

ANDRE ALLARD MEMORIAL LECTURE

REGULAR CHECK UP & NON-LINEAR TIME EVOLUTION IN THE DYNAMIC HUMAN SYSTEM

Prof. BM Hegde

Aviation medicine has to do a lot with flying at high altitudes and at phenomenal speeds where the human physiology could undergo remarkable changes. Unfortunately, in medical physiology we have been following since the 12th century and continue to follow even now the reductionist science of linearity, milieu interior, and rhythmicity in place of wholism, chaos and non-linearity. Even the changes in physiology of high altitude flying, sudden loss of cabin pressure in a pressurised aircraft on the human body, and the long term effects of flying etc. have not been fully understood although we make lot of intelligent guesses.

Physics, the king of sciences which walks with the shoes of mathematics, has also been using the faulty reductionism from the beginning. Quantum physics uprooted all those concepts in the beginning of the last Century but, other sciences did not follow suit, least of all the glorified "statistical science" of medicine which is still mired in the ancient deterministic predictability while a doctor could never ever predict the future of a dynamic human being using a few of the phenotypic data, as we do now. You give your "apparently healthy" aircrew a routine check up and declare him/her fit. There could always be a "butterfly effect" in the time evolution of your predictions with catastrophic results that might be expensive in terms of human lives.

Quantum physics teaches us as to how the subatomic world does not obey any of the great Laws of Newton, Einstein or John Von Neumann! If they were to do so there would be no atom at all. Newton's Laws, if followed, would make the electrons destroy their own nucleus and electromagnetism would have made electrons do what they should not do. We have been studying the physiology of chaos in the human system with special reference to the heart but also other areas. The work which is more than three decades old is still in its infancy. The talk would take you through our journey of "joys and sorrows". It hopes to throw some light in those areas. This will also help your practice with civilians and the families of cadets and officers in day today life.

EVALUATION AND DISPOSAL OF BORDERLINE HAEMATOLOGICAL CONDITIONS IN AIRCREW

Air Cmde RK Ganjoo AVSM VSM

The commonest haematological disorder of clinical significance in aviation is anemia, which lowers the tolerance of the aviator to hypoxia. Simple as though the condition sounds, it encompasses a wide variety of disorders. Further one must realize that anemia is only a presentation of a disease entity and not a diagnosis as such. The need to be able to evaluate cases of anaemia by proper history taking, detailed clinical examination and relevant laboratory investigations cannot be overemphasized. A systematic approach will help in ascertaining the aetiology in most cases. It is well beyond the scope of this talk to discuss all the types of anaemia. The presentation will cover some of the common types of treatable anemia (e.g. Iron deficiency pernicious anemia, nutritional deficiency anaemia and post infection) which entail only temporary disqualification. Some of the controversial issues related to aviation like thalassaemia trait, β thalassaemia post bone marrow transplant (BMT) and sickle cell trait will be covered. Also discussed will be some of the haemolytic anaemia like hereditary spherocytosis and G6PD deficiency, the haematological malignancies like CLL and lymphomas which may be compatible with flying in early stages or post chemotherapy, when in remission. The decision to grant flying status in case of military aircrew and flying certification in case of civil aircrew will be discussed. This will depend on many factors like the cause of anemia, the severity of the anaemia, the role of the aviator, pressurized/ non-pressurised aircraft, combat role/ commercial pilot and whether the individual is a fresh entrant for initial entry or an experienced qualified pilot for renewal of license.

HYPERTENSION: WHEN TO BEGIN DRUG THERAPY, A LONG STANDING AVIATION DILEMMA

Pettyjohn, Frank S, Bernstein, Stephen, Gorbandt, Monica; Quattleman, Martin

BACKGROUND:

Hypertension has had various definitions over the past decades. In the field of aviation medicine, an upper limit of blood pressure has been arbitrarily applied to all aircrew. As blood pressure rises, the aviator passes through a series of preventive efforts to delay the onset of "fixed hypertension". The aviator is required to return for 3 days of blood pressure, counseled on reducing salt intake, exercise, and other non-pharmacologic modalities. Over the years, records indicate that those aviators experiencing pre-hypertension or intermittent hypertensive level blood pressures ultimately require institution of a blood pressure control drug. This study was undertaken to review the sequence and natural history of hypertension in aircrew.

METHODS & MATERIALS:

The U.S. Army Aeromedical Database of 134,000 aircrew was surveyed for the onset of "pre-hypertension" as defined by JNC VII. The onset of the initial pre-hypertensive and hypertension readings, the age of fixed hypertension, and the age of institution of drug therapy were obtained.

FINDINGS:

The data was separated into ten year deciles. The onset of pre-hypertension was noted at a younger age than expected in the 30-39 year old decile. Pharmacologic treatment, however, is not instituted until the 40-49 year old decile and fixed hypertension occurs in an increased number. The most common drugs used are diuretics, beta-blockers, angiotensin converting enzyme inhibitors (ACE), angiotensin receptor blockers (ARB), and calcium channel blockers.

DISCUSSIONS:

Aviation medicine is faced with the dilemma of early drug therapy in aircrew who try to remain off drug. A recent study "TROPHY", utilized an angiotensin receptor blocker in a pre-hypertension level group. The results of this study indicated that two years of ARB treatment would delay the onset of actual hypertension by nearly four years. It was noted, however, that ultimately hypertension did supervene as the subject ages. Hypertension has been proven to be a significant risk factor for the onset of arteriosclerotic vascular disease. The usual rule of thumb is for every two millimeter increase in systolic blood pressure, the risk of heart disease increases by one percent. The FAA has authorized any drug in any combination to control hypertension. This has permitted aircrew to continue a flying career on multiple medications to control blood pressure. Long term outcome studies have not been accomplished. Based on the results of the TROPHY study and the efforts to minimize the impact of hypertension on the cardiovascular system, the early institution of drug therapy would appear to be indicated in aircrew demonstrating "pre-hypertension".

FUTURE THERAPEUTIC OPTIONS IN THE MANAGEMENT OF AIRCREW WITH TYPE 2 DIABETES

Dr RV Johnston

Introduction: Type 2 diabetes is characterised by a combination of factors that ultimately lead to loss of glycaemic control, including (1) insulin resistance in the liver, muscle and adipose tissues; (2) defective suppression of post prandial glucagon levels leading to increased hepatic glucose production and (3) a progressive decline in beta cell function leading in the later stages of the disease to relative insulin deficiency.

Current therapeutic options: Several agents including insulin and insulin analogues; glucagons-like peptide-1 (GLP-1) receptor antagonists e.g. eventide; sulphonylureas; meglitinides; α -glucosidase inhibitors and biguanides are currently in use either as monotherapy or in combination to improve glycaemic control. Newer insulin derivatives including inhaled insulin offer advantages. However, many of these agents present problems in the aviation environment due to the rate of hypoglycaemia, the rate-determining step in risk assessment. In addition the efficacy of these agents reduce over time (United Kingdom Prospective Diabetic Study (UKPDS) and other studies have suggested that > 60% of Americans have poor diabetic control as defined by a haemoglobin A_{1c} > 7%. There is thus a need for alternative therapeutic strategies.

Future Strategy: Incretin-based therapies represent a novel approach to this therapeutic challenge.

Discussion: Recent therapeutic advances will be reviewed and the incretin-based therapies will be discussed in detail, as they target not only deficits in insulin secretion but also reduce post prandial glucose and glucagon levels. Preclinical studies with these therapies have shown an increase in β cell mass via stimulation of β cell proliferation and inhibition of β cell apoptosis. There is also preliminary evidence that these agents may have a much lower incidence of hypoglycaemia than currently available treatment options which would be a considerable advantage in the aviation environment.

CONTINUING CONTROVERSIES IN REFRACTIVE SURGERY FOR AIRCREW

Dr Rob Scott

There are a number of options for refractive correction in aircrew. Spectacles work extremely well though there are problems with misting, reduced visual field and optical aberrations. They do not interface well with helmet mounted devices and the majority of aviators prefer not to use them. High water content soft contact lenses solve many of these problems and are popular in aviation, but have some associated risks and are not universally tolerated. More modern options include corneal and intraocular surgery for ametropia. Corneal surgery for aircrew includes the excimer laser treatments; laser in-situ keratomileusis (LASIK), laser epithelial keratomileusis (LASEK) and photorefractive keratectomy. The Royal Air Force allows the latter two procedures in its aircrew. Other corneal procedures include corneal inlays, intrastromal corneal rings and conductive keratoplasty. Intraocular lens procedures include phakic lens implants and clear lens extraction. In aircrew, a suitable refractive procedure must be appropriate to their aviation activities and environment. The length of time where an aviator is declared unfit flying duties varies from 3-12 months depending on the procedure. The refractive effects of the surgery are evaluated and any deterioration of contrast sensitivity, night vision or sensitivity to glare is measured, before a return to aviation duties is allowed.

PBG – COMFORT VS BENEFITS

Wg Cdr Rajesh Kumar

The advances in technology has made it possible to design and build aircraft capable of withstanding higher +Gz loads. The induction of SU-30 aircraft in Indian Air Force inventory has brought about a sea change in the firepower and technology in military aviation. It is highly maneuverable twin seater fighter aircraft, which has large endurance and multiple role capability. The maneuvering capabilities of modern fighter aircraft exceed man's physiological tolerance to high G forces. The introduction of highly maneuverable fighter aircraft has led researchers to explore new methods of enhancing aircrew tolerance to repeated and sustained high +Gz accelerations. Positive pressure breathing for G-protection (PBG) has been established as an effective method of increasing +Gz tolerance. The SU-30 aircraft has PBG incorporated to assist G tolerance. However, even after 8 years of its induction into IAF, the pilots are still wary of using this system due to various reasons. This paper compares the questionnaire study conducted in year 2000 and 2006 to assess the acceptance of PBG by pilots.

ANALYSIS OF MULTI-AXIS ACCELERATION PROFILE IN A SUPERMANOEUVRABLE AIRCRAFT OF INDIAN AIR FORCE

Sqn Ldr NK Tripathy

Introduction: Supermanoeuvrable aircraft in addition to sustaining high +Gz acceleration during conventional air combat, is capable of manoeuvring in all the three axes because of its unique aerodynamic geometry. The acceleration profiles of such an aircraft were studied to quantify the extent of in-flight acceleration stress during multi-axis fighter manoeuvres.

Methods: Randomised selection of multi-axis manoeuvre sorties was done. The relevant data was collected from graphs and / or digital print outs of the flight data recorder and data processing system and was analysed to study the in-flight acceleration environment.

