
INTRODUCTION. Especially the cardiovascular systems are affected by positive radial and axial gravity, increased in the levels of stress hormone occurred and secretion of renin from the kidney depends on the blood flow through the glomerulus. ANP and PRA under the positive acceleration in human. Therefore, the subjects included 14 students of Korean Air Force Academy and 7 pilots. The cardiac output was noninvasively measured by echocardiography.

RESULTS. Mean levels of PRA increased from 2.32+/-1.1 mUI/ml/h to 4.80+/-1.0 in students and from 2.92+/-1.1 to 6.4+/-1.0 in pilots after exposure. ANP decreased from 38.2+/-15.6 to 18.6(p<0.01) in students and from 25.3+/-12.8 to 9.8(p<0.01) in pilots after exposure. CONCLUSION. ANP and PRA changes under the positive acceleration are important for the regulation of cardiovascular response in humans.

EFFECTS OF 3 WEEKS CENTRIFUGAL ACCELERATION IN RATS. M. Sudoh, H. Waki*, Y. Honda*, S. Ikawa and H. Sait*.

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INTRODUCTION. This study was performed to clarify the effects of gravity on physiological parameters in rats exposed to 3 weeks centrifugal accelerations.

METHODS. The Wistar rats were exposed to either 1G, 1.6G and 3G (n=each) centrifugal force for 3weeks. The control (CON) group was not exposed and received saline injections. All other rats received 2 intraperitoneal injections per day, given approximately one hour apart, for 3 weeks.

RESULTS. During this period, daily changes in body weight, urine volume, food intake, water intake and urinary excretion of creatinine were measured. In addition, water balance was determined by urine volume and water intake. Body weights in groups 1G and 3G decreased by 7% on the 2nd day and by 14% on the 5th day, respectively. They, however, recovered to the pre-exposure control level by the end of the experiment.

CONCLUSION. It is suggested that body weight and daily intake of food and water decrease in response to hypergravity, a centrifuge having an effect of gravity. Further investigations are required to elucidate the mechanism of the decrease in body weight and food intake.


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EVALUATION OF LYMPHOCYTE POPULATIONS OF NAVY AVIATION PERSONNEL DURING OPERATION DESERT STORM. A. Mateczan*, H.M. Needell*.

L.W. Schoenberg*, N. El Ghshab, Naval Aerospace Medical Research Laboratory, Pensacola, FL 32508-2700 and Naval Medical Research Unit 3, Cairo, Egypt.

INTRODUCTION. The numbers and distributions of lymphocyte populations vary in response to both acute and chronic physical or psychological stresses. Deviations from reference ranges may denote disturbances in normal chemistry, clinical illness, and/or fatigue interfering with job performance or safety. Military personnel have been studied during prolonged operational and training exercises to evaluate these changes as potential predictors of stress response. This study evaluated deployed aviation personnel during Operation Desert Storm. METHODS. Fifty subjects representing aviation, shipboard and medical personnel volunteered for this study. A single blood sample was obtained from each subject for lymphocyte and blood chemistry evaluations within 7 days of cessation of combat operations (43 subjects) and after 6 months (7 subjects). Lymphocytes were prepared and fixed immediately, then evaluated within 36 hours. RESULTS. Mean values and 95% confidence intervals were determined for each lymphocyte population. The lymphocyte populations were not significantly different among the three study groups. CONCLUSION. It was concluded that lymphocyte populations do not change significantly during extended operations.

A COMPARISON OF PULMONARY FUNCTION IN RNoAF PILOTS FLYING FIGHTERS AND MULTI-ENGINE AIRCRAFT. C.C. Christensen, L.O. Owe*, O. Schamma, H.T. Anderson* L.I. Neslien and F. Lian, RNoAF Institute of Aviation Medicine, PO Box 14, Blindern, 0313 Oslo, NORWAY.

INTRODUCTION: Norwegian military aviators are medically screened at our Institute of Aviation Medicine (IAM) initially on selection, and at 6 years intervals until age forty. Pulmonary function tests routinely performed during IAM and local during annual medicals, are: Vital capacity (VC) and forced expiratory volume during the first second of expiration (FEV1).0, with estimation of the ratio of FEV1.0 to VC (FEV1.0/VC%). METHODS: Based on an observation that fighter pilots seemed to develop a more pronounced reduction in FEV1.0/VC% with age than other aircrew, a statistical analysis was performed. Changes in pulmonary function during the first 6 years in service were compared in pilots flying fighters and multi-engine aircraft. RESULTS: There was a significant reduction in FEV1.0 in fighter pilots during the first 6 years of observation, while pilots flying multi-engine aircraft did not have a significant FEV1.0 reduction over the same period. The VC remained constant in both groups. A significantly higher fraction of the pilots in the fighter group had a reduction in FEV1.0/VC% to values below 70% than in the multi-engine group. CONCLUSION: Fighter pilots in the RNoAF develop a significantly greater reduction in FEV1.0 during the first 6 years in service than their colleagues flying multi-engine aircraft.

