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English and French Titles:

CHANGES OF EYE MOVEMENT AND PUPIL DIAMETER OF PILOTS DURING FINAL APPROACH

CHANGEMENTS DU MOUVEMENT DE L'OEIL ET DU DIAMÈTRE DE LA PUPILLE DES PILOTS DURANT L'APPROCHE FINALE

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Background: In-flight mental workload is a multidimensional construct, and a lack of standardized and accepted assessment techniques makes it difficult to measure. An increase in mental workload may result in change of eye movement and pupil diameter.

Objective: The purpose of the present study was to observe the feature of eye movement and pupil diameter changes of pilots during final approach, and to investigate the feasibility of in-flight mental workload assessment using eye movement patterns analysis and pupil diameter determination.

Methods: Six male pilots participated in traffic pattern flight in a flight simulator. A head-mounted SIM-ETG60 eye tracking system was conducted in measuring total amount of eye movement and average of pupil diameter in five different flight phases, which contained last 10 s of cruise on the downwind leg, mid 10 s of turn and descend on the base leg, first 10 s, mid 10 s and last 10 s of final approach. Subjective mental workload of five flight phases was also assessed using NASA-TLX after simulated flight.

Results: The overall TLX subjective workload ratings scores in the last 10 s of final approach were significant higher compared with those in last 10 s of cruise on the downwind leg. During final approach, pupil diameter of pilots gradually increased (F=10.332, P<0.01). Pupil diameter in last 10 s of final approach was significant higher than that in last 10 s of the downwind leg (3.92 ±1.12 mm v.s 3.41±1.26 mm, P<0.01). During last 10 s in final approach, total amount of pilots eye movement were significantly reduced than that on downwind leg and on the base leg.

Conclusion: During final approach, reduced total amount of eye movement and increase of pupil diameter may reflect a high mental workload.
Unlike the general public, keen pilots are highly motivated to look after themselves. When diagnosed diabetic they are sometimes offered a dietary remedy, but more usually given medication. This complicates very much their medical certification of fitness to fly.

Cases will be presented to show that often, pilots in the early stages of diabetes can reverse their condition permanently by limiting carbohydrate intake. With little or no glucose in the blood, there is no diabetic challenge.

This is becoming a mainstream idea, since carbohydrate intake has at last been linked by academics with diabetes risk. Clinical application represents a constructive use of the palaeolithic diet, a return to the usual human eating habits prior to the breeding and cultivation of grains for food, which began as recently as 5000 years ago.

The prize that motivates the pilot is unrestricted certification as fit to fly privately. The general public have no such motivation, so diabetes is unnecessarily prevalent. We need to develop no-claims discounts or tax incentives to encourage the general public to follow the pilot's example.

This provides one concrete example of how the AME can become active in preventing disease in his clients. Weight control is another, and closely allied. Lean, active, non-diabetic pilots are far less prone to a wide range of conditions. It is time for all of us to exploit this opportunity to the full.
ARTIFICIAL GRAVITY WITH ERGOMETRIC EXERCISE IMPROVES CARDIOVASCULAR FUNCTION IN HEALTHY MEN

LA GRAVITÉ ARTIFICIELLE AVEC L'EXERCICE ERGOMÉTRIC AMÉLIORE LA FONCTION CARDIOVASCULAIRE CHEZ LES HOMMES EN SANTÉ

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Introduction: Artificial gravity was suggested as a universal countermeasure against deconditioning during microgravity, since it acts almost on all physiological systems simultaneously. However, centrifuge-induced artificial gravity alone is not sufficient to improve the multisystem hypofunction during microgravity and fails to maintain maximal oxygen uptake, heart rate, or pulmonary ventilation during exercise. To overcome this demerit, our previous studies focused on artificial gravity induced by centrifuge combined with ergometric exercise. However, an optimal duration, level and rate of exposure to artificial gravity with ergometric exercise have not yet been determined. The purpose of the present study was to investigate the cardiovascular effects of three weeks of intermittent artificial gravity with ergometric exercise training on normal ambulatory men.

Methods: During 3 weeks experiment, ten healthy male subjects received alternate +1 to +2 Gz (at the foot) short-arm centrifuge training with 60 W ergometric exercise for 30 min per day. Cardiac function, heart rate variability, heart rate and blood pressure were measured before and after training.

Results: Stroke volume and total peripheral resistance increased significantly after 3 weeks training, compared with the pre-training baseline. Left ventricular ejection time (LVET) and ejection fraction increased significantly after 3 weeks training, while heart rate, the ratio of pre-ejection period to LVET, and the ratio of low frequency to high frequency power decreased significantly after 3 weeks training.

Conclusion: These results suggest that three weeks short-arm centrifuge training with ergometric exercise could improve human cardiac systolic and pumping functions, and increase cardiac vagal modulation.
Introduction: The incidence rate of type 2 diabetes in the Czech Republic has tripled since 1975. We examined a database of 772 military and civilian pilots with diagnoses of hyperglycaemia, an impaired glucose tolerance (prediabetes), and the type 2 diabetes, in order to establish the increase among aviators, and to take measures to reverse this unfavorable trend.

Methods: I retrospectively reviewed our medical files of 19,783 aviators, who underwent clinical examinations in the Institute of Aviation Medicine Prague between 2010 and 2014. These aviators underwent the Fasting Plasma Glucose (FPG) test every 2 years after reaching 40 years of age and eventually underwent an examination for glycated haemoglobin (HbA1c), if their FPG results were found to be slightly above normal. We have repeated the FPG and the HbA1c examination at every following regular medical checkup and then performed an Oral Glucose Tolerance Test (OGTT) in all cases of abnormal FPG, but normal HbA1c, as well as in all cases of abnormal FPG and abnormal HbA1c, in order to classify each individual disorder and to take the appropriate measures.

Results: We identified 772 cases of abnormal glycaemia level among aviators aged 24 to 79, out of which 267 cases were type 2 diabetes, 125 cases classified as prediabetes and 380 cases classified as hyperglycaemia. 281 cases were connected with other diagnoses (obesity, hyperlipidaemia, hypertension), creating the so called metabolic syndrome. The occurrence of the type 2 diabetes in pilots had doubled during the 5-year period and the FPG occurrence increased sixfold by the end of the observed period.

Conclusion: The prevalence of type 2 diabetes and prediabetes increased twofold during the 5 year period. The number of aviators with type 2 diabetes, prediabetes and the metabolic syndrome has increased despite our regular followups, calling for continuous education of pilots and usually also for expanded cardiological examinations.
Introduction: In recent years, marked shift in lifestyle of South Asian countries caused by economic growth, urbanization and dietary westernization have brought in "Diseases of Affluence." Metabolic Syndrome (MetS), being one of those, has gained popularity in aviation for its possible effect on aircrew morbidity. With differences in various MetS definitions and with no consensus on its application, this study was carried out to analyze the possible lacunae in this domain and collate evidence for further correlation.

Methodology: The prevalence of MetS and its identification group were analyzed using 3 definitions among 421 Indian civil aircrew reporting for their regular medical evaluation. The pattern of clustering of several risk factors in each definition and further statistical correlation was done to find the significant predictors for MetS among the risk factors.

