

VERY LOW PREVALENCE RATE OF NIDDM AMONG COCKPIT CREWS OF JAPAN AIRLINES. Y. Shibata, C. Yamada, N. Tajima, Y. Sakuramoto, T. Okamoto, K. Sakai, M. Yuzawa, N. Takeda, E. Maeda, J. Yokoyama, M. Ohno, Y. Noguchi, M. Hokari. Flight Crew Medical Service Department, Japan Airlines, Tokyo, Japan.

INTRODUCTION. The present study was conducted to evaluate the prevalence of NIDDM among cockpit crews and to analyse the present status of individuals with NIDDM and impaired glucose tolerance (IGT). **METHODS.** A total of 1263 active crews age ranging 40-60 yrs are included in the study. All received aviation medical examination every 6 month since employment and those who showed urine glucose > trace and/or fasting plasma glucose (FPG) > 100mg/dl took 75gOGTT. Diagnosis of NIDDM was made by WHO's criteria. As of 3-31-91, laboratory variables were measured to determine their control status. **RESULTS.** Of 1263, 43 were diagnosed as NIDDM, 192 as IGT, 10 as renal glucose uria and the remaining 1018 were normal. Prevalence rate of NIDDM was 3.4%. A cross sectional study demonstrated that present age (52.8, 49.2 vs 46.8 yrs), FPG (107, 104 vs 92 mg/dl), HbA1c (6.1, 5.8 vs 5.5%) were higher in NIDDM and IGT than in normals, however, BMI, T.chol and uric acid levels were identical among three groups. None of them were grounded due to poor control of diabetes. **CONCLUSION.** The occurrence of NIDDM among cockpit crews was approximately 1/3 of general population despite their irregular and stressful life style. Healthy worker's effect cannot be neglected, however, intensive supervision by us seems to be effective to ameliorate their glycemic control.

FRACTURE OF THE FEMORAL NECK SUSTAINED DURING ROUTINE CENTRIFUGE TRAINING M.E. Reid, M.D., Maj. J.S. Han, Ph.D. William Beaumont Army Medical Center, Orthopaedics, El Paso, TX 79920. Texas Tech University Health Sciences Center, Biomechanics Laboratory, El Paso, TX 79905.

INTRODUCTION. In efforts to enhance a high performance fighter pilot's tolerance of high sustained +Gz (HSG), centrifuge training in which the subject undergoes a series of runs attaining a maximum of 7G for 15s are commonly employed with minor if any complications. This paper, however describes just such a routine centrifuge session resulting in the fracture of the subject's femoral neck. Thorough search of the literature revealed no similar mechanism of injury. **CASE REPORT.** A 30-year-old Air National Guard pilot in good health (no history of lower extremity injury or pathology or change in activity) was approved for centrifuge training at a military training facility. In a rapid onset run (ROR) of high +Gz, he was accelerated from 1.2G to 7.0G at a rate of +2.0 G.s-1, sustaining 7.0Gz for an additional 15s while performing the M-1 maneuver. At the completion of this run, the patient reported marked pain in his right hip. Examination revealed a complete fracture of the right femoral neck with no concomitant pathology. Initial biomechanical assessment of possible causative factors suggests that a minor shift in seating during the rapid onset of G's may have channeled enough force through the hip to exceed bone strength. **IMPLICATIONS.** With thorough biomechanical analysis, the possible etiologic factors of this unique case will be demarked, furthering our understanding of human function under high-G stress, and hopefully preventing future occurrence of such injury.

A REVIEW OF ACCELERATION INJURIES ON HUMAN CENTRIFUGES IN THE UNITED STATES AND CANADA SINCE 1985. D. McGowan*, J. Whinnery*, ACME Labs, Naval Air Development Center, Warminster, PA 18974-5000; K.K. Gillingham*, Armstrong Labs, Brooks AFB, TX, 78235-5301; F.J. Maggior*, G.W. Gray*, Defense and Civil Institute of Environmental Medicine, North York, Ontario, Canada, M3M 3B9; J. Green*, R.D. Vanderbeek*, USAF TAC HQ, Langley AFB, VA 23665.