INCIDENTE OF DECOMPRESSION SICKNESS (DCS) IN HIGH ALTITUDE RECONNAISSANCE PILOTS. A.A. Pilmanis* and R.U. Nixon, Armstrong Laboratory, Brooks AFB TX 78235.

INTRODUCTION. USAF pilots flying U-2/TR-1 reconnaissance aircraft are routinely exposed to cabin altitudes between 25,000 and 30,000 ft for 9 or more hours. One hour at a ground level prebreathing with 100% O2 is used to reduce DCS risk, and 100% O2 is breathed during flight. Former reports of DCS are rare. Pilot Research subjects exposed to altitude profiles similar to the U-2/TR-1 profiles showed a 73% incidence of DCS. METHODS. To resolve this incidence discrepancy and document the extent and nature of DCS in the reconnaissance community, an anonymous survey was administered to active U-2/TR-1 pilots. Due to the subjective nature of DCS, and self-diagnosis, there is a high probability for symptom origin other than DCS. Other causes may include immobility, temperature extremes, fatigue, and equipment effects. RESULTS. The results showed that the average pilot was 35.5 years old (27 to 46), and had flown 110 high altitude missions (65 to 330 altitude hours). During their career, 62% of the pilots had experienced at least one case of DCS on a high altitude mission. The number of cases per pilot ranged from 1 to 25 (mean of 6.1 cases). There was a 4.2% DCS incidence (Kasame/Armstrong). The predominant symptom was pain (91%). In 31% of the reports, manifestations other than pain were described. These were grouped into 3 categories: (14%) neurological, (14%) and pulmonary (3%). Specific neurological complaints included diaphoresis, weakness, and cognitive, speech and equilibrium dysfunction. Only 2 cases resulted in mission abort. The primary reason given (48%) for the reluctance to report DCS was the fear of being grounded. CONCLUSION. This survey documents a higher DCS incidence in high altitude reconnaissance pilots than previously reported.
FLYING AFTER DIVING: VALIDATION TESTS FOR MILITARY DIVERS. R. E. Bossert, E. D. LaFon*, and A. A. Pilamati**. HUB, San Antonio, Texas 78230, USAF School of Aerospace Medicine and 2 Armstrong Laboratory, Brooks AFB TX 78235

INTRODUCTION: Dives conducted at sea level by military personnel, followed by an immediate ascent to altitude present operational requirements for decompression sickness (DCS) prophylaxis. Methods: The limiting tissue nitrogen values (MPv values) were adjusted to 10,000 ft (FAD-I) and 8,500 ft (FAD-II). In FAD-I, military divers were exposed to 6 different dive profiles. After each dive, the subjects ascended to 10,000 ft for 4 hours, were kept at 8,500 ft for 2 hours, and then returned to sea level. In FAD-II, the subjects were exposed to 3 different dive profiles followed by altitude exposures as described except that altitudes were reduced to 8,500 and to 14,250 ft respectively. Subjects were monitored for decompression sickness (DCS) and for venous gas emboli (vge) during the altitude exposures. The voluntary, fully informed consent of the subjects used in this research was obtained as required by APR 169-3. Results: FAD-I results (20 different subjects/110 exposures): 10.9% terminated exposures due to 3% cases of pain-only DCS; 6.4% with vge scores resulting in early termination. FAD-II results (20 different subjects/57 exposures): 5.3% terminated exposures; 1.8% case of pain-only DCS; 3.5% with vge results resulting in early termination of the exposures. Conclusions: Revised surfacing ratio limits (calculated tissue PN2/PB) were used to determine new-decompression limits for dives at sea level which allow immediate ascent to altitudes up to 10,000 ft.

PERMANENT GROUNDING OF A COMMERCIAL AIRLINE'S PILOTS: A 20-YEAR REVIEW. R. W. JONES* AEROSPACE ASSOCIATES, One Cler Court, Oakweli Farms, San Antonio, TX 78218-1741

INTRODUCTION: Accurate psychiatric assessment of aviators requires an examination of pertinent signs and symptoms, an acceptable diagnostic nosology, and valid standards for aeromedical recommendations. Little is known about the work-related psychiatric disorders of the pilots. METHODS: A questionnaire (mostly in "yes or NO" format) was sent to medical offices of ICAO and NATO constituent agencies. RESULTS: We received 43 returned questionnaires. Of 43 returned, 21 were from government bodies, 12 from private air carriers, and 2 from others. Some answers did not total 43 because of non-responses. Applicants are examined: by aeromedical examiners: yes, 17; no, 4; 39 min. Psychiatrists: yes, 17; no, 26; 17 min. Psychological tests are given by 24, and EEGs by 9. Fourteen agencies use the American Psychiatric Association's "DSM-III-R," 14 use the WHO's ICD-9. CONCLUSION: Psychiatric techniques and nosology standards vary worldwide. If standards are not validated against some "gold standard" of performance, they should be based on the collective experience of aeromedical examiners and aviation-oriented psychiatrists and psychologists. We hope to report further on this in the future.