Results: The prevalence of MetS varied from 2.6% to 5.2% depending on the definition used. It was observed that only 3, 4 and 8 aircrew fell in MetS category using WHO & NCEP, WHO & IDF and NCEP & IDF definitions respectively. Only 2 aircrew satisfied the criteria of all 3 MetS definitions. The common clustering pattern noted in IDF, WHO and NCEP definitions were WC,FBS,HDL; IGT,BP,WHR; BP,TG,HDL respectively. Multivariate logistic regression analysis of criterias was done to delineate the significant prediction power for presence of MetS in an individual. These in order of ranking were WC (>90cm male, >80cm female), FBS (>100mg/dl), BP(>130/85mmHg), TG (>150mg/dl), HDL (male<35, female<39mg/dl), age >40 years.

Conclusion: Regular aeromedical evaluation could be attributed to the lower prevalence of MetS compared to general population studies. The variable clustering pattern of risk factors in different definitions and its predictive power for MetS, in addition to the detection of somewhat different group of subjects by different defining criteria suggests the scope for unifying ethnicity-based criterion development and its validation for MetS detection in aircrew to facilitate flight safety.
OCULAR VESTIBULAR EVOKED MYOGENIC POTENTIALS (OEMPS) IN NORMAL THAI VOLUNTEERS

POTENTIELS ÉVOQUÉS OCULO-VESTIBULAIRES MYOGÉNIQUES CHEZ DES VOLONTAIRES THAILANDAIS NORMAUX

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Introduction: Ocular-vestibular evoked myogenic potentials (oVEMPs) by air-conducted sound and bone-conducted vibration which represents dynamic utricular function is a useful investigation for diagnosing and following up the patients with vertigo or disequilibrium.

Objectives: To measure the response of the ocular vestibular myogenic potentials by air conducted sound and bone conducted vibration in normal Thai volunteers classified by age group.

Methods: 70 healthy Thai volunteers who had no vestibular or hearing problem, normal otoscopic examination and normal audiometry underwent the ocular vestibular evoked myogenic potentials test by click sound, 500Hz tone-burst sound and triggered tendon hammer.

Results: Bone-conducted vibration (BCV) oVEMPs evoked by a triggered tendon hammer gives a better response compared to air-conducted sound (ACS) oVEMPs elicited by 500Hz tone-burst sound and click sound. All ACS responses are measured from the contralateral side from the monaural testing. The mean of N10 amplitude of BCV from the present ACS response group is much higher than the absent ACS response group. Asymmetrical ratio (AR) seems to increase in volunteers from 50 years old upwards. We can conclude that the representative value of AR should be the group of less than 50 years old which is 17.61 ± 18.12.

Conclusion: Bone-conducted vibration (BCV) oVEMPs is the best dynamic utricular function test. Asymmetrical ratio of BCV increases while N10 amplitude of BCV decreases in volunteers from the age of 50 years and above. The AR of the older group of Thai population should be considered in the future study.
Introduction: Various countries train their flight surgeons (FS) through their own training schedules. However, international participation in the majority of these courses is limited due to the differing languages. In addition, there is no standard curriculum for these courses which could be applied across the board to all the countries’ aerospace medicine programs. Information about courses in aerospace medicine across the world is limited. This study is intended to highlight the aerospace medicine training programs and FS duties in various countries and also to emphasize the differences between them.

Materials and Methods: Points of contact (PsOC) were obtained in various NATO countries. 15 PsOC were contacted by e-mail in 13 different NATO countries out of a total of 28 NATO member countries. They were asked to answer a questionnaire which was sent as an attachment with the e-mails. The questionnaire was in two parts; first part containing questions pertaining to the FS' course and the second part containing questions pertaining to FS' duties.

Results: Out of 15 PsOC, 13 replied to the questions. Standardized course curricula appear to be lacking in FS training across NATO members. Basic FS courses' durations vary from 2 weeks to 6 months. In addition, some countries have advanced flight surgeon courses and refresher courses. All countries except UK and Germany have flight time incorporated in their FS course curriculum. Some countries have mandatory or optional flying hours/experience for FS on their bases. Only two countries carry out daily pre-flight medical checks for pilots.

Conclusion: International partnership and cooperation should be sought to standardize the curriculum and duration of these courses. This would go a long way toward improving the practice of aerospace medicine around the world and contribute to reduced attrition of man and machine; thus in the long run, enhancing mission effectiveness.
Introduction. The aim of the study was to determine the effectiveness of hydrogels (pillows filled with 0.35% methyl lactate with cooling properties) on improving pilot's psychophysical efficiency and subjective perceptions with reference to a state of the body thermal comfort and a degree of physical work-load in heat conditions.

Methods. 26 healthy subjects participated in the study. The individual examination included alternating rest-activity cycles in stimulated conditions (climatic chamber: Ta=35±1°C, RH=30±1%, t=105min) proceeded 1) in association with selective cooling sternum and nape and 2) in control conditions (without hydrogels). During the study were recorded: HR, Tsk (sternum, nape), Tc, subjective assessment of a degree of physical work-load (Borg test), state of thermal comfort in relation to the whole-body and thermal perceptions in relation to the cooled areas (Bedford test). The psychomotor efficiency and concentration of the focus were assessed on the basis of: UMACL scale, RW test, test on Cross-Shaped Apparatus.

Results. Lower HR and Tsk values both from the sternum and nape areas were observed in the group using hydrogel. The influence of the selective cooling proven beneficial effect in the aspect of the Bedford and Borg tests, subjects felt the significant improvement in assessment of thermal sensations both with reference to the cooled area. The usage of hydrogels improved participants' psychomotor abilities and emotional state.

Conclusions. Hydrogels filled with 0.35% methyl lactate effectively improved the psychophysical state of the body in the positive thermal load conditions, reduced subjective perception both in case of the assessment of thermal comfort and thermal perceptions and diminished a degree of physical workload.
Introduction: Small and remote airfields with infrequent aircraft movements may require air traffic control (ATC) from employed staff in the local ATC Tower. Solo controller operations are not uncommon, but due to leave, rostering, training and management requirements, the usual staff establishment for each tower is five trained ATC personnel. A number of Air Navigation Services Providers (ANSPs) are evaluating the feasibility and safety of providing ATC services remotely using a range of visual, infrared and other sensing devices from a centralised location, thus reducing the requirements for trained ATC personnel. It is anticipated that in the future it might be possible to remotely control multiple airfields.

Methodology: We conducted a structured literature review based on a series of key words relating to: Detection, Accommodation, Scanning, Discrimination, Visual fields, Flicker and fusion, Colour perception, Contrast and luminance, Movement, Perspective, Human factors, Non-visual ergonomics, Display design, and Continuous duty periods.

Results: The technological and organizational design and infrastructure of Remote Tower Operation (RTO) facilities must meet certain minimum performance criteria with respect to validity, reliability, screen performance, utility, responsiveness, workload and work flows, flexibility, adjustability, and compatibility with the physiological limitations of the human operator of all ages.

Conclusion: RTO operations offer significant potential benefits in terms of cost, teamwork and ability to present additional weather, air and ground movements data to ATC personnel through remote sensing devices. However, current limitations on visual information capture and presentation currently limit the safety and utility of RTO operations.
PRIMARY RAYNAUD'S PHENOMENON AND THE ABILITY TO WORK IN A COMMERCIAL PILOT (CASE REPORT)

LE PHÉNOMÈNE DE RAYNAUD PRIMAIRE ET LA CAPACITÉ DE TRAVAILLER D'UN PILOTE PROFESSIONNEL (ÉTUDE DE CAS)

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Introduction: Raynaud's phenomenon (RP) is a condition characterized by an excessive vasoconstrictive reaction in response to cold or emotional stress that manifests itself as limited discolouration or slight cyanosis of cold fingers. If the condition appears without an evident cause, it is known as primary RP, while when it is associated with a known disease, it is called secondary RP. Secondary RP is encountered alongside various systemic inflammatory disorders and may accompany other connective tissue disorders, peripheral artery disease, vibration disease, etc. Discolouration may be accompanied by a diminished sense of touch, tingling sensations and pain.