Results: The mean duration of time for which the aircrew were exposed to multi-axis acceleration was 840.96 seconds and it was observed that the aircraft was manoeuvring in combined transverse (Gx) and vertical (Gz) axes for the major portion of the time. The average peak + Gz acceleration achieved was 6.72 G with a mean onset and offset rate of 3.09 G/s and 2.66 G/s respectively. Acceleration in other axes revealed that the mean peak G was 1.07 G in + Gx axis, 0.25 G in – Gx axis, 0.42 G in +Gy axis and 0.56 G in –Gy axis. The mean peak level of combined acceleration was observed to be 1.07/6.06 G for +Gx/+Gz, -0.25/1.15 G for -Gx/+Gz, 0.42/2.60 G for +Gy/+Gz and -0.56/1.95 G for -Gy/+Gz. Even though the aircraft was going into -Gz at times during these manoeuvres, the magnitude of combined acceleration in this axis was negligible.

Interpretation and conclusion: This study revealed that the aircraft is capable of manoeuvring in all the three axes. The multi-axis acceleration stress, when Gz, Gx and Gy are experienced together is unique to the aircraft. Such acceleration can potentially produce loss of situational awareness and spatial disorientation and may induce hitherto unknown vestibular illusions and could adversely affect the Gz tolerance.

Keywords: Aerodynamic geometry, Supermanoeuvrable aircraft, Multi-axis manoeuvre, Flight data recorder.

DESIGN AND DEVELOPMENT OF PLC (PROGRAMMABLE LOGIC CONTROLLER) BASED ANTI-G SUIT

Munna Khan, Shagufta Yasmin, Anil Kumar, MK Gupta, Udayvir Singh, Mr Khan

Introduction: Acceleration is a unique environment, which acts directly and continuously upon the body of aircraft pilots during all gravity (G) exposures. Modern high performance aircrafts are capable of developing 9 G within 1 second that can be sustained for several minutes. Tolerance of aircraft pilot is increased to high G-levels using G-protective system such as anti G-suit (AGS), pressuring breathing during G (PBG), Anti-G straining maneuvers (AGSM), Physical conditioning, and anti-G system based on postural modification. The AGS consists of five interconnected bladders is considered basic unit of combined anti-G protection system. Inflation/deflation of G-suit is not properly optimized according to actual blood pooling of pilot.

Discussion: A practical approach of PLC (programmable logic controller) based system has been designed and developed for optimum inflation/deflation of AGS. A PLC (programmable logic controller) based system consists push button, processor, solenoid valve, air source and anti G-suit. A push button is used to provide the various commands to operate PLC. A command generated signal is propagated into the processor. Output of processor controls the air in the solenoid valve. Precise opening and closing of valve monitored the amount of air flow into the AGS. Results are in the form of AGS inflation/ deflation successfully within the desirable time. A number of photographs are taken from experimental setup using digital camera. A movie clip of AGS pressurization is also prepared for various input commands. A PLC programming enabled the valve to monitor air flow into the AGS. The solenoid valve opens and closes for suitable time automatically. The PLC controlled AGS may used to increase G tolerance and online monitoring of aircraft pilot.

Key words: Anti-G suit (AGS) pressurization, PLC (programmable logic controller), solenoid valve, aircraft pilot.

EPIDEMIOLOGICAL ATTRIBUTES OF ISCHEMIC HEART DISEASE (IHD) IN INDIA

Dr D Prabhakaran

IHD is the single largest cause of death in the developed countries and is one of the main contributors to the disease burden in developing countries. In 2001, IHD was responsible for 7.3 million deaths and 58 million DALYs lost worldwide. Seventy-five percent of global deaths and 82 percent of the total DALYs resulting from IHD occurred in the low- and middle-income countries. Deaths from coronary heart disease in India rose from 1.17 million in 1990 to 1.59 million in 2000 and are expected to rise to 2.03 million in 2010. Much of the expected rise in potentially productive life years lost (PPYL) due to Cardiovascular Disease (CVD) in India from 9 million in the year 2000 to 17.9 million in the year 2030 is attributable to IHD. Between 2000 and 2030, about 35 percent of all CVD deaths in India will occur among those age 35 to 64, compared with only 12 percent in the United States and 22 percent in China.

The two leading manifestations of IHD are angina and acute myocardial infarction (AMI). Thirty-day mortality after an AMI is high: even with best medical therapy. In a comparison of 2 years outcomes among patients of Acute Coronary syndrome (OASIS registry II), the overall mortality rate in India (15%) was more than double that of China (6.9%). Additionally, there is strong socio-economic gradient existing in case fatality rates against the socially disadvantaged in India (Create registry).

Cost effective management of IHD events (acute phase) are widely available. The incremental cost per DALY averted was less than US\$25 for the aspirin and aspirin plus atenolol interventions; US\$634 to US\$734 for aspirin, atenolol, and streptokinase; and slightly less than US\$16,000 for aspirin, atenolol, and tissue plasminogen activator. In secondary prevention in setting where hospitals are available, a combination of aspirin and atenolol dominated no therapy and is cost saving. Almost 90% of the population attributable risk of AMI can be explained by simple nine modifiable conventional risk factors; smoking, adverse lipid profile, high normal blood pressure, diabetes, abdominal obesity, lack of fruit and vegetable consumption, lack of physical activity, and psychosocial factors. Therefore a comprehensive approach combining both high risk approach and population approach will be very effective in reducing the future burden of IHD in India.

EFFECT OF MODERATE LEVELS OF ALCOHOL ON THE PERFORMANCE IN DISO SIMULATOR

Te-Sheng Wen, Chien-Liang Chen, Yuh-Min Tsai

Introduction: Alcohol has long been known to affect the function of the vestibular system during angular acceleration. The most significant effect is the impairment of the fine skills and mental processes unique to flying, and perhaps causes spatial disorientation. **Methods:** There were 41 subjects, 39 males and 2 females (22~32 ages) volunteered to take part in this study. On the first day, they were arranged to flight the DISO simulator without alcohol (water only). This device is characteristic of 6-DOF motion platform and computer-based generating flight scenarios. At first, they were exposed to angular acceleration (clockwise, 0 to 20 rpm) and angular deceleration (counter-clockwise, 20 to 0 rpm) in darkness and reported the offset time of the somatogyral illusions. Secondly, they were instructed to fly the DISO into the graveyard spin from 35,000 feet and then to recover by themselves. Both of recovery time and altitude were recorded. On the second day, they were asked to intake one drink of beer (Taiwan Beer, 4.5%) and repeat the program 1 hour later. The blood alcohol concentrations (BAC) were measured by a breath alcohol tester (Drager). **Results:** The mean BAC of all subjects was 0.06 0.07 % obtained 1 hour after drinking. During demonstrating somatogyral illusions, blood alcohol significantly shortened the time of losing the sensation of turning (acceleration: 19.86 1.47<24.79 1.54 sec; deceleration: 14.39 0.87<18.58 1.18 sec). Besides, blood alcohol also extended the recovery time (45.45 2.90>38.92 2.80 sec, $P<0.05$) and lowered the recovery altitude (19,905 1,535<23,566 1,021 feet, $P = 0.11$). To our surprise, there were 15 subjects of no measurable alcohol content still having longer recovery time and/or lower recovery altitude. **Conclusion:** The results indicate that BAC as low as 0.06% can compromise the human performance in DISO. It may be resulted from the altered density of endolymph of the semicircular canals. Moreover, zero BAC does not mean the alcohol hazard is also zero, which is clearly incorrect.

AIRCREW FEEDBACK ON SIMULATOR BASED SPATIAL DISORIENTATION TRAINING IN INDIAN AIR FORCE

Wg Cdr Rajat Bajjal, Gp Capt VN Jha, Wg Cdr A Sinha, Wg Cdr SK Sharma

Introduction: There is worldwide acceptance that Spatial Disorientation (SD) prevention strategies need to focus on four major categories: education, training, research and equipment. Physiological training, to augment the didactics, involving demonstration of illusions and the limitations of human orientational mechanisms is considered to be the most important dimension of the SD prevention strategy. The fighter aircrew in Indian Air Force (IAF) receive instructions on SD during various stages of flying training and later in the flying squadrons. Earlier, the demonstration of SD was limited to vestibular illusions generated by head movement at low G in a human centrifuge. As a proactive step towards SD prevention IAF has acquired Air Fox DISO SD simulator in 2004. Dedicated and structured simulator based SD training of aircrew was initiated in August 2004. This study has been undertaken to assess the aircrew's perception of the simulator based SD training. **Method:** SD training consists of a five day course involving lectures and simulator based demonstration of active and passive illusions. A questionnaire based feedback was obtained from the aircrew at the end of each course. The response of 178 fighter pilots flying different fighter aircraft in the IAF was analyzed for the purpose of this study.

Results: Mean flying hours of pilots was 455 hrs. Prior to training 95% of pilots had satisfactory to good SD awareness and 5% had very good to excellent. Post training 12% pilots had good SD awareness while 88% reported it to be very good to excellent. Realism of illusions in the simulator was found to be satisfactory by 15% of pilots and good to excellent by 85%. 49% of pilots reported poor to satisfactory realism of controls and displays in the simulator while 51% found it to be good to very good. 95 % of pilots found the simulator to be good to excellent in imparting training for recognition of SD conducive conditions. 90 - 97% of pilots rated the simulator based training as good to excellent in reinforcing trust in instruments and ability to initiate corrective actions. 96 – 98% of pilots reported as good to excellent the cost benefit and the quality of simulator based SD training.

Conclusion: This study analyses the SD awareness levels of the pilots and post SD training benefits accrued. The subjective validation of SD simulator and training to reinforce their theoretical knowledge is very encouraging. Based on the findings of this study, there is a proposal to reduce the duration of the course and increase its frequency, to impart the basic SD training on the simulator to all the fighter aircrew of IAF at the earliest.

Educational Objectives: The positive feedback from the target population (fighter pilots) has strongly justified the implementation of simulator based SD training in IAF as an effective enhancement to the aeromedical training of fighter aircrew.