INTRODUCTION. As tactical aviation moves farther into the high-G environment, research exposures above 10 +Gz make critical the proper selection of experimental subjects, yet the extent and cost of screening has expanded without a clear correlation to benefits. **METHODS.** A review of all centrifuge related injuries was conducted combining human experience in the U.S. and Canada. Consideration was given to the G profile flown, the subject's previous G-exposure experience, and the selection process or screening criteria utilized before the exposure was authorized. **RESULTS.** Injuries were infrequent, unpredictable, generally minor, and occurred to both screened and unscreened subjects. **CONCLUSION.** The injuries experienced by training subjects (not prescreened other than being on flight status) would not have been avoided by use of current screening criteria. Experimental subjects may be over screened, with resulting unnecessary expense of selection and exclusion of many subjects. Careful review of screening requirements and selection criteria for high-G exposure should be explored along with a careful expansion of the G envelope.

RETROSPECTIVE REVIEW OF CENTRIFUGE MORBIDITY. P. M. Giovanetti*. HQ TAC/SGPA, Langley AFB, VA 23665.

From September 1988 through June 1991, 6,078 Tactical Air Command (TAC) aircrew members have undergone G tolerance training at the Holloman Air Force Base, NM centrifuge. In May 1989, Headquarters TAC surveyed experienced aircrew members to assess morbidity associated with the centrifuge training program. A broader-based follow-up survey was conducted in August 1990 and was interrupted by Operation Desert Shield. Results of these surveys indicate that significant morbidity associated with centrifuge training is low--Duties Not Including Flying (DNIF) rate of 4% in the initial survey, 0.8% in the follow-up. However, the duration of DNIF is long - mean 3.1 weeks in the initial survey; 30 days in the follow-up. Seven cases of significant morbidity temporally related to centrifuge training are presented.

THE FATE OF EYEWEAR IN EJECTION. S.R. O'CONNELL, A.S. MARKOVITS. Naval Aerospace Medical Institute, Pensacola, FL 32508-5600

INTRODUCTION. Ejection from jet aircraft is an area that has been exhaustively studied from many perspectives, e.g. causes of ejection, types and causes of ejection injuries, etc. Curiously, no study was found concerning the fate of eyewear in ejections. Many pilots are required to wear corrective lenses during flight ops and many wear sunglasses. What happens to these during ejection? What injuries are caused? What factors can be identified that influence retention rate and severity of related injury? Do contact lenses provide significant advantage? **METHODS.** 48 ejections occurring from '77 to '90 involving corrective or sun lens use were retrospectively examined. 5 were contact lens wearers. Most information was obtained from Naval Safety Center records and some from personal questionnaires. Injury and retention rates were examined as functions of several variables. **RESULTS.** Though 37 of 46 lost all lenses every single instance of retention occurred with visor down, O2 mask on, helmet properly secured, and at lower ejection speeds. Related injuries were minor and occurred in only 20%. **CONCLUSION.** The utility of and need for enforcement of standard operating procedures (i.e. mask on, helmet secured, and visor down) was clearly demonstrated. Only 19 of 46 clearly met all three criteria. Contact lens users were too few to draw meaningful conclusions.

PHYSIOLOGICAL CONSTRAINTS ON DECELERATION DURING THE AEROCAPTURE OF MANNED VEHICLES. J.E. Lyne* NASA Ames Research Center, Moffett Field, CA 94035.

INTRODUCTION. The peak deceleration load allowed for aerobraking of manned vehicles is a critical parameter in planning future excursions to Mars. However, considerable variation exists in the limits used by various investigators. The goal of this study was to determine the most appropriate level for this limit. **METHODS.** Since previous U.S. spaceflights have been limited to 84 days duration, Soviet flight results were examined. Published details of Soviet entry trajectories were not available. However, personal communication with Soviet cosmonauts suggested that peak entry loads of 5-6 g had been encountered upon return from 8 months in orbit. Soyuz entry capsule characteristics were estimated, and the capsule's entry trajectory was numerically calculated. The results confirmed a peak load of 5 to 6 g. **RESULTS.** Although the Soviet flights were of shorter duration than expected Mars missions, evidence exists that the deceleration experience is applicable. G tolerance has been shown to stabilize after 1 to 3 months in space if adequate countermeasures are used. The calculated Soyuz deceleration histories are graphically compared with those expected for Mars aerobrakes. **CONCLUSIONS.** Previous spaceflight experience supports the use of a 5 g limit for the aerocapture of a manned vehicle at Mars.

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F-16 PILOT EXPERIENCE WITH COMBAT EJECTIONS DURING THE PERSIAN GULF WAR. C. S. Williams.* 401st Fighter Wing Hospital, Torrejon Air Base, Spain, APO, AE 09641.