Case: The case involves a first class pilot candidate: 19 years old, intending to enroll at the Faculty of Mechanical Engineering, Aviation Division. In the candidate's family history there are similar symptoms, but of a lesser degree. There are no rheumatic, vascular or skin disorders present in the family. Since age 10 the candidate has been seeing a rheumatologist for livid discolouration of his hands up to the wrist appearing in the cold and resolving once the hands get warm. The patient does not report any pain, tingling, swelling or diminished dexterity of the fingers.

Results: ANA, ENA, aCL, cryoglobulins, cold agglutinins and ANCA are within normal bounds. Hand photoplethysmography: significantly decreased digital pulse amplitudes at room temperature and in ice bath. Capillaroscopy shows local thinning in all fingers, and individual megacapillaries in most fingers, primarily consistent with acrocyanosis. Haemoglobin sedimentation is normal.

Conclusion: This is a case of primary RP of a functional nature due to a hypersensitive vascular system; systemic connective tissue disease is ruled out (negative serology, no skin changes). The risk for systemic connective tissue disease is low. It is necessary to carry out annual follow-up examinations accompanied by a rheumatologist's opinion, as well as repeat serology tests, plethysmographies and capillaroscopies. The candidate is able to perform the job he is applying for, provided he undergoes annual follow-up examinations.
Introduction: The assessment of pilots gaze and eye movements is extremely important, especially in the training period. The possibility of seeing what a trainee sees is priceless for the instructor. Possible errors in attention distribution may be corrected on the spot immediately. Eye tracking is getting more popular but still is not used as much as it should be.

Methods: In our experiment the assessment of the visual attention distribution and the intensity of visual information gathering without G-load and under the occurrence of +Gz acceleration was performed using the SMI Eye Tracking Glasses. The experiments were conducted in a Human Centrifuge. We measured the number of saccades and fixations as well as their mean duration during selected, key moments of flying the jet fighter. We were looking for the differences between eye measurements while in flight with and without acceleration.

Results: After the evaluation of the gathered video and data a few conclusions emerged. It may be observed on the obtained video that the area of pilots visual control was decreased during the acceleration. Both saccades and fixations properties appeared sensitive to the ongoing acceleration. During the acceleration saccades occurred less frequently and fixations were longer in comparison with the same part of flight without acceleration.

Conclusion: Using the eye tracking method gives us an opportunity to perform better in training new pilots and to become more aware of pilots visual performance level. Knowledge of what to expect under G-load makes pilots' visual performance assessment easier and more adequate.
Background: A new Clinical Aviation Medicine Service (CAMS) was launched in September 2011 to provide aviation medicine and occupational expertise to minimise time to diagnosis or exclusion of pathology for military aircrew, mitigating the impact of clinical conditions on flying duties.

Aim: This poster describes the endocrinology and diabetes mellitus caseload in the first 2 years of CAMS and outline the impact of such conditions on a military aircrew population. It aims to consider the ramifications of these conditions on aviation, focusing on type 2 diabetes mellitus and thyrotoxicosis, highlighting areas for future research.

Methods: Anonymised data was captured on 2 years of consecutive referrals to CAMS, including demographics, speciality, referral indication and outcome. Pertinent data were extracted by referral indication. Guidelines were extracted from the Royal Air Force Air Publication 1269A.

Results: Of 816 referrals made between 1 Sep 2011 and 30 Aug 2013, Endocrinology and Diabetes Mellitus indications accounted for 50 (6.13%). Endocrinology and Diabetes Mellitus indications also formed 32.4% of all General (Internal) Medicine (G(IM)) referral indications, making it the largest represented subspecialty within G(IM). Mean age was 44 (SD 7.9) years, 44 (88%) were male. The commonest referral indications were type 2 diabetes (20, 40%), hyperthyroidism (16, 32%), hypothyroidism (8, 16%) and hyperprolactinaemia (3, 6%). Flying duties were permanently restricted in 7 (14%), temporarily restricted in 30 (60%) and unrestricted in 13 (24%).

Conclusions: Endocrinology and Diabetes Mellitus occupy a significant caseload in clinical aviation medicine, leading to flying restrictions a large proportion of referred patients. The problem is set to increase, as the global incidence of type 2 diabetes is rising rapidly. With the advent of new treatments, in particular for type 2 diabetes, focussing research on the safety of such medication in aviation could extend the occupational return of the aircrew population.
DETECTION AND ASSESSMENT FOR 10 DRUGS ABUSE AND DRUGS DEPENDENCE IN FLIGHT CREW IN IRAN FROM 2012 – 2014 (3 YEARS).

DÉTECTION ET ÉVALUATION DE 10 DROGUES D’ABUS ET DE DÉPENDANCE CHEZ LES PILOTES EN IRAN DE 2012 À 2014 (3 ANS)

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Introduction: The safety and security of air travel depends upon properly trained personnel, well-founded systems and procedures and the development and application of a range of techniques to detect, identify, quantify and respond to both active and passive threats to the safety and security of aviation. The use of these substances is considered incompatible for flying due to their uniformly harmful effects resulting in psychological, mental, social and personality disorder. The goals of this study were to describe the prevalence of OTC, prescription, and illicit drug usage in flight crew in Iran from 2012-2014 (3 years).

Methods: A license holder is legally obliged to undergo regular health examination, performed by a designated medical examiner in an aeromedical center (AMC). According to ICAO regulations, a urine sample shall be collected and sealed in a bottle provided by laboratory with signature of concerned aircrew. If laboratory was doubtful, the urine sample is sent to chromatography (TLC) test.

Results: Over 3 years, 17000 applicants and certificate holders were assessed in the air medical center and 580 (3.4%) men and women were positive. The most holders were class I (CPL, CPL-IR and ATPL) and the most drugs detected were benzodiazepines and morphine.

Discussion and Conclusion: The use of psychoactive substances usually alters the mental state, interferes with judgment, alertness, vision and coordination; where abuse of, or dependence upon, such psychoactive substance is strongly suspected, aircrew must immediately be assessed as temporary unfit. To ensure safety of flight, use of psychoactive substances/drugs amongst flight crew are of particular concern in the aviation industry where high level of performance is mandatory. There are certain psychoactive drugs/substances which are considered incompatible for flying due to their uniformly harmful effects, resulting in psychological, mental, social and personality disorders.
Objective: Long-term spaceflight could result in a series of physiological changes in astronauts, especially cardiovascular function disorders. The aim of this study was to make countermeasures to orthostatic intolerance and to provide a theoretical basis for preventing postflight orthostatic intolerance in long-duration spaceflight.