Key Words : Fighter aircrew, Spatial Disorientation, SD, Simulator

SPATIAL DISORIENTATION: PSYCHOPHYSIOLOGICAL CHANGES AND FLIGHT PERFORMANCE DURING A FLIGHT SIMULATOR TRAINING FOR JET PILOTS

Karin Tropper, K. Wolfgang Kallus, Carsten Braun-Seith, Richard Schlüsselberger

The objectives of our research focus on the development and evaluation of systematic training programs to cope with different kinds of spatial disorientation phenomena and the analysis of the psychophysiological processes. An experimental study was conducted using the multi-axial moveable AIRFOX® spatial disorientation trainer DISO (AMST Systemtechnik GmbH, 5282 Ranshofen, Austria). 26 jet pilots were randomly allocated to one of three testing groups – two experimental training groups (training group, awareness group) and one control group. Each pilot attended three flight simulator phases lasting between 50 and 90 minutes. Flight performance (observations, performance ratings, time-measurements), psychological (subjective rated physical and psychic state, reconstruction interviews), and physiological variables (ECG, EEG, EOG) were assessed. Spatial disorientation profiles were leans, dark take-off, false horizon, expectation error (confusion with ground lights), and black hole approach. Flight performance data confirm that participants who had completed the whole training (training group) reach better flight performance in the test phase than pilots of the other two testing groups; e.g. the training group shows the best ratings concerning overall performance within the test profile expectation error [Kruskal-Wallis Test, Chi-Square (df = 2) = 8.75, p = .010].

The psychophysiological analyses reflect clearly the strain of demanding flight situations as illustrated within the profile black hole approach (difficult landing procedure at night). Within the landing procedure, there is a strong increase of the heart rate before the touch-down [$F(5.9,105.7) = 16.3$, p < .001], combined with a decrease in the blink rate [$F(2.7,56.3) = 11.5$, p < .001] and a low heart rate variability [Friedman Test: Chi-square (df = 12) = 77.7, p < .001], caused by increasing mental workload. In addition, the increase of heart rate is stronger in pilots who cause a crash at the end of the profile, compared to those who finish the landing procedure with a safe touch-down [Interaction: $F(11.7,105.7) = 2.0$, p = .031]. This indicates that negative flight performance due to spatial disorientation is accompanied by high physiological arousal.

In conclusion, our study contributes to basic research by analyzing psychophysiological reaction patterns during different flight tasks as well as to applied science by proving the effectiveness and by emphasizing the importance of systematic spatial orientation training programs for pilots to avoid fatal aviation accidents.

Key words: Spatial disorientation, simulator training, jet pilots, ECG

AIR SICKNESS MANAGEMENT OF AB-INITIO PILOTS IN IAF: EMERGING TRENDS

Wg Cdr Atul Gupta, Wg Cdr Dilish Malik

Introduction: Air Sickness in ab-initio pilots is one of the potential problems in flying training. The main problem being exposure to abnormal motion stimuli to which the flying trainee is unfamiliar and hence unadapted. Non-pharmacological methods of management are the only mode of management in Military Aviation as; anti-air sickness medication precludes the Military pilot from flying. 2 AMTC has been managing potential air sick flying trainees since flying training commenced at Air Force Academy.

Material & Methods. Air Sickness desensitization therapy (ASDT), a form of nonpharmacological method, has evolved since then. It now involves both psychological (counseling and yoga) and physiological (Physical exercise therapy and Barany Chair rotation) methods of approach to achieve satisfactory vestibular habituation.

Results: Success rates (79.1%) have been comparable to world wide figures. However, one of the causes of concern has been persistence of air sickness in those who successfully underwent ground based DT (8.7%). The present study spanning just two courses and 11 Trainees from Jul 2005 to Jun 2006, has achieved a high success rate (100%) with no recurrence.

Conclusion: This was possible by modifying the existing protocol and incorporating a few factors in the management. Some of the factors are, incorporating Phase 1 and 2 in the management, close supervision of all the sessions by a trained observer, withdrawal of the cadet from any training activity and early resumption of flying after ground based desensitization. However, some more data would be required to establish statistical significance between the modified protocol and success rate.

Keywords: Air sickness (AS), Flying Trainee, Air Sickness Desensitization therapy (ASDT), Aero Medical Training Center (AMTC), Physical Exercise Therapy (PET), Yogic Exercise.

INDIAN SPACE PROGRAM

Shri G Madhavan Nair

Chairman ISRO & Secretary to Govt. of India, Dept of Space

The Indian Space Program is characterized by a vision to achieve self reliance in space technology and its applications for the socio-economic benefit of the nation. Over the past three decades, India has achieved remarkable progress in the areas of design, development and operation of satellites, launch vehicles and has also developed world class launch facilities. Indian Space Research Organization (ISRO) has also developed application programs to meet the requirements of telecommunication, television broadcasting, meteorology, disaster warning and management systems, natural resources survey and management, Tele-education and Tele-medicine systems. It has developed excellent remote sensing data collection and dissemination programs to help planning the utilization of natural resources. Indian Space Program is also engaged in atmospheric studies and space science programs and has embarked in the ambitious Chandrayaan mission to study different aspects of moon. Under the program of social relevance, ISRO has embarked on setting up Village Resource Centers to provide single window service to the common man in health care, agriculture and education. In the area of health, a chain of Telemedicine centers are established and linked to the super specialty hospitals in the metros to bring best medical care to the remote villages. Education programs from leading institutions of knowledge are made available to far flung places through implementation of EDUSAT programs through out the country.

**PANEL: INDIAN PEACE KEEPING AND MEDICAL MISSIONS UNDER
UNITED NATIONS**

S No	Topic	Speaker
1	Peace Keeping Missions - An introduction	Wg Cdr Anirudh Agrawal
2	Medical set up and experiences	Wg Cdr Rajesh Kumar
3	Air operations in United Nations peace keeping missions : Aeromedical aspects	Wg Cdr VV Joshi
4	The Indian medical mission at Mazar-i-Sharif, Afghanistan	Gp Capt Deepak Rautray VSM

PEACE KEEPING MISSIONS : AN INTRODUCTION

Wg Cdr Anirudh Agrawal

The Indian Air Force has deployed in three UN Peacekeeping Missions in the recent past. The first was a contingent to UNAMSIL in Sierra Leone which consisted of 212 personnel (including 33 aircrew) and 8 helicopters (4 Chetak, 4 Mi-8 and 3 Mi-35 gun-ships) from Dec 1999 to Feb 2001. The medical component in UNAMSIL consisted of one aviation medicine specialist and four paramedical staff manning a limited Level – II facility.

The second Indian Air Force deployment was in the Democratic Republic of Congo to provide aviation support for the peacekeeping operations of United Nations Organization Mission in the Democratic Republic of Congo (MONUC). The contingent had 333 personnel was a mix of 243 IAF personnel and 90 Indian Army (Infantry) personnel. The medical component consisted of a Level –I facility with one aviation medicine specialist and six paramedical staff.

Pre-induction issues related to preparations including medical intelligence, projection and planning of requirements for stores, vaccinations for troops and pre-induction UN medical examination are discussed. In addition, issues related to medical advance parties, siting of camps and other preventive aspects are discussed.

Keywords: United Nations, UNAMSIL, MONUC, Military Medicine, Planning and projection of medical requirements for UN contingents, Tropical Medicine

PEACE KEEPING MISSIONS : MEDICAL SET UP AND EXPERIENCES

Wg Cdr Rajesh Kumar

Indian Aviation Contingents were deployed in UN Peacekeeping Missions to provide aviation support for the peacekeeping operations of United Nations in the recent past. The first was a contingent to UNAMSIL in Sierra Leone which consisted of 212 personnel (including 33 aircrew) and 11 helicopters (4 Chetak, 4 Mi-8 and 3 Mi-35 gunships) from Dec 1999 to Feb 2001. The medical component in UNAMSIL consisted of one aviation medicine specialist and four paramedical staff manning a limited Level –II facility.

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This paper deals with medical set up in two missions, procedures, clinical data and experiences.

Keywords: UNAMSIL, MONUC

PEACE KEEPING MISSIONS: AIR OPERATIONS IN UNITED NATIONS PEACE KEEPING MISSIONS- AEROMEDICAL ASPECTS

Wg Cdr VV Joshi

The Indian Air Force's helicopter contingents comprised of 33 aircrew operating 11 helicopters (4 Chetak, 4 Mi-8 and 3 Mi-35 gun ships) in Sierra Leone (UNAMSIL) and 38 aircrew operating 9 aircraft (5 Mi-17 and 4 Mi-25 gun ships) in Democratic Republic of Congo (MONUC).

The major Aero medical challenges were to maintain high aircrew fitness to ensure operational preparedness, to conduct CASEVAC / MEDIVAC by helicopters in the mission area, to ensure operational safety despite geographical unfamiliarity, lack of communication protocols and disorientation – prone conditions. Malaria prevention in aircrew using drug prophylaxis vis-à-vis flight safety was also a tricky issue.

In UNAMSIL during 1 year period, an aircrew fitness rate between 95 to 98% was achieved in the mission area, 30 CASEVAC / MEDIVAC sorties were conducted to evacuate 43 patients (including 15 battlefield casualties), four aircrew required hospital admission in one-year period and there was one battlefield – related flying incident. In MONUC during two-year period, three aircrew required hospital admissions, there was one human error - related incidence and one technical - related accident.

The paper discusses in details the relevant data, aero medical challenges and the methods adopted to address them in the trying operational field conditions. The flying incidents and accidents are also briefly described.

Key words: Peacekeeping Operations, Flight Safety, Aero Medical Experiences.

THE INDIAN MEDICAL MISSION AT MAZAR-I-SHARIF, AFGHANISTAN

Gp Capt D Rautray VSM

In Nov 2001, just after the Taliban had been evicted from Afghanistan, in the American led mission- operation 'Enduring Freedom', the Government of India asked the Indian Air Force to send a medical team, as a humanitarian aid into the war-ravaged Mazar-i-Sharif, in north Afghanistan. The medical team comprising a surgical, medical & anaesthesiology specialist, all from Command Hospital Air Force, Bangalore, was tasked to set up the Indian medical mission at Mazar-i-Sharif. This was a pioneering mission, as there was no other Indian presence there at that point in time, given the prevailing politically tumultuous situation. Infact ours was the first foreign medical mission to be set up there. Given this background, task ahead was a daunting one, to say the least, mandating that we function not only as doctors, but also as diplomats for our country.

In view of the prevailing adversities, the task was straddled with uncertainties, for want of any clear inputs. There was no civil air movement in Afghanistan then, so we were flown to Tashkent, Uzbhekistan, to the north of Afghanistan, and drove into Mazar, accompanied by the Indian ambassador in Tashkent. The foremost task was laying of a social foundation. Toward this we were formally presented to each of the 3 dominant war-lords of the Northern Alliance, who promised to extend their whole-hearted cooperation and support to our noble mission.