INTRODUCTION. Most experience with ejections from modern fighter aircraft has occurred in mishaps outside of true combat operations. During the Persian Gulf War, the 401st Tactical Fighter Wing lost 4 F-16C aircraft while on combat missions. All 4 pilots ejected safely, but under varying and different parameters. A questionnaire was developed to recall and review their egress situation, any problems or injuries they encountered, and their present confidence in the F-16 ejection system. METHODS. All 4 pilots were given the questionnaire that allowed them to provide essay answers to 12 questions pertaining to their ejections. Questions ranged from recalling the parameters of their egress to conscious recollections of the event and their assessment of how well the system worked. RESULTS. All 4 ejections occurred under different parameters. Two were at high altitudes. All 4 pilots were able to vividly recall their egress experience and recount some part of the event that was a surprise. None suffered any significant injury and one was wearing contact lenses which remained in during the ejection. All felt the seat and survival gear performed flawlessly. CONCLUSION. This was one of the first times that experience was obtained with the egress system in the F-16 fighter under combat operations in which the reason for emergency egress might be different, e.g. frag damage, than in peacetime. In the experience of these 4 pilots, the F-16 egress system is reliable even in combat operations.

NEW HYPOTHESIS ABOUT +Gz-INDUCED UNCONSCIOUSNESS.

R. Betancourt.* Hospital Militar Central. Bogotá. Introduction. +Gz-induced loss of consciousness (G-LOC) is considered an effect of suddenly reduction of cerebral blood flow as a result of blood shift to lower body. However, the physiopathogenic mechanisms are poorly understood. I propose other neurophysiologic 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 be cerebral hyperfusion, the effects of hypoxia - ischemia on neuronal function, and applied the laws of physics under +G - effects in the intracraniospinal content. Results and conclusions. The laws of physics state that during the G-induced changes the cerebrospinal fluid (CSF) displaces downward the spinal subarachnoid space, the brain weight increases and displaces the CSF from the supratentorial basal space upward 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 collapsed. Moreover, by viscoelastic properties of the brain, distortion of the cerebral tissue can occur. The +G mainly exposes critical brain areas (inferomedial surfaces of temporoccipital lobes, diencephalic structures and mid-brain), and explain G-LOC clinical picture.

INVESTIGATION OF A HELMET LIFT REDUCTION CONCEPT FOR IMPROVED WINDBLAST PROTECTION DURING EMERGENCY ESCAPE. S.R. Gordon, L.J. Specker, J.A. Plaga, and F.S. Knox III* Armstrong Laboratory, Wright-Patterson AFB, Ohio 45433-6573.

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 ejecting crewmember enters the airstream, the windblast forces act to lift, or remove, the helmet from the head, transferring aerodynamic loads through the chin and nape straps to the crewmember. A wind tunnel study was conducted to assess the ability of vented helmets to reduce this loading. METHODS. Six vented 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 ejection seat attitudes and increasing helmet separation distances. Total head/neck loads were measured with an instrumented manikin. Helmet loads were measured with a separate six-component balance. Pressures between the helmet and the head were also measured. RESULTS. Helmet lift and pressures acting between the helmet and head increased with increasing positive angle of attack (nose up) and helmet separation distance. The vented helmets reduced these forces. The reduction was related to total venting area. CONCLUSION. Aircrew subjected to emergency ejection forces undergo potentially injurious head/neck aerodynamic loading upon entering the airstream. Vented helmets reduce this loading and may provide a solution for reducing probability of windblast related head/neck injuries.

INVESTIGATION OF A WINDBLAST DEFLECTOR CONCEPT FOR IMPROVED WINDBLAST PROTECTION DURING EMERGENCY ESCAPE. L.J. Specker, S.R. Gordon, J.A. Plaga, and F.S. Knox III* Armstrong Laboratory, Wright-Patterson AFB, Ohio 45433-6573.

INTRODUCTION. The high speed performance of open ejection seats is restricted by the occurrence of windblast related injuries. These injuries, which include disruptions of the joints of the extremities, and fractures of the arms, legs, neck and skull, are directly attributable to the dynamic pressure of the airstream. A wind tunnel study was conducted to assess the ability of different windblast deflector configurations to reduce the windblast forces acting on the ejection crewmember. METHODS. Ten ejection seat-mounted windblast deflector configurations were tested. Deflector size and incident angle, along with ejection seat attitude and wind tunnel dynamic pressure and manikin size were varied. Total aerodynamic head/neck loading was measured with an instrumented manikin. Pressures surrounding the parachute headbox were also measured. RESULTS. Head/neck loading was reduced for some deflector configurations; furthermore, total aerodynamic seat/man coefficients were also reduced. Load reduction was related to blast deflector size, location, and orientation with respect to the airstream. CONCLUSION. Aircrew 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 aircrew windblast protection and reducing the probability of windblast related injuries.