Methods: In this study, an inflatable suit was employed to provide external compression on the lower body of the subjects. The inflatable suit consisted of 5 interconnected and separate bladders, one lower abdominal, two thigh and two calf bladders; neither the hip or knee area were covered. The suit was inflated manually with air through the abdominal bladder to generate external compression. The pressure in the bladders was equally adapted to the legs and abdomen by pipes between them. The target pressures were set as 40-50 mmHg. We observed and compared the lower body negative pressure (LBNP) tolerance of subjects who underwent orthostatic stress tests of combined head-up tilt and LBNP. Beat-by-beat arterial blood pressure was measured during the study and compared the changes of cardiac function.

Results: We used LBNP-induced presyncope to determine orthostatic tolerance. DNP is defined as duration of LBNP, and CSI is calculated as sum of the magnitude of LBNP at each level times duration. A greater DNP and CSI indicated a longer sustained duration of LBNP, which represented higher orthostatic tolerance. Both DNP and CSI were significantly increased in all subjects of the two target pressure with inflatable suits compared with the control. SBP showed no difference in all groups at baseline. In subjects with inflatable pressure suits response to LBNP challenge, SBP decreased significantly at -40 mmHg and -50 mmHg in control group compared with baseline (P<0.05), whereas there was no significant difference in subjects with inflatable pressure suits.

Conclusion: Data shown here indicated that subjects with compression suits preserved the orthostatic tolerance determined by LBNP.
Introduction: +Gz tolerance is determined by many factors. One such factor is Weight, however Weight is itself a composite of Fat Mass (FM) and Fat Free Mass (FFM). Both FM and FFM can contribute differently to relaxed +Gz tolerance.

Methods: The body FM, FFM and Total Body Water (TBW) of 75 volunteers were calculated by Bioelectrical Impedance Analysis and Relaxed +Gz tolerance was assessed using the High Performance Human Centrifuge at IAM IAF. The data was evaluated using Pearson Product Moment Correlation. Further, the pooled data was divided into two groups, Above-Average Tolerance (AATG) and Below-Average Tolerance (BATG) with mean +Gz value as a cut-off. Physical parameters of these groups were compared.

Results: The mean ± SD of relaxed +Gz tolerance was 4.35 ± 0.55G. The mean, FM, FFM and TBW were, 12.08 ± 3.81 kg, 59.51 ± 5.40 kg and 41.12 ± 3.05 L respectively. The result indicated that relaxed +Gz tolerance showed significant moderate level positive correlation with FM (r = 0.498). Low positive correlation was observed between FFM (r = 0.254) and TBW (r = 0.291). In addition, it was noted that the AATG had significant higher levels of, FM, and MAP than the BATG.

Discussion: High Fat Mass is associated with increased sympathetic nervous system activity in the body and over time altered the baroreceptor responses to sympathetic activity. Hence individuals with excess fat mass, even though they are normotensive, have high resting BP than others and this high resting BP has positive correlation with resting relaxed +Gz tolerance.

Conclusion: The results obtained in this study indicate that an individual with higher fat content within the permissible range will have higher relaxed +Gz tolerance. The relationship of Straining +Gz tolerance and +Gz Duration tolerance with body composition also needs to be explored.
Introduction: Aircrew use the anti-G straining manoeuvre (AGSM) to complement the protection afforded by anti-G systems. Whilst this increases +Gz tolerance, repeated straining can be physically demanding. Full-coverage anti-G trousers (FCAGT) and positive pressure breathing for G protection (PBG) are used in the Typhoon aircraft. The improved +Gz tolerance afforded may allow for a modified (lower physical effort) version of the standard AGSM technique providing sufficient +Gz tolerance at lower metabolic cost to the aircrew.

Methods: Eight male subjects were exposed to +7, +8 and +9Gz (15s), and a simulated air combat manoeuvre (SACM) on four separate occasions in a human centrifuge wearing the Typhoon Aircrew Equipment Assembly. On two occasions, subjects performed repeated AGSM cycles throughout the +Gz exposure (Standard), while in the remaining two they performed only two or three AGSM cycles following inflation of the FCAGT, before returning to normal breathing thereafter, with additional isolated AGSM efforts instigated only if visual symptoms became evident (Modified). Open-circuit spirometry was used to measure expired ventilation (VE) and oxygen uptake (VO2) with beat to beat blood pressure, heart rate (HR) and visual light loss recorded.

Results: Compared with the Standard technique, peak HR, VE and VO2 were significantly (P<0.05) lower during all G exposures with the Modified technique. Cumulative VO2 during and 4 min following exposures were ~18% (+7, +8 and +9Gz, P<0.01) and 30% (SACM; P<0.001) lower with the Modified technique. Systolic blood pressure was lower (P<0.01) with the Modified technique but clear vision was maintained by all subjects.

Conclusions: Used in conjunction with Typhoon anti-G systems (FCAGT & PBG), the Modified AGSM technique maintains clear vision up to +9 Gz and during a SACM at a lower energy cost compared with the Standard AGSM. These data suggest that the Modified AGSM technique may delay fatigue and increase combat effectiveness without compromising G protection.
Introduction: All over the world, including Poland, obesity has become one of the major health problems. The goal of this study was to assess nutritional status among pilots and paramedics crew members of the Helicopter Emergency Medical Service (HEMS).

Methods: The study was performed among all helicopter pilots (n=66) and all paramedics (n=65), who were members of HEMS. Height, weight, waist and hip circumferences (WHR), Body Mass Index (BMI) and total body fat were used to evaluate the amount and distribution of adipose tissue.

Results: Pilots were older than paramedics (49.1±7.5 vs. 36.2±6.6 years; p<0.001). There were statistically significant differences (P<0.05) between pilots and paramedics in the parameters assessed: body weight 89±17 vs. 83±12kg, waist circumference 100±13 vs. 94±9cm, BMI 28.3±5.0 vs. 25.8±3.2kg/m2, WHR 0.94±0.05 vs. 0.97±0.07, the percentage of body fat 24.9±6.2 vs. 21.4±5.8%.

Conclusion: Results of our study revealed that most of HEMS crew members are overweight or obese. The prevalence of obesity was higher among pilots. In accordance to our results, an interventional programme involving treatment and prevention of obesity should be introduced.
Introduction. Medical service at IGI Airport, New Delhi, is supported by Medanta, Medicity JCI, and NABH (accredited unit) which includes advanced primary medical care by a qualified team of medical professionals.

Method. From June 2010 to May 2015, a retrospective analysis of all reported cases has been performed, which includes the frequency and types of cases as well as deaths.

Results. During the study period, approximately 224 million passengers utilized the airport, of which 35% were international passengers. In the same period, 26,695 cases were reported at MMC, which implies one sick passenger per 8300 passengers. 8,958 cases (33.56%) were received from the domestic terminal, out of the 17,737 cases (66.44%) received from the international terminal. 5,846 (21.9%) were medical emergencies. Additionally, 31% of the cases were gastrointestinal or related to traveler’s diarrhea, and 19% were cardiovascular cases. Other emergencies included cases related to Convulsions, Shock, High Fever, Injury, Burns, Metabolic disorder (Diabetes), Respiratory distress, Baro-otalgia, Epistaxis, Urine retention, Hematuria, Threatened abortion, Alcoholism, Tetany. 58 Cardiac patients (MI and post-CPR) were successfully revived until date, and one onboard delivery was performed. During this period, there were 16 unscheduled landings due to medical reasons. There were 96 deaths of air passengers, which implies four deaths per million passengers. Out of these, 62% were related to Terminal Cancer, CKD, CLD cases; 25% were post-CABG/PTCA, and 13% were cases of mid-air collapse.