INTRODUCTION. GAF IAM the introduction of routine and thereby preventive HIV-antibody tests, carried out with military personnel of the Federal German Armed Forces in the period from June 1985 to June 1991, shows a prevalence of 0.21 per 1000 for HIV-infected persons and a prevalence of 0.32 per 1000 for HIV-infected persons. METHODS. We have performed a sero-epidemiological study and HIV anti-body testing on all military pilots in the period from June 1983 to June 1991. Results. Hitherto, there are 5 known cases of death representing a mortality of 0.09 per 1000 in the period from June 1983 to June 1991. According to the constitutional law valid in the Federal Republic of Germany and after written consent, aircrew of the German Armed Forces can voluntarily perform the HIV-test during their examination of physical fitness at the GAF IAM. In the period from August 1988 to June 1991, obligatory testing for HIV-1 antibodies at the time of their physical fitness examination, specially required for training in the USA, showed no proof of HIV-seropositivity. In Civil Aviation, aircrew with HIV-seropositivity are principally classified into "not physically qualified for flying duties" while in Civil Aviation HIV-antibody testing is at present solely laid down respectively recommended. In the opinion of the GAF IAM the introduction of routine and thereby preventive HIV-antibody tests, e.g. at the annual physical evaluation, would be an adequate and legitimate claim particularly with respect to the special flight related and task-associated standards on aircrew.


INTRODUCTION. Increased airways reactivity(IAR) among pilot candidates have been investigated through routine airways challenge tests (RACT) in order to estimate the prevalence of IAR. The sensitivity of different methods, and the relationship with atopy. METHODS. 100 pilot candidates aged 17-24 y. with negative chest Xray and normal pulmonary function test lists. Lung function was measured using a Distilled water(UW) and methacholine challenge test (MCT) in random sequence. A screening test for allergic diseases(Phadiotop) and screening skin tests were also performed. Asthma was defined as measured by shutter method) were considered to be representative of IAR. RESULTS. No subject showed IAR after UW. After MCT IAR was found in 18 subjects: high in 3(300-600 of histamine), moderate in 4(300-500), low in 1(200-300). Out of 18 had both FEVI and RAW simultaneously. Phadiotop and prick tests were positive in 15. Conclusions. The prevalence of IAR, the different sensitivity between methods, the different levels of IAR and the presence of sensitivity to FEVI, were assessed. In addition, pilot candidates require discussion and additional work to be defined now and to what extent IAR alone relates to flight and in defining the methodology of next.
APPROPRIOTIN B AS A USEFUL TOOL TO FORECAST CARDIO-VASCULAR RISK IN NORMAL OR HYPERCHOLESTEROLEMIC SUBJECTS. P. Blanco Bojo, J.M. Párez, Sastre.Occupational Medicine Service of IBERIA airline company of Spain, Madrid.

INTRODUCTION. It is generally accepted that apo B is a reliable predictor of cardio-vascular risk disregarding pathological antecedents. This paper presents the results of a study that measured cholesterol, apo A and apo B plasma levels in otherwise healthy ground and flight workers sample. METHODS. Total cholesterol was determined by Abbott's enzymatic test, and apo A and B by Behring's NEFOL mieluminothetical method in 268 random workers. RESULTS. 35.40% males and 13.48% females were hypercholesterolemic, being 75% and 68% respectively considered high cardiowascular risk. 12.8% males and 4% females with normal cholesterol were also considered high risk, due to both being high apo B and low apo A levels. CONCLUSIONS. Apo B should be determined in Hyper and/or Normocholesteremic workers when there are other associated factors (smoking, hypertension, diabetes) and/or safety related jobs (aircrew) in order to comply or not harsher therapies to prevent cardio-vascular disease.

REGULATION AND ADAPTATION PROCESSES OF HUMAN BODY IN LONG-TERM MICRogravity: A. G. Gopinathan and A.A. Egorov, Institute of Biomedical Problems, Moscow 123077, USSR.