A FIRST "RUN EFFECT" ON THE HUMAN CENTRIFUGE. A. E. Tozer and A. R. J. Prior* Royal Air Force Institute of Aviation Medicine, Farnborough, UK. GU14 6SZ.

INTRODUCTION. Centrifuge subjects have previously reported that exposure to +Gz acceleration on the human centrifuge caused a greater loss in peripheral vision during the first run of a session than subsequent runs at the same acceleration. Initial trials showed that six out of eight subjects exhibited a "first run" effect based upon visual loss criteria. It was therefore decided to study this phenomenon in greater detail and to assess the possible cause. METHODS. Seven subjects were exposed to five successive runs on the human centrifuge at their previously determined relaxed G tolerance (3.2 - 3.8Gz, at 1G/s onset rate, with fifteen seconds at peak G). The time between runs was standardised at approximately thirty seconds. Eye level blood pressure, heart rate, lower body blood volume and peripheral vision were continuously monitored during exposure to +Gz acceleration. RESULTS. Lower body blood volume and heart rate showed no significant differences between runs. A significant difference was clearly evident with peripheral vision and eye level blood pressure. Peripheral vision showed a 44% greater loss overall [p<0.001] during the first run (436°.sec. mean loss) compared with subsequent runs (302°.sec. mean loss). Eye level blood pressure showed an overall greater loss of 23% [p<0.001] during the first run (788mmHg.sec mean loss) compared with subsequent runs (641mmHg.sec mean loss). CONCLUSION. This study has established that a high proportion of centrifuge subjects experience a "first run" effect. This phenomenon manifests itself as a significantly greater loss in peripheral vision and eye level blood pressure under +Gz acceleration during the first run compared to those recorded in subsequent runs at the same acceleration. Both parameters appear to be independent of changes in lower body blood volume. The results from this study suggest that it is essential to be aware of this phenomenon when assessing relaxed G tolerances if gross errors are to be avoided. Further investigations will be necessary to determine the underlying cause.

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A TWO-DIMENSIONAL ECHOCARDIOGRAPHY STUDY OF LEFT VENTRICULAR CHARACTERISTICS IN PILOTS Z. Li, Y. X. Zheng Qingdao Sanatorium, Chinese Air Force, Qingdao 266071 P.R.China

INTRODUCTION. Left ventricular end-diastolic muscle volume (LVMV) and weight (LVMW) of pilots were studied with 2-dimensional echocardiography with modified Devereux formulae and were compared with those of groundcrew. METHODS. 42 male pilots (mean age 28.1, Group A) and 23 male groundcrew (mean age 28.6, Group B), without any CV anomalies, were examined with systolic time interval (STI) indices and 2-dimensional echocardiograph (Aloka SSD710) for left ventricular end-diastolic dimension (Dd), interventricular septum end-diastolic thickness (IVSTd) and left ventricular posterior wall end-diastolic thickness (PWTd) and therefrom ventricular volume and weight were derived with Wuhan Medical College (WHMC) and Devereux formulae:

LVMV = (Dd + IVSTd + PWTd)² - Dd² } WHMC
LVMW = 1.05 ((Dd + IVSTd + PWTd)³ - Dd³) - 14 Devereux

RESULTS. No significant difference were found in STI parameters between A & B (p>0.05), but LVMV and LVMW were significantly different as shown in the following Table. The correlation between results from WHMC and Devereux formulae was 0.99. CONCLUSIONS: While A and B are not significantly different in STI indices, their LVMV and LVMW are significantly different (p<0.01)

	LVMV (mm³)	LVMW (g, WHMC)	LVMW (g, Devereux)
Group A (N=42)	196.2±39.2	206.0±41.1	190.0±40.7
Group B (N=23)	171.0±29.7	179.6±31.2	163.9±30.9