Conclusion. Maximum cases were reported among long distance air travelers, which may indicate an Aero-Nomadic Stress Complex among air travelers which may have been triggered by airport tumult, aircraft stressors, which include barometric changes, or compromised physical or mental conditions of passengers. These cumulatively cross the barrier of the stress threshold, thus precipitating sickness. The scope of analyzing these stressors and finding a possible non-interventional technique to reduce stress is the need of the hour, as it will allow us to minimize mid-air as well as airport emergencies.
Introduction: Generally, trends of normal age-related brain morphometric changes characterized by shrinkage of grey matter and white matter volumes have been studied by formal research. In this project, we analyzed MRI structural images of healthy airline pilots in China, using a surface based automated parcellation approach, proposed to examine pilots' age-related cerebral cortex structural changes, and to find out the impact of flight occupational characteristics on the structure of the cerebral cortex.

Methods: 1065 pilots with ages ranging from 35 to 64 years (mean age=47.64±3.95 years) were included. Magnetic resonance imaging examination confirmed no brain lesions, no bleeding and infarction, and no major neurological diseases. Three dimensional structural MRI scans were acquired on a 1.5T GE scanner using a T1-weighted 3D-T1 BRAVO sequence. Images were processed by FREESURFER software (version 5.1.0, based on Ubuntu 12.04). First, by preprocessing steps, all the images were visually inspected manually. Then cortical surfaces were reconstructed automatically using validated algorithms. Finally, we ensured 797 valid data, and did the statistical analysis by General Linear Model and Correlation Analysis with SPSS15.

Results: The average total cortical volume was 471.04±31.78 cm³. The average surface and thickness for the whole cortex were 1690.57±116.66cm² and 2.56±0.07mm respectively. Correlation Analysis revealed negative correlation between total cortical grey matter volume, total surface area, average cortical thickness and age of pilots (p<0.01). The Linear Regression showed that effects represented global reductions of 1.707 cm³ per year in total cortical grey matter volume, 4.939 cm2 in total surface area, and 0.002mm in thickness.

Conclusion: We studied on trends of age-related brain morphometric changes across cortical thickness, surface area and grey matter volume of pilots. The results showed that all the three aspects had negative correlation with age. But the rate of change is relatively slow.
Human tolerance of head-to-foot acceleration (+Gz) is lower with rapid than gradual onset rates due to the initial absence of cardiovascular reflexes. Cerebral autoregulation requires a finite time to operate and might also influence +Gz tolerance, but has received little study.

Eleven (11) male subjects were exposed to a single gradual onset run (GOR;0.1Gs-1) and a series of incremental rapid onset (ROR;1Gs-1) exposures (20s) on a human centrifuge. Each condition was terminated by the subject at central light loss (CLL); the G level reached taken as the individual’s relaxed +Gz tolerance (RGT). Heart-level mean arterial blood pressure (MAPheart), mean blood flow velocity in the middle cerebral artery (MCAvmean), an estimate of the cerebral perfusion pressure (eCPP:MAPMCA x MCAvdiastolic/MCAvmean+14) and cerebral oxygenation (ScO2) were recorded.

RGT was +4.0±0.4Gz and +5.2±0.7Gz for the ROR and GOR, respectively. MAPheart was reduced in the ROR (-25±16mmHg, P<0.001) but remained unchanged from pre-exposure in the GOR. The fall in eCPP (-76±4% vs -70±7%, P=0.06) was similar across the two conditions while MCAvmean was decreased more in the ROR (-59±14 vs -38±18%, P<0.001), resulting in larger changes in MCAvmean as a function of eCPP (0.77±0.15 vs 0.53±0.24, P<0.01). Decreases in MCAvmean(-19.8±5.2 vs -9.8±4.9%, P<0.001) and ScO2 (-3.3±1.1 vs -2.8±0.9%, P<0.05) per unit increase in +Gz were larger in the ROR.

The fall in cerebral blood flow velocity as a function of perfusion pressure was less under +Gz with gradual than rapid onset rates, suggesting that during the initial seconds of the ROR autoregulation may be absent, or attenuated. These differences, resulting from the latency in cerebral autoregulation, potentially contribute to the differences in G tolerance observed.
Following on from a legal challenge a couple of decades ago, the Australian Regulator has had a policy which allowed all recreational aviators with any colour deficiency to fly unrestricted. The policy also extended to commercial pilots, but until 2014, no colour deficient pilot was able to operate the privileges of his ATPL. In Australia, a pilot with a CPL is able to fly as a co-pilot in an airline operation. This means that there are some pilots who can and do fly as co-pilots in operations where the captain is the holder of an ATPL. The colour vision restriction limits them from flying as a captain while allowing them to fly as a co-pilot. Not surprisingly, a couple of years ago, one of these pilots mounted a judicial appeal against this restriction. This presentation describes the events that occurred, and the many approaches attempted via judicial, political, union, media, and social media networks. In Australia, the review can consist of a merits review, and this was the approach taken in this matter. In February 2015, the judgement was released. The outcomes have significant implications for Australian Aviation policy, and because of the international nature of aviation, these impacts will be felt far beyond the Antipodes. The findings and outcomes of the judgement are described and the implications for Australian regulatory policy discussed.
Introduction: Motion sickness occurs commonly during flying training and can impair student progress. If, despite medical therapy, symptoms persist beyond a further 4-6 hours of flying training aircrew are referred to the Royal Air Force Centre of Aviation Medicine (RAF CAM). Each motion sickness desensitisation programme is tailored to the individual and their aircraft platform. Typically it comprises a 4-week ground phase in a disorientation trainer followed by a 15-20 hour flying phase in the Hawk T1. Non-fast jet aircrew may undertake the flying phase in an alternative more relevant platform. Rotary-wing rearcrew undertake the ground phase only. The aim of this study was to audit recent referrals to RAF CAM.

Methods: Referrals from October 2013 to December 2014 were retrospectively reviewed looking at several aspects. Final outcomes included whether the subject was able to successfully return to flying duties.

Results: There were six referrals of which five were accepted. The mean time to acceptance or rejection was 16 working days (range 7-35). One pilot withdrew from the programme and subsequently left the service and another pilot left the service before entering the programme. Two aircrew completed desensitisation programme including the flying phase and at 3 months follow up both had returned to flying but one did not complete flying training for non-motion sickness reasons. One rotary-wing rearcrew undertook ground phase desensitisation programme and subsequently completed flying training.

Discussion: There has been a reduction in the number of referrals and from a more diverse range of aircrew than previously seen but the programme still successfully returns aircrew to flying. The audit also identified a number of issues, for example, the referral process has now been modified to reduce delays. Further review will address the need for more formalised data recording and follow-up to facilitate future audit and service improvement projects.
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English and French Titles:

**RISK FACTORS FOR CARDIOVASCULAR DISEASES AMONG PILOTS AND PILOT STUDENTS IN KINSHASA**

**FACTEURS DE RISQUES CARDIOVASCULAIRES PARMI LES PILOTES ET LES ELÈVE-PILOTES À KINSHASA**

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Introduction: Cardiovascular diseases (CVDs), the leading etiology of morbidity and mortality worldwide, are responsible for loss or restriction of medical flight certification. The objective of this study was to assess risk factors for cardiovascular disease among Congolese airmen.