INTRODUCTION. Mechanisms of regulation and adaptation of cardiovascular, respiratory, muscular-skeletal, hematologic and immune systems in microgravity are discussed in this paper. METHODS. Spaceflight medical investigation results are analyzed and summarized in terms of general physiological mechanisms. RESULTS. Microgravity induced elimination of gravity-related daytime and night-time sleep patterns, mechanical loading of the human body structures changes after flight and removes weight-load and hydrostatic blood pressure. A series of short- and long-term adaptation responses are developed. It was noted that changes in the regulatory mechanisms, resulted in an adaptive reorganization of the functional state of the main human body systems. The fluid shifts are accompanied by reflex changes in regulation of circulation, water-salt metabolism, and hormones. The regulation of the body weight-bearing structures results in partial loss of properties and acquired by man under influence of the Earth's gravity, and causes changes in the intensity of the oxidative processes, structure and plastic and transport support of a number of body functions. CONCLUSIONS. The human body is a complex system which occur in microgravity result in the intriguing of the self control and adaptive mechanisms, which in combination with the compensates measure complex, prevents further progress of disorders and to certain extent smooth them.

INITIAL RESPONSE OF THE CALCIUM HOMEOSTATIC SYSTEM TO SPACEFLIGHT. C.E. Canny*, C.D. Araújo, B.P. Halleran, M.E. Hammond, D. Matsumoto, S. Sanchez, University of California, San Francisco, CA 94113.

INTRODUCTION. Bone loss following spaceflight is well documented, and if left untreated, may accelerate the rate of bone loss over long periods. Studies in vitro have been performed during the past 48 hours of spaceflight. We hypothesized that the initial response of bone to unloading will be a release of calcium, through increased bone resorption, into the extracellular calcium fluid compartment including blood. If this is correct, the serum ionized parathyroid hormone (PTH) level will decrease in an adaptive response, leading to other observed effects such as increased urinary calcium. We tested this hypothesis in the payload crew of the SLS mission. METHODS. Serum samples were obtained from four crew (2 male, 2 female) on days 18, 7, 2, FD2, FD6, R+1 and R+6. We measured serum ionized calcium (Ca2+), magnesium, phosphorous, intact PTH (iPTH), with measurement ofPTH in > 95% of normal subjects and 1,25 dihydroxyvitamin D using microtechniques developed in our laboratory. RESULTS. Serum Ca2+ showed the expected negative correlation with PTH for all samples, confirming biological validity of our data. An unexpected finding was a much stronger correlation for the male crew (r=0.8, p<0.001) than for the female crew (r=0.3, N.S.). Ca2+ increased markedly (25%) by FD2 and remained elevated (19%) through FD6, with recovery by R+1. PTH decreased by FD2, was low through FD6, and also recovered by R+6. Mg and P did not change. CONCLUSION. The hypercalcinemia is clinically significant, and could be responsible for some symptoms of space adaptation syndrome. The early Ca homeostatic response to spaceflight is consistent with increased bone resorption, but this is not proved. Antiresorptive drugs such as those in research trials in osteoporosis and metastatic bone disease may be useful in preventing bone loss in spaceflight.


INTRODUCTION. The USSR experience, having been accumulated in LDSF medical support, has shown the necessity of the definite correction and specification of methodology of MCS design. METHODS. By use of systemic analysis, the generalized estimation of the results of MCS in space has been performed. There have been revised the results of examination of 19 Soviet cosmonauts, who performed LDSF, lasting from 2 to 12 months, in 1986-90. Moreover the analogous estimation has been carried out in 566 experiments with volunteers during the modelling of space flights. RESULTS. The systemic analysis has shown, that in addition to 3 well-known methodological principles (i.e. pathogenesis, "MC by stages" and succession's ones), 4 new principles must be formulated and taken into account. They are the systemic-structural approach, the determinism of the infrastructure of the basic physiologic mechanisms, the notion of the total "image" of MCS, the search of "organ-targets". CONCLUSION. The realization of the all above mentioned methodological principles leads to the significant improvement of the informative and diagnostic possibilities on board MCS in LDSF.

RESULTS OF AN INTERNATIONAL SPACE CREW DEBRIEF. P.A. Santy*, A.R. Hollens*, L. Songer*, and R. Harrison-Morth*, UTHSC, Galveston, TX 77550; and Johnson Space Center Biobehavioral Laboratory, Houston, TX 77058.

INTRODUCTION. In order to identify potential multinational and multicultural problems for future International Space Station Freedom crew, a crew debrief questionnaire (called an "International Crew Debrief") was developed for U.S. astronauts who flew on Shuttle missions with one or more crewmembers from other countries. METHODS. From 1981-90, a total of 20 U.S. astronauts flew on International space missions. Dilemmas were collected and analyzed with instructions not to identify themselves or their specific mission. The debrief focused primarily on preflight training and postflight incident investigation, and represented a microcosm of the intercultural friction among crewmembers. Astronauts were also asked to rate the impact of the incident to the mission (low, medium or high). RESULTS. 33% of astronauts responded, but only nine responses were considered high enough to rate the impact of the incident to the mission (low, medium or high). CONCLUSIONS. The debrief respondents provide useful and timely recommendations on preflight training which might help facilitate the integration of multinational crews and prevent multicultural or multinational factors from interfering with mission operations.