CARDIAC IMPEDANCE DIFFERENTIAL LOOP IN AIRCREW
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INTRODUCTION. Cardiac impedance differential loop (IDL) is a plot of impedance ΔY versus impedance differential dY/dt (Palke 1983). It is more informative and accurate than impedance cardiogram (Xing 1989). The IDL of 50 Chinese pilots are reported here. **METHODS.** IDL was recorded in 50 aircrew and in 50 comparable groundcrew for comparison. All anomalies of CV diseases were excluded. The implement consisted of vectocardiograph (VA-3GR Fukuda), an impedance recorder (HB-ADM) and an X-Y plotter. Electrode placement was the same as impedance cardiography. Subjects were divided into 2 age groups. **RESULTS.** The important and age related parameters are tabulated in the Table. It can be seen that IT & ITmax of aircrew are much shorter and IA, IIIA, IIIA/IA much greater than those of groundcrew. **CONCLUSION.** Because of screening & regular exercise, aircrew's SIDL is unique & warrants their own normal standard as cited below.

	Age group 22-40 (N=34@)		Age group 41-52 (N=16@)	
	AIRCREW	GROUNDCREW	AIRCREW	GROUNDCREW
IT(ms)	170.1±22.5	183.5±8.1*	182.8±10.6	206.2±13.1*
ITmax(ms)	76.9±7.1	84.8±5.7*	83.4±5.6	97.5±6.8*
IA(units)	6.6±2.0	4.8±1.1*	5.1±2.5	3.9±0.7*
IIIA(units)	0.18±0.08	0.1±0.05*	0.16±0.13	0.05±0.03*
IIIA/IA(%)	2.7±1.04	2.5±0.76"	3.0±1.96	1.2±0.86**

IT=phase I time; ITmax=max. injection time; IA, IIIA: phase I, III area respectively. *p<0.001; **p<0.005; †p<0.01; ‡p>0.05

HYPERTENSION MANAGEMENT IN AVIATORS OF A COMMERCIAL AIRLINE. I.T. Himonas,* G.V.Masdrakis, E.C.Stathogiannis. Hellenic Air Force Aerospace Medical Centre, Athens GREECE.

INTRODUCTION. Effective control of arterial hypertension in aviators still remains a problem. Diuretics and β -blockers, adequately tested so far, are known to cause unfavourable effects on lipid and glucose metabolism. Yet diuretics cause electrolyte disturbances and β -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 nor sedative effects. On the contrary ACE inhibitors may increase alertness. Based on these considerations, these classes of drugs have been in recent years introduced 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 in HAF Aerospace Medical Centre. Whenever hypertension is detected the aviator is grounded. After clinical and laboratory investigation, a stepped care treatment of hypertension is started. **RESULTS.** Out of 480 aviators, 43 were found hypertensive (BP>150/95). 17 of them succeeded adequate control of BP only by salt restriction and life style modification. The remaining 26 received successfully drug therapy: β -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.

USING TOTAL QUALITY CONTROL (TQC) TO ASSESS FLIGHT SURGEON'S WORK QUALITY.
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INTRODUCTION. The assessment of work in health maintenance is almost traditionally qualitative because of the difficulty involved in its quantification. In order to improve the work quality of Flight Surgeon, this study is to work out a method to evaluate the health maintenance work of Flight Surgeon quantitatively. **METHODS.** According to concepts of management, Total Quality Control and investigation in basic unites, we first work out a comprehensive indices system on work quality. The second step was to attach each index with a weight factor thru Delphi method and Analytic Hierarchy Process method. The third step was to establish the grade demand of each index, basing on investigation in 17 basic units. **RESULTS.** solving the three problems mentioned above, we arrived a quantitative evaluation procedure of Flight Surgeon's work composed of 30 items, grouped into 4 categories (Flight Surgeon's quality, Flight Surgeon's work, application and management of equipments, the health condition of pilots). **CONCLUSIONS.** This quantitative evaluation procedure of Flight Surgeon's work is practicable and reliable in actual application.

CENTRAL EFFECTS OF ANTI-HYPERTENSIVE DRUGS

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Anti-hypertensive drugs are used increasingly in the management of mild to moderate hypertension in air personnel, and the central effects of these drugs must be considered when deciding the most appropriate therapy. We have studied, in a series of experiments over several years, the effects of beta-adrenoceptor antagonists, an angiotensin converting enzyme inhibitor, a calcium antagonist and a diuretic on performance and subjective feelings, as well as on the electroencephalogram (EEG). With both atenolol (50 to 100mg) and propranolol (40 to 160mg) there was electroencephalographic evidence of sedation, and with propranolol short term memory was also impaired. Captopril (12.5 to 50mg) improved psychomotor performance and short term memory without any change in the EEG. Nifedipine (10 to 40mg) led to feelings of increased agitation with electroencephalographic evidence of arousal. Bendroflorazide (2.5 to 10mg) impaired psychomotor performance, but there was no change in short term memory or in the EEG.