Methods: This was a historically retrospective study of 80 pilots and pilot students seen in the «Centre d'Expertise Aéro-Médicale» of the University Hospital of Kinshasa, from January 2003 to December 2013. Measurements included: Body weight, height, waist circumference, systolic and diastolic BP, pulse rate, medical history, type of license requested, and waiver.

Results: In 80 participants (92.5% men, 55% pilots, 45% students, mean age 34±14y with extremes from 21 to 65y), the frequency of hypertension, diabetes and overweight/obesity was 49%, 29% and 30% respectively. Among subjects with hypertension (32% prehypertension, 26% stage 1, 21% stage 2, and 21% systolic hypertension), 21% were aware. Diabetes was clustered with hypertension, asthma and overweight/obesity in 56.5%, 15%, and 12.5% respectively. The probability of diabetes was higher in airmen who smoke (OR: 3.378; 95% IC [1,163-9,816], p=0,025), in those with faster pulse rate (OR: 3.789; 95% IC [1,776 -18,501]; p=0,010), and overweight/obesity (OR: 7.85; 95% IC [1.823 -34.013]; p=0,006). The odds for overweight/obesity increased with the pulse rate (p=0.033). The frequency of other factors of risk was 54%, 20% and 15% for alcohol, smoking, and asthma respectively.

Conclusion: Our findings point out that cardiovascular diseases still endanger Congolese airmen and actions need to be taken: low-fat diet, regular exercise, alcohol reduction and smoking cessation.
Introduction: We examined the annual health screening database of a sample of 1,317 aircrew and compared it with Ministry of Health statistics to determine health trends between these two populations.

Methods: We retrospectively reviewed the annual health screening records of 1,317 aircrew from 1 April 2013 to 31 March 2014. 11 health indices were examined: diabetes mellitus (fasting blood glucose, FBG >= 7.0mmol/L), impaired glucose tolerance (FBG 6.1-6.9mmol/L), hypertension (SBP >= 140 and/or DBP >= 90mmHg), pre-hypertension (SBP 120-139 and/or DBP 80-89mmHg), LDL-cholesterol >= 4.1mmol/L, HDL-cholesterol < 1.0mmol/L, obesity (BMI >= 30), high-risk BMI (BMI >= 27.5), smoking, physical inactivity (exercises < 2x/week) and regular alcohol consumption (drinks > 4 days/week). These were compared with previous year’s records as well as age-matched prevalence analysis against the latest Ministry of Health’s National Health Survey 2010.

Results: The health demographic profile of aircrew were better compared to the corresponding male cohorts in the national population. However, there were conditions/risk factors which displayed a higher prevalence (regular alcohol consumption in aircrew aged 18-29 year-old [2.0% vs 1.8%], low HDL-cholesterol in aircrew aged 50-59 year-old [12.8% vs 10.6%]). Comparing with the previous year’s aircrew statistics, the prevalence of pre-hypertension remains high (35.5% vs 35.3%) and prevalence of physical inactivity has increased (21.6% vs 20.8%).

Conclusion: The aircrew population is pre-selected for medical fitness. Thus they have better health demographic profiles compared to the national population. However, it shows the presence of precursors of medical conditions and lifestyle risk factors which may potentially lead to established chronic medical conditions in the course of their careers and transition to civilian life. Comprehensive health management programmes have to be implemented to identify and monitor areas of concern, as well as to evaluate effectiveness of interventions implemented.
RESEARCH ON SNP OF RS1333049 IN A GROUP OF CIVIL AVIATION PILOTS

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Introduction: Conception of risk factors has a leading significance to assess the risk of initiation and progression of CAD. Study of other markers of cardiovascular risk is one scientific area, such as molecular genetic factors in genetic predisposition to multifactorial diseases.

Objectives: To investigate uses of SNP rs1333049 (locus 9p21.3) in MI-risk assessment.

Methods: Genetic study was performed in a group of 235 civil aviation pilots between 54 and 63 years of age (mean 54.48+/-.0.13). Duration of flying service experience was 33.36+/-.0.47 yrs, time of flight 14493.79+/-.243.77 hrs. Risk factors: smoking 21.3%, dyslipidemia 38.5%; excessive weight 58.7%, obesity I 20%, II 1.7 %; SCORE 3.54+/-.0.12. All subjects had no cardiovascular complaints. Cardiovascular indicators: high blood pressure 23%, US signs of atherosclerosis in thoracic aorta 94.5%, in abdominal aorta 22.6%, great head vessels 97% (in 44.7% - obstructive). Medical assessment: 77.9% - fit to fly; 8.1% unfit due to atherosclerosis. Comparison group consisted of 63 patients who survived myocardial infarction. Control group consisted of randomly chosen 138 persons. DNA extraction was performed by phenol-chloroform method. SNP rs1333049 was tested by PCR in real time according to the manufacturer's protocol.

Results: genotype rs1333049 occurrences varied significantly between groups with and without MI (p=0.025). There were no differences between pilot group and the control group. Genotype CC carriers occurred more often in the group with MI in comparison with the group of pilots (OR 1.86 (95% CI 1.01-3.44; p=0.05).

Conclusion: One can use genetic marker rs1333049 in assessment of MI risk both in general population and in aviation specialists along with traditional methods.
Introduction. The aim of the study was to examine influence of practical training in the air on reaction of physiological indicators and psycho-motor predictors among cadets by means of an exercise test on looping as well as a new method of psychical condition evaluation.

Method and material: 20 cadets-pilots [age 22 - on average] from the Air Force Academy were involved in the examination. Two examinations were introduced: before [the first one] and after [the second one] practical training in the air. Among the cadets, heart cramps frequency [HR], systolic and diastolic pressure were evaluated. It was done by means of an electronic apparatus and an exercise test. It was done with evaluation of psycho-motor skill by means of diagnostic and training equipment [concentration ability and attention focus]. The equipment consists of a rucksack where a small computer was placed as well as glasses where motor situations simulation reached. The cadets had to perform five tasks during realization of the exercises on looping [windlasses]. Physical skill was recorded in a number of windlasses done.

Results. In examination I and II HR and systolic blood pressure increase was shown after the exercise comparing with initial value [before the test]. Moreover, in examination II essential systolic decrease was shown in comparison with examination I. Furthermore, in examination II essential statistically improvement of physical skill was shown. [increase in a number of windlasses done] as well as motor abilities and skills [p<0.01] comparing with examination I.

Conclusions. 1. The examinations showed that practical training in the air of the cadets caused physical and psychic skills improvement as well as stress decrease. It is proved by systolic blood pressure decrease after the exercise in examination II. 2. The diagnostic and training equipment has essential diagnostic value in evaluation of psychic skills.
THE VALUE OF ENHANCED CARDIOVASCULAR SCREENING (ECS) IN MILITARY AIRCREW

LA VALEUR DU DÉPISTAGE CARDIOVASCULAIRE ACCRU CHEZ LE PERSONNEL NAVIGANT MILITAIRE

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Introduction: Military aircrew are often placed under considerable occupational stress and require a high level of physical fitness. Recognising age as an independent risk factor for cardiovascular disease (CVD), the Royal Air Force (RAF) Clinical Aviation Medicine Service developed an Enhanced Cardiovascular Screening (ECS) programme for aircrew and aircraft controllers aged over 59 years.

Methods: A retrospective cohort analysis of all military aircrew, airspace managers and rearcrew aged over 59 years referred for ECS was undertaken. Assessment was made of the demographics, cardiovascular risk profile, exercise electrocardiogram (ECG), additional investigations and occupational disposal.