Since we lacked adequate infrastructure of our own, we decided to pool our man & material resources with theirs, and chose their main hospital Mazar General hospital, to establish our functional unit. We were able to set up an (very modern, from their standards) Operation theatre, performing all kinds of major and minor surgeries, with excellent results. Our physician was much sought after in his Out Patient Department (OPD), which soon became remarkably popular. We were able to establish a healthy social relationship with the local population, who were most grateful to us for all our efforts.

This mission was unique and different from the UN sponsored missions elsewhere, because of our lack of security and infrastructural support. We were 3 officers and 3 Operating Room Assistants (ORAs), with no other Indian/ neutral support available locally at Mazar-i-Sharif. Our instructions and administrative support came from the Indian ambassador across the border at Tashkent. I shall exchange our experiences there with you.

PREVENTION OF CORONARY ARTERY DISEASE IN YOUNG AVIATORS – HOW MUCH AND HOW FAR ?

Wg Cdr Dr SS Iyengar (Retd.)

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Coronary Artery Disease (CAD) in the young is a real threat in our country and the young aviator is as vulnerable unless his awareness about and action against it are at a fully operational level. As aviation is about man-machine complex in a none-too-hospitable environment, coronary health is about man-genetics complex in a none-too-healthy environment.

It is a well established fact that the mean age of our population which gets heart attack is atleast 10 years younger than what is seen in the developed countries. INTERHEART, a case controlled mega-study of myocardial infarction (MI) involving 29,972 subjects from 52 countries representing every inhabited continent gave a loud and clear message that nine easily measured risk factors account for 90 % of the risk of MI worldwide in both sexes, all ages and all regions. These risk factors are abnormal lipids, smoking, hypertension, diabetes mellitus, abdominal obesity, psychosocial factors, consumption of fruits, vegetables and alcohol and regular physical activity. Attention to these risk factors has the potential to prevent most premature cases of CAD.

Primary Prevention is to treat these adverse risk factors effectively and adopt the protective factors intelligently. Primordial prevention is to reduce the prevalence of these adverse risk factors and the aerospace organization is eminently eligible and perfectly positioned to institute the measures for primordial prevention among aviators.

After going through a rigorous and expensive flying training and entering into an exciting and glorious flying career, the show should not be spoilt by becoming a victim of CAD. To achieve this objective, no effort is too much and no distance covered is too long!

GENDER DIFFERENCES IN THE PERFORMANCE OF EXTERNAL CARDIAC MASSAGE DURING HYPOGRAVITY SIMULATION

Gustavo Dalmarco, Alyson Calder, Felipe Falcão, Dario F. G de Azevedo, Subhajit Sarkar, Simon Evetts, Samuel Moniz, Thais Russomano

Introduction: There is an estimated 1% per year risk of a life-threatening medical condition occurring during a long-duration space mission. Basic life support (BLS) is a vital skill in critical care. The new BLS international guidelines recommend an external chest compression (ECC) depth of 40-50mm at a minimum rate of 100 ECC/min with a ratio of 30 ECC to 2 ventilations. This study evaluated gender differences in the performance of ECC during the simulation of Martian (0.38G) and Lunar (0.17G) gravities.

Methods: A body suspension device (BSD) to simulate hypogravity was used to assess 8 men and 8 women during the performance of ECC on a BLS training manikin. A mathematical model calculated the counterweight necessary to reduce body weight. After training, subjects followed a protocol of 30 ECC to 6s of rest, which simulated the time for two ventilations, for 3min. ECC adequacy was assessed by rate and depth of compressions. An electrogoniometer measured elbow movement. Heart rate was taken before and after ECC as a measure of post-CPR fatigue. Both groups were of normal body mass index. All subjects maintained adequate ECC rate during both hypogravity simulations, apart from females in the Lunar environment (mean 93.9 ± 17.8 ECC/min).

Results: Males achieved adequate ECC depth in all gravitational environments. Chest compression depth was inadequate for both Martian (mean 34.9 ± 6.3 mm) and Lunar conditions (mean 32.4 ± 5.3 mm) in the female group. All subjects increased elbow flexion during ECC in hypogravity compared to control (1G), with no differences between genders: mean $13.1 \pm 1.8^\circ$ (Lunar), $17.7 \pm 1.6^\circ$ (Martian). Heart rate significantly increased in both groups after ECC. This study suggests that the 'straight arm' terrestrial method of performing ECC is not adequate in a hypogravity environment. Adequate chest compression depth may be possible when flexion and extension of the arms provide additional muscular force, especially for stronger individuals.

INTRAOCCULAR PRESSURE AND VISUAL ACUITY CHANGES DURING 6 HOURS OF SIMULATED MICROGRAVITY BY DRY FLOATATION

Dahiya M, Tripathi KK, Vevai RJ

Introduction - Intraocular Pressure (IOP) is reported to rise during Parabolic and Space Flights and also during simulation of microgravity in form of Head Down Tilt (HDT). However, no study has ever examined IOP changes during Dry Floatation (DF), a manipulation which simulates cardiovascular effects of exposure to microgravity better than HDT. Additionally, concern that it may be associated with transient impairment of Visual Acuity has also not been addressed, adequately. The study was to examine changes in Intra Ocular Pressure (IOP) and Visual Acuity during microgravity simulation, in the form of thermo-neutral (34.5 –35.5°C), supine Dry Floatation, for 6 hours.

Methods - IOP, Visual Acuity, Thoracic Impedance, Heart Rate and MAP were measured during DF (20 min, 40 min, 60 min, 120 min, 240 min and 360 min) in 12 healthy male volunteers (28-39 yrs) and compared with values in a ground based supine posture. Additionally, IOP was measured in 6 subjects (n=12 eyes), maintained in a ground based supine posture for 2 hours (every 30 min), to examine the repeatability of the instrument (Keelar Pulsair Non Contact tonometer). Results were analysed using repeated measure ANOVA with Greenhouse Geisser correction due to significant departure from sphericity.

Results- IOP did not change with the progression of ground based supine posture (F=0.996; p=0.413). Reliability of the instrument could be rated as excellent, as per criteria of Shorut and Fleiss (1979), as evident from Intra Class Coefficient (0.83). During DF, IOP changed significantly (F=13.45; p=5.61E-07). The values at 20 min and 40 min (19.7±2.9 mm Hg, 19.4±3.2 mm Hg, respectively) were significantly higher (p=0.0001 and p=0.001, respectively) than during supine (17.2±3.2 mm Hg). The increase in IOP was much less pronounced than that reported in parabolic or space flights. Values after 60 min of DF were not different (p=0.061), and values during recovery were lower (p=0.008) than supine values. Thoracic Impedance increased (F=7.747; p=0.001) indicating haemodilution. Heart Rate and MAP decreased (F=4.476; p=0.011 and F=3.627; p=0.021, respectively). However, IOP correlated poorly with Thoracic Impedance (r = -0.06; NS). There was no change in distant or near visual acuity.

Conclusion- Supine Dry Flotation results into a small and transient increase in IOP, which is not associated with changes in visual acuity. The changes are also not correlated with the extent of haemodilution.

DEVELOPMENT OF A DIFFUSION CHAMBER TO EVALUATE *IN VITRO* RESPIRATORY EPITHELIAL CELL LAYER PERMEABILITY IN MICROGRAVITY

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Felipe Falcão, Leonardo Martinelli, Christopher Marriott, Ben Forbes

Introduction: The 3-D clinostat is a valuable tool in the study of how cells might adapt to a microgravity environment. However, drug permeability has not yet been investigated *in vitro* during microgravity simulation, although it has been suggested that this might affect drug absorption *in vivo*. A 'clinostat diffusion chamber' was therefore developed to accommodate epithelial cell layers in the 3-D clinostat to allow transepithelial permeability to be measured in microgravity *in vitro*.

Methods: Human bronchial epithelial Calu-3 cells were used to model the airway epithelium. Cells were seeded on 24-well polyester Transwell® cell culture inserts at a density of 10^5 cells/cm². To investigate the effect of microgravity on cell growth, cells were transferred after 24 h to an air-liquid interface in specifically designed 'clinostat diffusion chambers' and cultured either under gravity (n=4) or under microgravity simulation in the 3-D clinostat (n=4) for 20 d. Transepithelial electrical resistance (TER) was used to monitor the development of the cell layer permeability barrier. To investigate epithelial cell layer function in microgravity, cells were cultured under standard culture conditions for 14 d, then exposed to microgravity simulation for 24 or 48 h (n=4) and evaluated by TER and mannitol flux (as a measure of solute permeability) measurement.

Results: Cells grown under gravity or in microgravity simulation formed layers exhibiting TER values higher than 350 Ω .cm² after 12 and 20 days in culture, respectively. Confluent Calu-3 monolayers transferred to the diffusion chambers maintained a high TER after 24 or 48 h in the 3D-clinostat.

Conclusion: The 'clinostat diffusion chamber' is suitable for growing monolayers of epithelial cells and for investigating their permeability *in vitro* during microgravity simulation in the 3D-clinostat.

OBJECTIVE EVALUATION OF CHANGES IN LEFT VENTRICULAR AND ATRIAL VOLUMES DURING PARABOLIC FLIGHT USING REAL-TIME THREE-DIMENSIONAL ECHOCARDIOGRAPHY

Pierre Vaïda, Enrico G. Caiani, Lynn Weinert, Roberto M. Lang

Background. Weightlessness-related changes in cardiac function have been previously studied during space flights using 2D echocardiography. This methodology is limited in its accuracy to obtain volumetric measurements because 1) it relies on geometric modeling; 2) apical views acquisition is frequently foreshortened. Real-time 3D echocardiographic (RT3DE) imaging overcomes these limitations by acquiring pyramidal datasets encompassing the entire ventricle.

Objectives. To test the feasibility of RT3DE imaging during parabolic flight and to study left heart chamber volumes under different gravity levels. In addition, we also studied the effects of lower body negative pressure (LBNP) applied during microgravity on cardiac volumes.

Methods. RT3DE datasets were obtained (Philips 7500, X3 transducer) during a breath-hold in 16 unmedicated normal subjects in the upright standing position at different gravity conditions (Gz, head-to-foot) during parabolic flight (normogravity, 1Gz; hypergravity, 1.8Gz; microgravity, 0Gz), with LBNP applied (-50 mmHg) at 0Gz in selected parabolas. Data were analyzed (Tomtec) to quantify left ventricular (LV) and atrial (LA) volumes at end-diastole (ED) and end-systole (ES).