The studies carried out within this programme suggest that angiotensin converting enzyme inhibitors are likely to have the least deleterious effect on central function in man.

TRANSIENT LACK OF LICENSING REQUIREMENTS OF MEDICAL FITNESS FOR FIRST CLASS CERTIFICATION IN ITALIAN AIR LINE PILOTS: STUDY ON THE MOST FREQUENTLY INVOLVED CAUSES. L. CRISTOFANELLI* - G. SIMINI - E. VELARDI. Servizio di Sanita' Aeronautica Militare - Istituto Medico Legale - Rome.

We evaluated 1.386 air line pilots (all males; age range 28-56, mean 44) from 1986 to 1990. This figure represents about 70% of all Italian air line pilots, and can therefore be regarded a representative of the all pilot population. Three hundred ninety six (28,6%) of subjects had presence of a disease state not satisfying the requirements for first class certification. Among these subjects 310 (21%) were assessed to have only minimal clinical and/or laboratory findings compatible with first class certification. The most frequently involved systems and apparatus were: a) metabolism, b) cardiovascular, c) bones and joint and, d) ear, nose, throat. The remaining 80 (5,5%) subjects were transiently disqualified for first class certification as they showed: a) cardiovascular, b) neuropsychiatric, c) bones and joint, d) ear, nose, throat disorders. Then (1,3%) had eye, abdominal and respiratory disorders. Medical advice, possibly coupled with pharmacological therapy were able to consistently prevent a worsening of the clinical situation. In fact, only in 5 (0,4%) pilots the disorders caused denial. It is concluded that: a) it is important to perform periodical medical examination at the same medical center to obtain consistent and reliable data and, b) an individually tailored medical counselling is able to reduce denial rate.

INTRAVENTRICULAR CONDUCTION DISTURBANCES IN CIVILIAN FLYING PERSONNEL: WOLFF-PARKINSON-WHITE SYNDROME. G. Canaveris*, M.S. Halpern, J. Przybylski. Instituto Nacional de Medicina Aeronautica y Espacial, Buenos Aires. Argentina.

INTRODUCTION. Out of the several evolutive characteristics of the Wolff-Parkinson-White (WPW) syndrome, 2 are of importance as risk factors in aviation medicine: 1) the probability of supraventricular arrhythmias development and, 2) its spontaneous intermittence that can conceal its diagnosis. **METHODS.** WPW pattern was present in 10 of 9112 males engaged in civilian flying activities (10 years average population) (prevalence: 0.10%). Antecedents of palpitations (throbbing), dizziness or syncopal episodes were searched for in every case. In all cases seen during the last 5 years, exercise test, M-mode and two-dimensional echocardiogram, Holter monitoring as well as electrophysiologic studies (ES) were performed, with Ajmalin test and atrial and/or ventricular overdrive to discard or provoke supraventricular tachyarrhythmias. **RESULTS.** The ages ranged between 19 and 48 (\bar{x} = 32.2 ± 10.8). Six cases were type A WPW (positive delta wave in V1) and 4 type B. The WPW pattern was permanent in only 2 cases; in 8 was transient or intermittent. Ajmalin blocked the anomalous pathway (AP) in 2 cases. The ES proved that one had sick AP. Nine cases had no demonstrable underlying heart pathology; one presented hypertrophic cardiomyopathy. Supraventricular arrhythmias were not detected in anyone. Eight cases were waived, one with restrictions. **CONCLUSIONS.** WPW in an asymptomatic pilot with no detectable nor inducible arrhythmias is not disqualifying for flying. When detected at entrance electrocardiogram, according to results of ES tests a waiver may be granted.

MITRAL REGURGITATION AS A COFACTOR IN MITRAL VALVE PROLAPSE Whitman J, Kadmas M, Munson RA; Aeromedical Consultation Service, Brooks AFB, Texas 78235

OBJECTIVE: To assess whether mitral regurgitation in the setting of mitral valve prolapse identifies a subset of individuals at higher risk for arrhythmias.

DESIGN: Case series study

SETTING: Referral center for evaluating aviators with possible heart disease

PATIENTS: Military aviators (n=198) known to have mitral valve prolapse; evaluated and followed in the period from June 1983 to February 1991.