Results: Between September 2011 and July 2015, 102 subjects were referred for ECS. 24 were excluded from this analysis due to pre-existing CVD or ongoing current investigations. The remaining 78 subjects (all male, median age 62 years (range 59-72)) had an exercise ECG and consultation with an RAF Physician. Of these, 92.4% were aircrew, 3.8% airspace managers and 3.8% rearcrew. Cardiovascular risks identified included: smoking (active 3.9%, ex-smoker 16.7%), hypertension (34.5%), hypercholesterolaemia (23%), atrial fibrillation (1.3%) and a family history of acute coronary syndrome (10.3%). Abnormal exercise ECG findings were identified in 17/78 (21.8%) subjects. Of these 11.8% underwent invasive angiography, 76.5% CT coronary angiography, 47.1% myocardial perfusion imaging (41.2% nuclear perfusion and 5.9% perfusion cardiac MRI). Several subjects had >1 investigation. Ultimately, 12/17 (70.6%) were found to have evidence of functionally significant coronary artery disease (CAD).

Conclusion: Approximately 20% of aircrew over age 59 years had a positive exercise ECG during ECS, with 12/78 (15.4%) diagnosed with functionally significant CAD following screening. These results support the requirement for ECS in aircrew over the age of 59 years.
A REVIEW OF GROUND-BASED HYPOXIA TRAINING IN THE UK MILITARY

UNE REVUE DE LA FORMATION EN HYPOXIE AU SOL DANS LES FORCES ARMÉE BRITANNIQUES

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Introduction: Hypoxia training traditionally involved hypobaric chamber exposure; training risks included decompression sickness (DCS) (1), fire (2) and potential for white matter hyper-intensities (3). To mitigate risks, the UK instigated ground-based hypoxia training in 2012 for some aircrews. The Scenario-based Hypoxia Training (SBHT) is a normobaric technique which uses crew/position-specific scenarios.

Methods: Records of hypoxia training were examined for adverse incidents between February 12 and June 15 (normobaric) and January 10 and June 15 (hypobaric). Both a benefit analysis of training modalities and a program of evaluation of SBHT integration into existing simulators were undertaken.

Results: 2230 participants undertook SBHT; 2 adverse incidents were recorded. Incident rate: 1:1115 training episodes. The monthly mean number of subjects was 21 in 2012 and doubled each successive year to 93 in 2015.

There were 5078 chamber experiences (student and instructor); 9 adverse incidents recorded. Incident rate: 1:564 chamber experiences. The monthly mean number of chamber experiences went from 138 in 2010 to 5 in 2015.

The 2 SBHT incidents involved loss/near loss of consciousness (LOC). Hypobaric incidents comprised 6 DCS, and 2 LOC with one convulsion.

Discussion: Our results suggest SBHT is safer than chamber training. Aircrew prefer SBHT: it mimics common hypoxia presentations and scenarios are representative of airborne tasks. However, aviators undertaking SBHT cannot experience rapid decompression; for this reason, limited hypobaric training continues. Future development work is underway to integrate SBHT into all UK simulators. Technical and Health and Safety concerns make integration challenging; this is best overcome in the design phase.
Objective: To evaluate the optimum strategy for metabolic stone evaluation and management to prevent recurrent kidney stones in civil aviation pilots.

Methods: To retrospectively analyze the clinical data of 50 civil aviation pilots, who were diagnosed and treated from May 2013 to May 2015.

Results: 48 (96%) pilots were verified to have kidney stones and the stones were taken out by flexible ureteroscopy among 50 pilots who were suspected. In two patients, stones could not be found. Those who pass the medical certification are qualified and are allowed to fly. All pilots are taken to basic metabolic evaluation and preventive management. Renal stone recurrence rate is 4% (2/50) at one year. Stone analysis: 100% (48/48) are mainly calcium oxalate, 75% (36/48) are combined with calcium phosphates. Every pilot is assigned to a low- or high-risk group for stone formation. Low-risk stone formers follow general fluid and nutritional intake guidelines, as well as lifestyle-related preventive measures to reduce stone recurrences. High-risk stone formers should undergo specific metabolic evaluation with 24-h urine collection.

Conclusion: Civil aviation pilots with kidney stones should be evaluated and treated in order to prevent new stone formation. Stone type determination and specific blood and urine analysis are needed to guide patient treatment. Metabolic stone evaluation is highly recommended to prevent renal stone recurrences in civil aviation pilots.
Introduction: Execution of flight missions requires performing tasks that are often related to rapid change of both the direction and the position in space of the aircraft. It is true for both aerobatic flight in aviation sports and Air Force during the training missions and combat maneuvers.

To effectively execute each stage of a flight, pilots need to prepare for such actions through exercises that can be safely carried out in laboratory conditions. Thus, to achieve this goal, various types of flight simulators are constructed. In case of the Polish Air Force military students it is SAGI (looping, gyroscope). The goal of the study was to evaluate the level of cognitive processes functioning during the exercise in SAGI.

Methods: The study involved a group of 20 students of the pilot course that were carrying out SAGI exercise. The study consisted of evaluation of both quality of execution of a SAGI tasks and efficiency of cognitive process (attention, short-term memory, reaction time) during the movement of student's body in space.

Results: Obtained results obtained for each of the cognitive tasks, performed in SAGI, were statistically analyzed using Statistica software. This analysis indicates their significant statistical correlation with the evaluation of these operations that was carried out during the tests in the laboratory conditions.

Conclusions: Evaluation of cognitive processes carried out in laboratory conditions is a good predictor of their level during exercises carried out in SAGI. Multisensory determinants of information processing should be examined during exercise in SAGI.
Introduction: Helicopter aircrew involved in crash impacts depend on aircraft crashworthy design features and effective aviation life support equipment (ALSE) for their survival. Military helicopter aircrew also require protection from combat-related injury, which may occur during flight or during subsequent egress, escape, or evasion. The purpose of this study was to review the patterns of injury in recent U.S. Army helicopter crashes to help determine the adequacy of injury-preventing ALSE and aircraft design features in the current helicopter fleet.

Methods: The U.S. Army Combat Readiness Center accident database was queried for Class A helicopter accidents occurring 2012-2014. Data were extracted regarding kinematics, injury patterns, helmet and seat performance, and egress/post-crash factors.

Results: There were 40 aircraft involved in Class A accidents during the study period. Forty-nine of the 63 occupants sustained 108 recorded injuries; 20 of these occupants were fatally injured. The most frequently injured body region was the head (31%), followed by lower extremities (17%), back (14%), upper extremities (11%) and "body in general" (11%). Correlations of injury patterns with survival equipment performance and kinematics were documented.

Discussion: Despite successful performance of modern flight helmets, the head and brain remain the most frequently-injured body region. Equipment damage confirms that serious head and back injuries would be much more common if helmets and energy-attenuating seats were not employed. Post-crash fire has been virtually eliminated as an injury mechanism, due to the success of crashworthy fuel systems, which have been installed in Army helicopter helicopters for the past 30 years. The relevance of helicopter crash injury data to the design of military helicopters and ALSE will be discussed.
Introduction: Present study examined effect of 32 hours of Total Sleep Deprivation (TSD) on straining G level tolerance and its modulation with modafinil.