Results. RT3DE imaging during parabolic flight was feasible in 14/16 subjects. Compared to 1Gz LV, ED and ES volumes (87 ± 22 ml, 29 ± 9 ml, respectively) significantly decreased at 1.8Gz (72 ± 29 ml, 23 ± 13 ml; $p < 0.05$) and increased at 0Gz (105 ± 32 ml, 35 ± 13 ml; $p < 0.05$). While ejection fraction did not change with gravity, stroke volume was significantly reduced from 58 ± 19 ml at 1Gz to 49 ± 21 ml at 1.8Gz and increased to 69 ± 25 ml at 0Gz. Compared to 1Gz LA, ED and ES volumes (40 ± 12 ml, 18 ± 5 ml, respectively) significantly decreased during 1.8Gz (26 ± 9 ml, 13 ± 4 ml; $p < 0.05$), and increased during 0Gz (58 ± 14 ml, 26 ± 9 ml; $p < 0.05$). When LBNP was applied, ED LV and LA volumes were restored to 1 Gz values. **Conclusion.** Our experimental set-up allowed us to study the effects on the heart of reversible and repeatable acute non-pharmacologically induced variations in venous return. We demonstrated that RT3DE during parabolic flight is feasible and provides the basis for accurate quantification of LV and LA volume changes with gravity. Also, the effects of LBNP at -50mmHg on cardiac volumes during microgravity were quantified. A better understanding of cardiac physiology during parabolic flight could help design and test of possible countermeasures.

SUBJECTIVE ESTIMATE OF FATIGUE AND PHYSICAL STRAIN OF AIRLINE PASSENGERS

Dr Fejsal Boric MD

Introduction: The results of an investigation of passenger's Subjective Estimates of Fatigue (SEF) and corresponding Subjective Estimates of Pain (SEP) in the locomotor's system are presented.

Material & Methods: The investigation comprised a group of airliner passengers (N=56) who spent more than eight hours flying overseas destinations without taking any active walking exercises during the flight, and a control group (N=38) of airliner passengers who had several short relaxing exercises throughout the similar flight. A specially designed questioner and Borg's 10 points rating scales were used to rate SEF and SEP respectively.

Results: SEF corresponded well with pain in the muscles and joints and occurred more frequently in the first group of passengers (74.2 %: 56.8 %). Physical strain or pain occurred most frequently in the lower back (37%), cervical spine (22.4 %), and the joints of the dominant legs (4.2 %).

In the examined group, SEP increased significantly during the flights (36.8 %), while SEP in control group was 15.4 %. In 52.6 % subjects of the examined group all disorders were associated with the long sitting position compared to the control group (18.9). On the basis of medical examination and earlier medical documentation, a diagnosis of fibromyalgia and low back pain were diagnosed equally (15.7).

Conclusion: The benefits of passenger's movement and isometric exercises during the long flight are mentioned and emphasized.

DOES SPACE WEATHER FORECAST WORTHWILE FOR AN AIRLINE IN TERMS OF RADIATION PROTECTION?

Dr Gérard DESMARIS

Regulations in terms of radiation protection demand to take into account the exceptional solar activities. The appropriate French computerized system called SIEVERT is capable to assess the dose received during a flight which was exposed to a radiations storm; but with hindsight.

Today, protective actions are taken in expectation of a severe solar activity : satellites are put into safe mode and astronauts are directed to take shelter.

Does this space weather forecast worthwhile for an airline?

The author explains the limits of the space meteorology and particularly the difficulties to predict well in advance which solar flare could give meaningful dose effects at civil aviation flight level.

However, when the Space Environment Center sends a prediction of strong solar flare, it happens that the Federal Aviation Administration makes direct polar route restrictions due to geomagnetic storm and suggests to lower flight altitude at high latitudes in order to mitigate radiation doses. These two phenomenons, geomagnetic storm and radiation storm are well different. The geomagnetic storms can impact communication and navigational systems but have no known biological effects.

Geomagnetic storms are relatively common when radiation storms are rare, especially these ones expecting to have potential effects at flight level in term of radiation protection.

The experts in radiation protection consider that the recommendations issued after radiation storm warning are too careful. That leads to confusion.

In fact, protection recommendations are issued from an S3 level event forecast; that's saying for a maximum peak flux of 0,1 mSv/h. This threshold seems quite too low and could explain the reaction of the International Aviation and Space Medicine Academy in June 2004. The Academy considered that to have changed flight plans with significant cost was unnecessary in terms of radiation dose protection. Nevertheless in case of severe S4 or extreme S5 events forecasts (peak flux above 1 mSv/h), the recommendations to lower altitude could avoid the more exposed aircrew to overshoot the 6 mSv per year threshold and female pilots 1 mSv during pregnancy.

Anyway, the decision to change route or altitude plans should be discussed in the light of the optimisation principle : "to keep exposure as low as possible according to technical, social and economic factors".

Key words : Cosmic radiations, Solar flare, Aircrew, Solar activity forecast

BIG BULLAE – AEROMEDICAL CERTIFICATION DECISIONS IN AIRCREW WITH PULMONARY EMPHYSEMA

Prof. Robert Anthony Cocks, Dr. Tania Jagathesan, Dr. Andrew Hopkirk

Introduction:

Pulmonary emphysema is defined as an increase in size in the airspaces distal to the terminal bronchiole with destruction of tissue. This results in the loss of functioning tissue, structural weakness, and the eventual formation of large spaces termed bullae. The main sequelae are reduction in respiratory function and the risk of pneumothorax. Rupture of bullae and air embolism may occur. The latter complications are a particular risk in aviators subjected to decreased ambient pressure.

Material and Methods:

Three pilots with large emphysematous bullae were studied. Each was investigated with Pulmonary Function Tests and Computerised Tomography (CT) scanning. A review of the medical literature was undertaken.

Results:

Past medical history, including that of smoking and of previous pneumothorax, was found to be significant. Disease may initially be silent and asymptomatic. The role of routine medical examinations and chest radiography in the detection of disease is discussed and the aeromedical certification decision process described.

Conclusion:

Large pulmonary emphysematous bullae are a significant and hazardous finding in aircrew. While small, para-mediastinal bullae may be acceptable for aviation medical certification, larger cavitations require careful risk assessment and loss of certification is a possible consequence.

Educational Objectives:

The presentation offers a practical template for the investigation and aeromedical certification of aircrew with pulmonary emphysema.

**CIVIL AVIATION MEDICAL CERTIFICATION: STRUCTURE
CARDIOVASCULAR RISK ASSESSMENT IS SUPERIOR TO
*TRADITIONAL AGE-BASED EXCLUSION PARADIGMS***

Dr Dougal B Watson, Preitner CG, Navathe PD, & Drane AM.

The purpose of civil aviation medical certification is to provide reasonable assurance that the pilot is “physically and mentally capable” of safely performing aviation duties and that there is no medical reason that makes the pilot “liable to incapacitation”. Increasing age brings with it an increase in the risk of medical incapacitation as well as a reduction in many of the physical and mental capabilities required for safe aviation. It also brings an increase in experience and, some would argue, and increase in insight and wisdom.

While there can be little doubt that aspects of pilot performance deteriorate with age there has been continuing debate within the aviation industry in respect to the suitability of age-based endpoints such as the exclusion of pilots from passenger transport captaincy at a predetermined age. Some countries, however, have not implemented such age-based exclusion provisions and endeavour to assess older aircrew, for medical certification purposes, using an evidence-based risk management approach.

Given the importance of the triumvirate of cardiovascular risk, neurological risk, and psychophysical performance the formal structured assessment of cardiovascular risk becomes a very important regulatory tool. In this presentation we describe the methods currently utilised in structured aircrew cardiovascular risk assessment, explore the utility and cost-benefit of such a system, debunk some of the arguments against this method, and discuss how this approach serves to maintain aviation safety and keep older pilots active within the aviation industry.

Our presentation concludes with the question “Why isn’t everyone doing this?”

Theme: Cardiovascular risk assessment and civil aviation medical certification
Training objective: Appreciate the benefits of structured cardiovascular risk assessment for civil aviation regulatory purposes

AIR TRAFFIC CONTROLLERS AND BIOCHEMICAL EFFECTS OF SHIFT WORKING- A CROSS-SECTIONAL STUDY

Masoumeh Ghasvand, Reza Golpira, Ramin Heshmat, Koroush Soleimani.

Introduction: previous studies have indicated on association between shift work and blood biochemical factors disturbances. blood biochemical factors disturbances could be due to internal desynchronization. The aim of present epidemiological study was to investigate, whether shift working is associated with serum lipids and fasting blood glucose disturbances or not.

Material and methods: A total of 442 air traffic controllers between the ages of 21 and 59 years in this study filled out a questionnaire, and total cholesterol, triglyceride and HDL-C concentration were measured after 12- hours fasting. Association between shift work and biochemical variables were measured. The SPSS software version 11.5 and STATA version 8 were used for statistical analysis, the X² and fisher's exact test were used for comparing the qualitative variables and for quantitative variables with normal distribution we used the parametric tests. Odd's ratio (OR), and 95% confidence interval (95% CI) was used for estimating the effect of shift working on lipid profile and high blood glucose levels. Logistic regression modeling was used for multivariable analysis and adjusting the effect of different variables.

Results: Sub- populations in this study were consisting of 305(69%) shift workers and 137(31%) day workers. The mean age of the shiftworkers was 40 ± 10 years old and the dayworkers was 40 ± 9. The mean of variables in the present study for total cholesterol, LDL-C ,HDL-C, triglyceride and Fasting blood glucose in the shiftworkers were respectively: 195±37mg/dl, 116.8±34.8mg/dl, 48.2±15.1mg/dl, 154±80mg/dl, 92±20mg/dl and in the dayworkers were respectively: 200±40mg/dl, 125.3±38.6mg/dl, 48.8±23.3mg/dl, 151± 77mg/dl, 90± 14mg/dl. Adjusted Odd's ratio for the effect of shiftworking on the biochemical blood factors didn't change the result.

Conclusion: This study showed that air traffic control shiftworkers didn't have disturbances in the biochemical blood factors. This finding persisted after adjustment was made for age. These results could be due to monitor intermittently for biochemical blood factors in this group. But this study doesn't rule out physiological and behavioral effects of shift working on the shiftworkers. It was concluded that shiftworkers should be examined periodically for biochemical blood factors, physiological and behavioral effects of shiftworking.

REQUIREMENTS FOR EUROPEAN CLASS 3 MEDICAL CERTIFICATION OF AIR TRAFFIC CONTROLLERS

RLMA VERMEIREN

Introduction: EUROCONTROL is an international treaty organisation which was established in 1960 in order to create a common European airspace system but subsequently reoriented to focus on the harmonisation and integration of air navigation services in Europe. The Organisation currently has 36 Member States, represented on its governing bodies by their Ministers of Transport and Directors General of Civil Aviation, who take decisions by consensus.