MEASUREMENTS: History, physical examination, echocardiography, Holter monitor, and other testing (including subspecialty evaluation) as required for a thorough aeromedical evaluation. Mitral regurgitation was considered present if there was a late systolic/holosystolic murmur that behaved appropriately with maneuvers and/or color-flow/continuous wave evidence for mild/moderate/severe regurgitation on at least one evaluation.

RESULTS: The 198 aviators underwent 320 evaluations averaging 1.62 visits per subject. MR was noted on physical exam and/or echocardiography in 133 of these aviators. Some degree of MR (mild/moderate/severe) was noted on Doppler study in 31 aviators; 25 of these 31 aviators had auscultatory MR as well as MR by echo. The only arrhythmia significantly more common in individuals with MVP and MR was supraventricular pairs (12.7% with MR vs. 1.5% without MR, p=.01). Ventricular pairing, ventricular or supraventricular tachycardia, atrial fibrillation/flutter, etc. did not show a significant association with the MR group.

CONCLUSION: In this group of 198 aviators with MVP only PAC pairing was significantly more common in the subjects with MR as compared to those without MR. MR is not useful for identifying aviators with MVP who are at risk for tachyarrhythmias.

BLOOD VOLUME AND ORTHOSTATIC RESPONSES OF MEN AND WOMEN TO A 13-DAY BEDREST. *S. Fortney, T. Driscoll, L. Steinmann, and C. Alfrey. 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 tolerance ensue. **METHODS:** Ten men (31.5 ± 5.2 yrs, STD) and eleven normally-menstruating women (33.3 ± 6.0 yrs, STD) underwent 13 days of 6° head-down bedrest. Plasma volume (¹²⁵I-labelled human serum albumin) and red cell mass (⁵¹Cr-labelled red blood cells) were measured before bedrest and on bedrest day 13. On the same days, orthostatic tolerance (OT) was determined as the maximal pressure during a presyncopal-limited lower body negative pressure test. **RESULTS:** Plasma volume (PV) and red cell mass (RCM) decreased (P < 0.01) during bedrest in both groups, with a greater PV decrease (P < 0.05) in men (6.3 ± 0.6 ml/kg) than in women (4.1 ± 0.6 ml/kg). Decreases in red cell mass were similar (1.7 ± 0.2 ml/kg in men and 1.7 ± 0.2 ml/kg in women). OT was similar for men and women before bedrest (-78 ± 6 mmHg in men vs. -70 ± 4 mmHg in women) and decreased by a similar degree (by an average of 11 mmHg in both groups) after bedrest. The changes in OT did not correlate with changes in plasma volume during bedrest (r² = 0.002).

CONCLUSION: Thus, although female hormones may protect PV during bedrest, they do not appear to offer an advantage in terms of loss of orthostatic function.

ASPECIFIC NASAL HYPERREACTIVITY IN AN AIR FORCE POPULATION AND ITS RELATIONSHIP WITH BRONCHIAL HYPERREACTIVITY AND ATOPY. L. Urbani*, R. Berti*, C. De Angelis, G. Petrelli, S. Farrace*, P.M. Matricardi, R. Nisini and F. Filiaci. IAF, DASRS, Dept. of Aerospace Medicine and ENT Clinic, University of Rome, Italy.

INTRODUCTION: Nasal function is of paramount importance for aircrew. Aspecific nasal hyperreactivity (ANH) prevalence in a young IAF population was investigated and compared to the prevalence of aspecific bronchial hyperreactivity (ABH) and atopy. **METHODS:** 90 healthy males (17-24 yrs) were administered cold water and methacholine nasal provocation tests (NPTs). ANH was evaluated by computerized rhinomanometry and, only for the methacholine NPT, by measurement of nasal secretions. A methacholine bronchial provocation test (BPT) was also performed, as well as a screening test for inhalant allergy (Phadiatop). **RESULTS:** 25% was positive to cold water NPT, 38% to methacholine NPT and 8% to both. BPT was positive in 18% and in more than 2/3 of cases ABH was associated with ANH to either NPTs. 24% was positive to Phadiatop and 91% in this group was positive to either NPT or BPT. **CONCLUSION:** ANH is more frequent than ABH, which is often associated to the former condition. Atopy seems to match very often with aspecific upper and/or lower airway hyperreactivity. Implications for selection of aircrew can follow.