Methods: Straining G level tolerance of 45 well-rested and slept, healthy, male humans (20-22 years) was measured in a baseline (non sleep-deprived) state and after 32 hours of TSD. During TSD, the participants were randomised to receive two doses of placebo (Gp P), modafinil 100 mg (Gp M1) or modafinil 200 mg (Gp M2) at ~16th and ~25th hour. Oral temperature, HR and MAP were also recorded. Stanford Sleepiness Scale (SSS) was used to score subjective perception of sleepiness/alertness. Results were analysed using ANOVA/ paired t-test/ Friedman's ANOVA.

Results: Modafinil (especially 200 mg) caused significantly increase in HR and MAP and prevented a nocturnal circadian dip in oral temperature. Straining G level tolerance decreased significantly after TSD in Gp P (5.5±0.2 G in baseline versus 4.8±0.3 G after TSD; t=2.51, p=0.026) and Gp M1 (5.2±0.2 G in baseline versus 4.3±0.3 G after TSD; t=2.98, p=0.011). In Gp M2, there was no significant change (5.1±0.2 G in baseline vs 5.0±0.2 G after TSD; t=0.56, p=0.583). Scores on SSS increased significantly in Gp P ($\chi^2=28.88$ p=0.000) and M1 ($\chi^2=10.74$ p=0.013) but not in Gp M2 ($\chi^2=2.29$ p=0.514).

Conclusion: Modafinil (200 mg) effectively mitigated decrease in level G tolerance due to TSD. It corroborated with scores of subjective perception of sleepiness/alertness. Such an effect was not seen with 100 mg dose.
IS THERE A ROLE FOR ACCLIMATISATION TO HYPOXIA IN MITIGATING THE EFFECTS OF ACUTE EXPOSURES TO ALTITUDE?

Y AT-IL UN RÔLE POUR L'ACCLIMATATION À L'HYPOXIE POUR ATTÉNUER LES EFFETS DE L'EXPOSITION AIGUÉ À L'ALTITUDE?

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Introduction: To avoid the detrimental effects of hypoxia, aircrew require supplemental oxygen at cabin altitudes above 8-10,000 ft, while parachutists are permitted to be exposed to up to 12,000 ft breathing air during daytime. These altitude exposure limits may restrict training and operational capability while supplemental oxygen use incurs a logistical and equipment integration burden and possibly hazard. The aim of this literature review was to assess whether i) exposure to repeated or chronic mild hypoxia induces acclimatisation, ii) acclimatisation improves performance during, or tolerance to, acute hypoxia, and iii) acclimatisation could increase altitude limits for supplemental oxygen use.

Methods: Literature search of international databases using the following keywords: HYPOXIA, ACCLIMATISATION, ALTITUDE, CHRONIC HYPOXIA, INTERMITTENT HYPOXIA, PERFORMANCE, COGNITIVE, VISUAL, AIRCREW.

Results: Acclimatisation to altitude can be achieved through either chronic or Intermittent Hypoxic Exposure (IHE). Many exercise performance-based studies show that VO2max at altitude is increased in acclimatised individuals and this can occur at altitudes as low as 7200 ft. Acute Mountain Sickness is reduced following IHE protocols. However, there is limited evidence that acclimatisation provides any protection against cognitive performance decrements during acute hypoxia. Similarly chronic exposure to 15,700 ft did not significantly reduce the degradation of red/green colour vision during acute hypoxia. Acclimatisation to altitude may not be without drawbacks with, for example, increased incidence of vascular thrombotic events reported in some lowland populations during prolonged exposures to high altitude.

Discussion: These studies suggest that, although not a standardised IHE protocol, aircrew or parachutists may be acclimatising to altitude in their day-to-day flying activities. However, there is inadequate evidence on the effect of acclimatisation on flight related measures of performance (including cognition and vision) during subsequent acute hypoxia. Further research is required to address this before any recommendations to change altitude limits for supplemental oxygen can be considered.
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English and French Titles:

A SYSTEM FOR CARDIOVASCULAR TESTS UNDER LOWER BODY NEGATIVE PRESSURE WITH NON-INVASIVE MONITORING OF OXYGENATION CHANGES IN THE CEREBRAL CORTEX

UN SYSTÈME DE TESTS CARDIOVASCULAIRES SOUS PRESSION NÉGATIVE DU BAS DU CORPS AVEC UNE SURVEILLANCE NON-INVASIVE DES CHANGEMENTS EN OXYGÉNATION DANS LE CORTEX CÉRÉBRAL

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Introduction: Pilots of highly manoeuvrable aircraft often suffer from hypoxic symptoms related to the impact of accelerations as well as hypotonic symptoms caused by sudden changes in body position. In such situations, the blood is accumulated in the lower extremities, which causes cerebral circulation disorders and oxygen deficiency symptoms. The consequences of hypoxia are: greyout, tunnel vision, blackout and G-LOC.

Methods: The authors have designed and constructed the ORTHO-LBNP system, which consists of a tilt table to provide orthostatic stress (range: -45° to +85°, rate of changes: up to 45°/s) and a chamber to cover the lower part of the body and generate negative pressure (range: 0 to -100 mmHg, rate of changes: up to 20 mmHg/s). The system allows for online monitoring cerebral oxygenation using an in-house designed 6-channel near infrared (NIRS) apparatus.

Results: Preliminary orthostatic tests have shown that the angle change of the tilt table from +85° to -45° induces an increase in the concentration of the total haemoglobin, measured at 6 locations with NIRS device, due to increased blood flow to the brain of the subject. Later, when the tilt angle was changed from -45° to +85°, the haemoglobin concentrations tended to return to their initial values measured in the first phase of the experiment.

Conclusions: The combination of the NIRS technique with a recognized and well documented LBNP method enables the application of new diagnostics in examinations of ischemic hypoxia and orthostatic hypotension. The development of objective indicators to evaluate the effectiveness of the regulatory mechanisms of the circulatory system will be of particular importance in assessing the suitability of pilots and their progress in aviation training.
Background: Infants with surgically repairable congenital cardiac defects are medically evacuated from low and middle-income countries (LMICs) to the countries with high quality of pediatric surgery. On the eve of medevac, those infants have to be prepared for the flight to avoid the worsening of their condition.

Objectives: To assess the burden of mortality and morbidity related to how Medevac was performed, we retrospectively collected data of infants from three hospitals in Kinshasa (University Hospital of Kinshasa, Clinique Ngaliema and HGRK), from January 2003 to December 2013.

Results: 64 children (56.3% girls, mean age 2.4 ± 1.1 y, extremes 1 and 15y) with congenital heart disease (14.1% PDA, 12.5% AVC, 10.9% VSD, 10.9% TF, 10.9% MI, 9.4% ASD, 9.4% AS, 7.8% APVC, 7.8% TA, 6.3% TGA), were medically evacuated mostly to South Africa (56.3%), India (32.8%), and Belgium (10.9%) in commercial aircraft (94%), and air ambulance (6%). In 16 (25%) infants who died after the transfer, 7 (44%) died during the flight and 9 (56.2%) after the flight. Three (33 %) died before surgery, 2 (22%) during surgery and 4 (45%) after surgery. The overall survival from the first day of the medevac was 91%, 86%, 80%, 75% at <1d, 6d, 10d and 15d respectively.

Conclusion: To prevent the noteworthy premature mortality and the lasting handicap from congenital heart anomalies due to their cost-effective intervention and medevac conditions, LMICs have to improve the medevac culture and the local health services.