Methods: In this evolution from a common European ATM project to harmonisation and support services, human factors aspects are also under consideration: manpower planning, performance evaluation, critical incident stress management programmes and also the development of a European licensing system for ATC, including standardised medical certification. Since a number of variations on ICAO and JAA standards existed within ATC in Europe, a harmonised approach seemed necessary. An international task force was therefore created to establish a document relating to medical criteria, which could serve as the basis for an acceptable means of compliance for Member States. Of note in the composition of this task force was the combination of medical doctors with ATC certification experience and professionals from the ATC environment. This was intended to ensure practice-based guidelines.

Results: The document was published in February 2006 as the **Requirements for European Class 3 Medical Certification of Air Traffic Controllers**. It incorporates the ICAO Class 3 standards as minima, but is based on the aviation medical considerations also used for JAA Class 1 medical criteria for professional pilots, because the sudden incapacity of an air traffic controller could have a similar impact on flight safety to the sudden incapacity of a professional pilot.

The Directive 2006/23/EC of the European Union, published on 5 April 2006 and to be transposed within 2 years into the national legislation of all 25 EU Member States, states in article 12.2 that the issuing of medical certificates shall be consistent with annex 1 of ICAO and the Eurocontrol class 3 medical requirements, which should enable free labour movement for ATCO's in EU Member States. Also the Human Resources representatives of the 36 Eurocontrol Member States have agreed in March 2006 to release the document as a European Air Traffic Management Programme deliverable, which gives it the status of acceptable compliance to the Safety Regulatory Requirements applicable in these Member States.

Session topic: regulatory medicine, air traffic control.

AEROMEDICAL DECISION MAKING IN PILOT APPLICANTS WITH A HISTORY OF FEBRILE CONVULSIONS

Wg Cdr PD Navathe

Introduction: Febrile convulsions are a common finding in the general population, and often present in the history of those who present for an aviation related medical examination. With more awareness about the problem, these cases can present a difficult problem for the person making an aeromedical decision. Different types of febrile convulsions have different outcomes, and there is considerable difference of opinion about the recurrence of convulsions in adulthood. Much of the decision making is dependant upon a detailed account and documentation of the events that occurred at the time, and this can be a challenge.

Discussion: This paper presents a case of a pilot who had febrile convulsions as a child, and describes the efforts made by the Civil Aviation Authority of New Zealand to make an evidence based decision about medical certification in this case. Policies of other jurisdictions are presented and a paradigm for assessment of such cases described.

Educational Objective : This paper will suggest a paradigm for making aeromedical decision making in persons who have a history of febrile convulsions

CLINICAL SIGNIFICANCE AND PROGNOSIS OF INCOMPLETE RIGHT BUNDLE BRANCH BLOCK

Wg Cdr V Vasdev, Wg Cdr D S Chadha, Air Cmde R K Ganjoo AVSM VSM

Introduction:

Incomplete RBBB is considered a benign ECG abnormality with little clinical significance in absence of structural and Ischemic heart disease. The purpose of this study was to follow up cases of incomplete Right bundle branch block (RBBB) incidentally detected on routine ECG, amongst Air force personnel and civil aircrew, with a view to evaluate their clinical significance.

Material & Methods :

Hundred and six subjects with incomplete RBBB were identified from a group of over 5000 Air Force personnel and civil pilots. All cases were further evaluated to rule out structural and ischemic heart disease. They were subjected to a detailed clinical examination, resting electrocardiogram, exercise stress test and echocardiography.

Results :

The mean age of subjects was 38 yrs. The mean observation period was 05 yrs. Two individuals were detected to have atrial septal defect. None of the subjects had evidence of Ischemic heart disease. Five individuals showed progression to complete RBBB, however none of them showed deterioration of Cardiac functions on follow up.

Conclusion :

Incomplete RBBB in absence of structural heart disease or ischemic heart disease carries good prognosis and does not require frequent close follow up.

A CASE OF EMERGING LEFT AXIS DEVIATION – LEFT ANTERO-SUPERIOR FASCICULAR BLOCK (HEMI-BLOCK) IN A 65 YEAR OLD PILOT: AERO-MEDICAL CONSIDERATIONS

Professor Michael Joy, OBE, MD, FRCP, FACC, FESC, FRAeS

Rosenbaum's criteria for left antero-superior fascicular block (left anterior hemi-block) include a mean manifest frontal QRS axis in the range -45 to -90 degrees, an rS pattern in II, III and aVF, a qR pattern in I and aVL and a QRS duration < 120 ms. The requirement for the rS/qR is to deny the presence of incomplete left bundle branch block. This pattern is present in 0.5 - 5% of routine professional air-crew ECG's and is most commonly innocent. Causes of this appearance include congenital anomaly in the conducting fascicle, myocardial ischaemia (via injury to the inter-ventricular septum, or, inferior infarction), hypertension, (dilated) cardiomyopathy, Lev's syndrome (proximal fibrosis of the Bundle of His), Lenegre's syndrome (distal fibrosis) as well a heterogeneous group which includes myocarditis and the infiltrative condition such as amyloidosis.

The propositus was a 65 year old Class II pilot with twin and instrument ratings. There was no relevant past medical history and he was a lifelong non smoker. The mean frontal axis evolved from -10 to $+45$ over a 10 year interval during which he remained normotensive with a good lipid profile, and, asymptomatic. Clinical examination was unremarkable. The ECG's will be presented together with the exercise and echo data – both were essentially normal and the trans-mitral EA ratio was normal.

The aeromedical disposition will be discussed in the context of the author's experience of the scrutiny of some 180,000 aircrew ECG's over a 30 year period.

Theme of the Abstract : Case report on a pilot whose ECG showed evolution of the mean frontal axis from $+10$ to -45 over 10 years, otherwise well. The differential diagnoses and likely outcomes will be discussed.

Educational Objective : Presentation of the common problem on an evolving mean frontal QRS axis and aviation certification.

REMOTE EVALUATION AND ORIENTATION OF THE CREW: PROPOSAL OF A METHOD FOR BAROTITIS PREVENTION

Introduction: Flying with upper airways problems can induce the development of middle ear gas trapped disease. Barotitis is an important cause of absenteeism in aircrew personnel (flight attendants and pilots). When the crew member is away from his/her base and complains of ENT symptoms after a flight leg, a decision must be taken in order to ascertain his/her condition to safely fly back. FRB has a 24/7 medical call centre with toll free access number and electronic patient record capability. The doctor on duty has access to a database of medical resources and the power to authorize expenses. A method of remote clinical evaluation and orientation was elaborated to support decision.

Method: The crew member with ENT complaints makes contact with the medical department to answer 4 simple questions:

- 1) Pain in the ear/otalgia? Yes or No
- 2) Any hearing loss (aural fullness or "full ear")? Yes or No
- 3) Ear discharge? Yes or No
- 4) Valsalva's manoeuvre: Effective or not effective, in both ears

Management:

- a) With pain, hearing loss and not effective Valsalva's manoeuvre = Do not fly. Local medical attention required and authorized;
- b) With pain, without hearing loss and effective Valsalva's manoeuvre = Fly with symptomatic relief medication. Contact medical department upon arrival;
- c) Without pain, with hearing loss and effective Valsalva's manoeuvre = Fly with oral non-sedating antihistamines + decongestants in spray form. Contact medical department upon arrival;
- d) Without pain, with hearing loss and not effective Valsalva's manoeuvre = Local medical attention required and authorized;
- e) With ear discharge = Fly back to base. Contact medical department immediately upon arrival. If flight attendant, not allowed to work during flight.

Conclusion: Through this tool we believe that is possible to make a remote cost/risk/benefit evaluation and subsequent orientation to crew members.

Radiological Assessment of Spinal Abnormalities in Aviation
- A Critique and prospect

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Wg Cdr VG Vasishta, Gp Capt RK Garg, Maj Gen JS Kulkarni

A critical reexamination and review of spinal skiagrams focusing attention on the regions which are of aeromedical significance revealed that among 167 Radiological evaluations for aircrew duties at the Institute of Aerospace Medicine, IAF, Bangalore, (76 candidates, 5 cadets and 86 serving personnel) 88 had abnormalities which had escaped detection during the previous examination. Among these 50 were of vital aeromedical significance. Two important suggestions are made with a view to improve the standard of selection and for maintaining aircrew at the fittest level. First, all candidates for selection for aircrew duties should be screened taking into consideration the regions of the spine of special aeromedical significance. Secondly, Training clinical Radiologists in Aviation Radiology would ensure uniform approach to aeromedical evaluation of the spine.

THALASSAEMIA MAJOR IN CIVIL FLYING: A CASE REPORT

Gp Capt S Damodaran*, Gp Capt C K Ranjan⁺ & Air Cmde R C Kashyap[#]

Thalassaemia is a quantitative Haemoglobinopathy. It can be alpha or beta Thalassaemia depending on the defective globin chain in the haemoglobin. Each one can be either in a heterozygous or homozygous form depending on the inheritance. The heterozygous form is known as Thalassaemia minor or Thalassaemia trait and the homozygous form is the Thalassaemia major. Beta Thalassaemia is the most prevalent, with a worldwide distribution. Beta Thalassaemia minor results in no anaemia or very slight anaemia. These cases are generally asymptomatic and do not require blood transfusion or iron supplement unless proven to be iron deficient. An Individual with Beta Thalassaemia minor has a normal life span and can be considered fit for flying duties. The homozygous form is the Thalassaemia major. Children with Beta Thalassaemia major develop symptoms in the first year of life and require repeated blood transfusion. Unfortunately repeated blood transfusion may result in iron overload and the risk of viral transmission. Bone marrow transplantation may cure Thalassaemia major provided an HLA-matched donor is available. Aeromedical evaluation of such cases require careful consideration on a case to case basis as there are no guidelines on disposal of such cases. A case of Beta Thalassaemia major treated with bone marrow transplant from his brother maintaining post-transplant stable blood count and Thalassaemia minor status with history of elevated liver enzymes and viral Hepatitis-A is discussed for its aeromedical implication in evaluation for civil aircrew duties.