EFFECT OF ANTIORTHOSTATIC BEDREST (BR) ON GASTROINTESTINAL MOTILITY (GIM) OF NORMAL SUBJECTS L. Putchal¹, R.P. Hunter², K.J. Tietze³, and N.M. Cintrón¹ ¹Biomedical Operations and Research Branch, NASA/Johnson Space Center, Houston, TX, ²KRUG Life Sciences, Inc., Houston, TX and ³Philadelphia 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-cecum transit time (MCTT) of orally administered laetulose (LAC); this test is used to assess changes in GIM in normal subjects and in patients with GI pathology and related disease conditions. 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 MCTT of LAC. **METHODS:** Subjects were 12 nonsmoking males between the ages of 35 and 50. After an 8-10 h fast, subjects ingested Cephalac[®] (20g solution) with a low-fiber breakfast on four different days (45, 30, 25, and 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 MCTT was determined from these data. **RESULTS:** MCTT 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 MCTT 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.

Tissue oxygen tension in patients with peripheral occlusive arterial disease during simulated altitude exposure.

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INTRODUCTION: Tissue oxygen pressure values were determined in the tibial anterior muscles of the diseased legs of 10 patients suffering from intermittent claudication due to chronic occlusive arterial disease before and after 20 min. of exposure to an oxygen reduced gas mixture (115 mmHg pO₂) simulating an altitude of 8500 feet. **METHODS:** Oxygen pressure values (medians) were determined with a polarographic method according to Ehrly and Schröder using atraumatic micro-PT-needle electrodes. In addition transcutaneous pO₂ and pCO₂ (Radiometer, Copenhagen), pulseoximetric O₂-saturation (Pulseox 7, Minolta) and blood gas analysis were performed (AVL, Schaffhausen, Switzerland). **RESULTS:** Arterial pO₂ decreased from 80.2 ± 15.1 mm Hg to 59.9 ± 10.4 mm Hg, O₂-saturation from 95 ± 2.5 to 90 ± 5.6%. Accordingly tissue oxygen tension in the tibial ant. muscle decreased from 6.5 mm Hg to 2.4 mm Hg. The pooled histograms were markedly shifted to the hypoxic to anoxic range. None of the patients complained of rest pain in the diseased leg. **CONCLUSIONS:** Exposure of patients with at rest compensated peripheral occlusive arterial disease of the leg led to a marked decrease of tissue pO₂ values without any evidence of clinical worsening, especially no rest pain. It may be discussed if rest pain in ischemic legs is due to low pO₂-values or to disturbed microcirculatory perfusion.

THE EFFECTS OF LYPRESSIN ON HEMODYNAMIC RESPONSES TO HEAD-DOWN TILT AND ORTHOSTATIC STRESS. D.E. Ward* and R.W. Gotshall*. Wright State University School of Medicine, Dayton, OH 45401.

INTRODUCTION: This study was conducted to assess the effects of the synthetic drug lysine-8-vasopressin (lypressin) on specific hemodynamic variables during nascent (4 hours) head-down tilt (HDT) and subsequent orthostatic stress. **METHOD:** Seven healthy male subjects, ages 23-37, participated in a blinded, cross-over study of lypressin versus the control, normal saline nasal spray, administered intranasally immediately before and two hours after beginning a 6 degree head-down tilt. Plasma volume, urine flow and cardiovascular dynamics were assessed by venous hemoglobin/hematocrit, urine volumes, electrocardiography, impedance cardiography and plethysmography measurements before, during, after tilt, and in response to a 10 minute stand test. **RESULTS:** In the lypressin trial, stroke volume, cardiac output and index, basal impedance, and pulse pressure were significantly decreased (p<0.05) while total peripheral resistance was increased at the end of tilt. Plasma volume change showed a significant increase of 5.9% by the end of tilt in the lypressin trial (p<0.005), while in the placebo group there was no significant change. Clinical observations included pre-syncope symptoms in three of the seven control trial subjects versus none of the lypressin trial subjects during post-tilt stand testing. Post-tilt stand tests showed that mean arterial pressure was maintained at a higher value in the lypressin trial compared to baseline stand test. The pulse time index and cardiovascular index of deconditioning showed a significant increase for placebo subjects after tilt and no significant change from pre-tilt with lypressin subjects. **CONCLUSIONS:** The cardiovascular system adapts to a new steady-state during 4 hours HDT that is maladaptive when provoked with orthostatic stressors. Exogenous vasopressin analogue ameliorates the deleterious effects of post-tilt stand testing by maintaining the intravascular volume at greater than pre-tilt values and increasing mean arterial pressure via peripheral resistance.