCM) decreased in men during bedrest, although plasma volume was not different between men and women at baseline or post-tilt. Mean arterial pressure (MAP) decreased in women and increased in men during bedrest.

**CONCLUSIONS.** Plasma volume and red cell mass were decreased in men during bedrest, and these changes were not different between men and women. The decrease in plasma volume during bedrest was not associated with a decrease in red cell mass, and therefore was likely due to a decrease in fluid volume. The increase in MAP in men during bedrest was associated with a decrease in plasma volume, and therefore may be due to an increase in red cell mass or a decrease in extravascular fluid volume. The decrease in plasma volume during bedrest was greater in men than in women, and this difference may be due to differences in baseline plasma volume or differences in body composition.

**EFFECT OF ANTIORTHOSTATIC BEDREST (BR) ON GASTROINTESTINAL MOTILITY (GIM) OF NORMAL SUBJECTS.** *E. Patch, K. J. Oles, R. M. W., I. L. Bernstein, NASA Johnson Space Center, Houston, TX, KRUG Life Sciences, Inc., Houston, TX and Philadelphia College of Pharmacy and Science, Philadelphia, PA.*

**INTRODUCTION.** The combined effect of postural changes, fluid shifts, and diuresis associated with the absence of the gravity vector may decrease GIM during space flight. GIM can be estimated from the mouth-to-occipital transit time (MOTT) of orally administered lactate (LAC), which is used as a test to assess changes in GIM in microgravity and in postflight, and is sensitive to fluid shifts. Since BR mimics some of the physiological changes that occur during space flight, the effect of ten days of BR on GIM was evaluated from the MOTT of LAC.

**METHODS.** Subjects were 12 non-smoking males between the ages of 35 and 50. After an 8-10 h fast, subjects ingested Cephalin® (2g solution) with a low-fat breakfast on four different days (45, 25, 20) before BR and on three separate days (4, 7, and 10) during BR. Breath-H2 concentrations were measured before and at 10-min intervals for 4 h after breakfast using a Quintron breathalyzer and MOTT was determined from these data. RESULTS. MOTT ranged between 50 and 100 min during ambulation and 80 and 210 min during BR with means of 79 min and 122 min, respectively. CONCLUSIONS. Mean MOTT during BR was 54% longer than during ambulation, suggesting that absorption and availability of orally administered medications and nutrients may be delayed or impaired as a result of decreased GIM during bedrest.