Key words : Beta Thalassaemia major, Bone marrow transplant, flying duties

OCCUPATIONAL CONTACT DERMATITIS TO AVIATION LUBRICANT- A CASE REPORT

Gp Capt PS Murthy

A 32 yrs old technical tradesman presented with intense itching, oozing and crusting of both the hands of 10 days duration. Detailed history revealed that he has recently arrived on posting to the Base Repair Depot and is presently working on aircraft (AN32) servicing. Being new to this type of the job he has not been taking adequate safety precautions and had an accidental occupational exposure to some of the FOLs used. There was no history of contact allergies or drug intake.

Dermatological examination revealed erythema, oozing, crusting of both palms extending onto the dorsum without clear demarcation. A provisional diagnosis of Allergic Contact Dermatitis was made and a search began to identify the offending allergen.

A list of FOLs used during the course of his job was made and Material Safety Data Sheets (MSDS) was obtained from the supplier M/s AVI-OIL India Ltd. Attempts to obtain the composition of each of the lubricants did not succeed as the manufacturers have withheld this information as "trade secret". The data sheets have advised general precautions during handling of the FOL's but were vague about the sensitization potential of the chemicals contained. A diligent Internet search failed to identify the possible allergen as existing literature on this subject was scarce. As there were no specific guidelines for patch-testing in MSDS, a crude test was performed by applying minute quantities of different lubricants on the upper back. The individual developed itching and erythema to NYCO GREASE GN10 which was then identified as possible allergen in this case. It is a carboxylic ester with additives jellified by lithium soap. It also contains aromatic amines and triazole derivatives, both of which are known to cause contact dermatitis.

He was treated with cold compresses and topical steroids and had complete resolution of his skin rashes.. He was advised to take precautions while handling FOLs in future. He did not report with recurrence till date.

Educational objective: Contact dermatitis due to occupational exposure is a leading cause for work related absenteeism and compensation claims in Industrial world. Hand eczemas in this high risk group are to be treated with a high index of suspicion for occupational contact dermatitis. Any patients who states that his hand eczema improves while on vacation must be presumed to have occupational contact dermatitis unless proved otherwise. Secrecy of the chemical composition of military grade FOLs make identification of the actual offending chemical impossible in most cases. Squadron Medical Officers must ensure that all safety precautions mentioned in MSDS are adhered to on the shop floor at all times. Health education about the risks involved reduces the incidence.

GERD IN A YOUNG FIGHTER PILOT - AEROMEDICAL IMPLICATIONS

Wg Cdr PK Tyagi

Introduction: Gastro-oesophageal reflux disease (GERD / GORD) in a fighter pilot could present a challenge to the aeromedical practitioner. While mild GERD with infrequent symptoms may be little cause for concern, a chronic, severe and recurrent disease has important aeromedical implications. Inflation of anti-G suit (AGS), performance of Anti-G straining manoeuvre (AGSM) and changes in gravitation position are inherent to fighter flying. These when coupled with reduced tone or inappropriate relaxation of the lower oesophageal sphincter (LOS) can aggravate symptoms and cause recurrent oesphagitis which may dictate a change from fighter to helicopter / transport stream.

Case Report. The paper discusses chronic, severe and recurrent GERD detected in a young MiG-21 pilot of this base.

Key Words : GERD, LOS, AGSM, AGS

SPINAL INJURY IN MULTIPLE EJECTIONS

Brigadier Harish Malik

Introduction: Compression fracture of spine, especially in the thoraco-lumber region, is the commonest significant injury sustained following an ejection. The disposal of the post ejection cases in IAF is done taking into consideration the symptoms of the pilot, neurological deficits if any, range of axial movements, stability of the fracture and the MRI findings. Cases of fully healed stable compression fractures are given full flying category. However, there is always a doubt whether damaged area is unduly susceptible to repeat fracture during the subsequent ejection. The present study was undertaken to analyse the cases of pilots who have ejected more than once to determine whether there is increased probability of sustaining spinal fractures after an ejection in which there may or may not have been spinal fracture.

Material & Methods: Computerised records available at the Dte of Flight Safety at Air HQ, RK Puram were scrutinised to determine the cases of pilots who had ejected more than once.

Results: There have been 22 cases of multiple ejections in IAF from 1973 till date. Out of these, 20 pilots had ejected twice whereas two pilots had ejected three times. Only three pilots out of 22 sustained spinal fracture in both the ejections. Both the pilots who undertook third ejection sustained spinal fracture during the third ejection; one of these had not got any injury during the first two ejections.

Conclusion: Although the total number is small, this study reveals that an ejection does not expose an individual to an increased incidence of spinal injuries during successive ejections.

Key Words: Accelerations, Compression fracture, Spinal disabilities, Stable fracture.

UNDERSTANDING THE NEED AND MAGNITUDE OF HELMET TO CANOPY CLEARANCE IN AIRCRAFT COCKPITS.

Wg Cdr Narinder Taneja

Introduction: The Indian Air Force (IAF) employs four anthropometric parameters for assessing the fitness of candidates for joining IAF for aircrew duties. Of these, sitting height has played a critical role in allotting trainee pilots the correct trainer aircraft. When conducting aircraft-aircrew compatibility assessments, it is an accepted, unwritten norm that three fingers space (approximately 3-5 cm) is kept between the top of the helmet and the undersurface of the canopy. Literature search did not reveal any published document on this aspect. This study was therefore undertaken to develop a clearer understanding on the role of helmet-canopy clearance in the cockpit.

Methods . A brief questionnaire was designed for the purpose. Aircrew were asked if clearance from helmet to canopy was important, and if yes, why. The procedure they were following to maintain this clearance in the aircraft they were currently flying was also asked.

Results. A total of 132 completed questionnaire forms were received. The prime reason for such clearance was to prevent injuries to the head and neck during ejection followed by mobility of the head during combat. Majority of the aircrew considered 3 fingers as the adequate clearance. Almost a quarter of the respondents thought that >3 fingers was the required clearance. Even the procedure followed in ensuring these clearances was different.

Discussion. This questionnaire survey provides unique insights into aircrew perspective of the need and significance of helmet-canopy clearance. While some aircrew consider prevention of injuries as the foremost concern others consider mobility for the head to be of much more importance. There is a need to specify the process of determining the clearance and amount of clearance for each type of aircraft. There is also a difference in opinion among aircrew of the same fleet about an 'adequate' helmet canopy clearance.

IS BACKACHE A SERIOUS MALADY AMONG INDIAN HELICOPTER PILOTS – A SURVEY REPORT

Wg Cdr Sanjiv Sharma, Wg Cdr Anupam Agarwal

Background Backache among helicopter pilots is a world wide malady, extensively studied, yet with no known remedy. Anecdotal reports and a few field based studies focussing on military aviators in India have also reported a varying incidence. Therefore this survey was undertaken among the helicopter pilots of the Indian Air Force (IAF) and civil organisation operating a helicopter fleet to study the extent of incidence of backache.

Methods An extensive questionnaire survey was sought from helicopter pilots across the country. The questionnaire, besides other inputs, included detailed information about their duty related activities including flying and personal life style.

Results The fill rate for the questionnaire was 82.50% (n = 165). The incidence of backache of varying severity was reported to be 57.57% (n = 95). The results have been further analysed as per the type of aircraft, flight operations and personal life style.

Discussion The factors responsible for the reported incidence of backache, probable aetiological correlations and various remedial measures attempted in the IAF are discussed.

Recommendation Considering that the backache in helicopter pilots is primarily related to posture during flying and sedate life style may affect the muscular tone of the spine, the preliminary recommendation of this study is organised toning up exercise by helicopter pilots. Aero Medical Specialist can play a significant role in development of such programme at the Station or Squadron level.

Educational Objectives This paper analyses the incidence of backache among Indian helicopter pilots. This shall help the aero medical specialists to plan preventive measures at individual level, and help the employer plan the long term employability of its helicopter pilots keeping the incidence and severity of this long known malady.

Keywords : Backche; Helicopter Pilots.

ANALYSIS OF THE SURVIVAL OUTCOMES IN 1,617 EJECTIONS FROM HIGH PERFORMANCE AIRCRAFT

Dr David G. Newman

Introduction: The ejection seat continues to save the lives of pilots around the world. Many air forces have published their ejection injury and survival statistics. The purpose of this study was to analyse all published ejection injury series, with particular emphasis on survival rates and prevalence of vertebral fractures.

Methods: The aeromedical literature was reviewed for all studies relating to ejection injuries. A total of 11 studies were used in this analysis. The analysis focused on the total number of ejections, the number of fatalities and the prevalence of ejection-related vertebral fracture. A further assessment of the contributory factors for fatality and vertebral fracture was also undertaken.

Results: A total of 1617 ejections were analysed. Out of this number, there were 117 fatalities, giving an overall survival rate of 92.8%. Only 8 studies gave details on the prevalence of ejection-related vertebral fractures. 119 pilots sustained at least one ejection-related vertebral fracture out of a total of 561 ejections, resulting in a vertebral fracture rate of 21.2%. The most common factors contributing to fatal ejection were ejecting outside the performance envelope of the seat, and delaying the ejection decision. **Conclusions:** The results of this analysis demonstrate that the chances of survival following ejection from a high-performance aircraft are extremely high. The advent of more sophisticated and capable ejection seat systems has further increased the chances of survival. While aircrew ejecting from a stricken aircraft have a 1 in 5 chance of sustaining a vertebral fracture, the ejection seat remains a vital life-saving device for pilots of high performance aircraft.

OBJECTIVE ASSESSMENT OF HYPERBARIC OXYGEN THERAPY ON DIABETIC FOOT BY PULSE DOPPLER METHOD: A PRELIMINARY STUDY

Wg Cdr S Bhargava, Wg Cdr CS Thakur

Introduction. Diabetes is a fairly common disease seen in India with prevalence of almost 17% in the Indian urban population and of 2.5% in the rural population. Diabetic ulcers are the most common foot injuries leading to lower extremity amputation. Peripheral arterial occlusive disease is four times more prevalent in diabetics than in non diabetics. Doppler ultrasound is frequently used as a screening tool when assessing patients for arterial disease. The ankle brachial pressure index (ABPI) is derived from the highest of the two arm systolic pressures, taken as the best non-invasive estimate of central systolic pressures, and the highest ankle systolic pressure for each limb and can indicate both the presence and severity of arterial disease. HBO has been proposed to achieve adequate tissue oxygen tension to permit healing of ischemic diabetic foot ulcers.

Results: The aim of this paper is to study the effect of hyperbaric oxygen therapy on the diabetic foot and to assess the progress by using a pulse Doppler. Twelve diabetics with chronic foot lesions were studied over a period of one year at our center. The HBOT was given in a multi place hyperbaric oxygen chamber at 1 AMTC, AF Hindon. The HBOT was administered at 2.5 atmospheres pressure for a period of 90 minutes at each of the sittings. The overall mean age of the patient's presentation was 43.5 yrs. The symptom period ranged from 15 days to 06 weeks. 5 patients reported with history of repeated ulcers. Non specific reports of pain, oozing from the wound and numbness were often the only complaints. A maximum of 28 runs of HBOT were administered to each patient with an average of 17.5 runs per patient. 7 (58.3%) cases showed ABPI >1 depicting normal arterial blood flow and 5 (41.6 %) cases showed ABPI <1.00 annotated an abnormal blood flow. In this study there was a significant overall control of wound infection and resultant wound healing after administration of HBOT.

Key Words : Non Healing ulcers, Pulse Doppler, Hyperbaric oxygen therapy

HIGH ALTITUDE PROBLEMS- AN IAF EXPERIENCE

Wg Cdr Sajjan Sethi, Gp Capt N Rattan, VSM

Operations conducted at high altitude entail the risk of experience of hypoxia, loss of cabin pressure, barotraumas, and exposure to low temperatures. These factors are the fundamental in the occurrence of aviation accidents and need to be countered effectively so as to ensure a safe flying environment. An extensive study was conducted in the Indian Air Force to assess the prevalence of experience of these problems. 613 aircrew were involved in this study, of which 145 (23.65%) experienced hypoxia. Further analysis revealed that 37.12% of the helicopter aircrew, 30.76% of the transport and 17.14% the fighter stream aircrew had experienced hypoxia. Loss of cabin pressure was experienced by a total of 124 (25.77%) aircrew, amongst which there were 62.09% of fighter and 37.91% of the transport streams 66.72% of all aircrew experienced barotrauma amongst which 78.63% were transport, 64.22% fighter, and 67.42% helicopter aircrew. 53.78% helicopter, 46.03% transport and 25.63% fighter aircrew experienced effects of exposure to cold. It was concluded that hypoxia, barotrauma, and effects of cold are still significant influences that effect flight safety. The causes and details are discussed in this paper.

ALTITUDE TRAINING FOR THE NEXT GENERATION OF AIRCREW

Group Captain DP Gradwell

Introduction. Since the Second World War the benefit of providing military aircrew with personal experience of exposure to altitude in the controlled environment of hypobaric chambers has been recognised. Knowledge and experience of the hazards as well as improvements in the life support systems and cabin pressurization have reduced the lives lost at altitude. In some nations the perception that hypobaric chamber training is itself unacceptably hazardous has led to attempts to provide experience of hypoxia by the respiration of reduced oxygen breathing gases at ground level or at a modest altitude.

Discussion. In the UK not only do we continue the practice of providing altitude training experience for aircrew but we strive to maintain its direct relevance for the aircrew by making the hypobaric exposures as analogous as possible to the operational environment for the individual. Thus aircrew are rapidly decompressed across a pressure difference to a final altitude pertinent to the cockpit pressurisation and operational ceiling of their specific aircraft type. With the introduction of new high altitude aircraft into military service, this philosophy has been maintained and also led to the adoption of a more representative chamber profile for the altitude training of rotary wing (RW) aircrew, who are currently required to operate at altitudes not previously encountered during RW sorties.

Conclusion. Aircrew benefit from personal experience of altitude exposure in training and that experience should contain more than the induction of hypoxia. Respiring hypoxic gas mixtures at ground level cannot achieve this degree of fidelity. Tailoring hypobaric chamber profiles to reflect as accurately as possible the operational environment in which specific aircrew will fly serves to retain the support of the flying training community for the effort expended on their behalf.

OTOSCLEROSIS AND AEROMEDICAL FITNESS

J COUTURIER, A MARTIN SAINT LAURENT, M.M FRACHET

Introduction :

L'otospongiose est une pathologie souvent dépistée par les centres d'expertise lors des visites orl d'aptitude du personnel navigant technique et commercial civil

Cette pathologie, dans le passé aboutissait à une décision d'inaptitude définitive. Les succès de la cophochirurgie dans ce domaine ont amené le *Conseil Médical de L'Aviation Civile* (CMAC) à envisagé la possibilité d'une aptitude par dérogation en visite de renouvellement dans certaines conditions précises que nous avons étudié

Rappel anatomo-clinique :

L'otospongiose est ostéodystrophie de la capsule otique, réalisant une surdité uni ou bilatérale, de transmission ou mixte, à tympan normal, d'évolution lentement progressive

Son traitement est chirurgical

Méthode :

Analyse des différents cas d'otospongiose découverts en visite de renouvellement et des décisions prises par le CMAC

Etude rétrospective sur 5 ans effectuée à partir des dossiers de demande de dérogation adressés au CMAC par les centres d'expertise

La majorité des dossiers étant représenté par le personnel navigant technique et commercial d'Air France

Résultats :

L'otospongiose représente 17% des dossiers examinés en ORL en visite de renouvellement de début 2000 à fin 2004

1/3 ont justifié d'une inaptitude, 2/3 ont bénéficié d'une aptitude par dérogation selon des critères spécifiques respectant les conditions de sécurité aérienne

Conclusion

Adaptabilité du CMAC à l'amélioration des techniques chirurgicales

Information des médecins agréés et experts de ces modifications de prise en charge de l'otospongiose

Nécessité d'une surveillance stricte, du fait aujourd'hui de l'absence de recul suffisant pour évaluer le rôle de l'activité aéronautique à long terme pour le personnel navigant opéré d'une otospongiose

Mots clefs : otospongiose, pnt pnc, CEMPN, ORL

Keywords : otosclerosis, pilot, flight attendant, AMC, ENT

THE IMPORTANCE OF EXAMINATION OCULAR BLOOD FLOW IN EARLY DIAGNOSTIC GLAUCOMA IN FLYING PERSONNEL

D. Bartoš

Introduction: Glaucoma is multifactorial disease. It is well known, that elevated intraocular pressure (IOP) damages the optic nerve and evidence of neurotoxic exists. Additionally, there is growing evidence that deficits in ocular blood flow (OBF) may be a factor in glaucoma. OBF as a diagnostic measurement is now recognized as important in research into this disease. Current technology such as color Doppler imaging (CDI), scanning laser doppler flowmetry (SLDF) and the Blood Flow Analyzer (BFA) was used to track ocular blood flow and provide significant data on the vascular network in the eye.

Methods: The measurement of retrobulbar blood flow was performed by CDI. The blood velocity in the ophthalmic artery (OA) and the central retinal artery (CRA) were measured. Using Heidelberg Retina Flowmeter (HRF) the retinal and the optic nerve head (ONH) microcirculation was examined. Pulsatile choroidal perfusion was measured by BFA. Pulse amplitude (PA), pulse volume (PV) and pulsatile ocular blood flow (POBF) were measured.

Results: Three groups of respondents were examined – 1/ 14 patients (28 eyes) primary open-angle glaucoma (POAG), 2/ 10 patients (20 eyes) normal-tension glaucoma (NTG), 13 respondents (26 eyes) control age-matched group (CG). We have found statistically significant difference in the RI (AO, CRA) between the CG and POAG, NTG. At POAG and NTG the blood flow in the ONH and the retina was significantly reduced to CG. POBF at NTG was significantly lower to CG.

Conclusion: The reduction in blood flow involves different parts of the eye, including the ONH, choroidal and retinal circulation, as well as retrobulbar blood flow. OBF decreases with increasing damage, however the reduction occurs in both early and late stages of glaucoma.

AVIATION OCCUPATIONAL NOISE: CHALLENGES AND SOLUTIONS

Dr Bhupi Singh

Noise Injury (NI) among aircrew and aviation ground personnel is a major Occupational Health and Safety (OH&S) issue and has become a leading cause for the payment disability compensation in many countries, particular in military aviation. The noise levels near the flight decks routinely range from 130-150 dB, necessitating 65 dBA of protective broadband control to meet the safe noise levels. To compound the problem, the standard for exposure to occupational noise has recently been revised downwards, from 85dB(A) to 80db(A) for an 8-hour workday. Current hearing protective devices in use in most air forces are unable to provide inadequate protection in and around many modern platforms. To meet this challenge, a significant amount of research activities are currently in progress in the US, and EU for a better understanding of the problem and to provide more effective protection to personnel working in high noise areas. Many air forces are turning to novel solutions, like communications ear plugs, custom-moulded ear pieces, and active noise reduction. This presentation reviews the features of various hearing protective devices (HPDs), and discusses their relative advantage and disadvantages.

A STUDY OF MIDDLE EAR DYNAMICS IN AVIATORS DURING EAR CLEARANCE TEST

Wg Cdr C S Thakur, Wg Cdr S Bhargava, Gp Capt Arvind Jha

Aircrews are exposed to sudden changes in environmental pressure especially during ascent and descent phases of flight. These changes in the ambient pressure affect the semi-closed cavities like middle ear. It is important for the aircrew to have normal eustachian tube functions, to minimize occurrence of barotrauma during flying or ear clearance test. Tympanometry is objective and non-invasive method, which facilitates complete evaluation of middle ear functions. Presently, middle ear pressures beyond the range of ± 25 mm of water are considered abnormal in aviators in Indian Air Force. This is at variance with currently accepted normal range of international standards of middle ear pressure which is ± 100 mm of water. To avoid this ambiguity, there is need to standardise the Indian standards for normal middle ear pressure (MEP) in aviators with internationally accepted standards.

The present study was undertaken to objectively assess the Eustachian tube functions of asymptomatic aviator with middle ear pressure beyond ± 25 mm water, by exposing them in altitude simulator following standard protocol for ear clearance test. This objective evaluation of the range of middle ear pressure as safe for military flying in IAF would help in reducing the grounding time of asymptomatic aviator.

The subjects for this study were divided into two groups. Group-I comprised of 112 asymptomatic aviators without preexisting ear pathology. Their mean age was 26.7 ± 4.6 years. All the subjects in this group were given ear clearance test (ECT) in altitude simulator, pre & post test tympanometry was done to generate the data about the subjects who are having middle ear pressure beyond currently accepted normal range and could clear ECT. Out of 220 tested ears in this group 74(33.6%) were found to have positive values of MEP ($+25.24 \pm 32.6$ mm of water) with 22 ears (29.7%) having MEP above +25 mm of water. Rest of 146 ears (66.4%) were recorded to have negative values of MEP (-19.14 ± 14.84 mm of water) with 33 (22.6%) of these having values beyond -25 mm of water. The range of MEP in this group was found to be between -100 to +139 mm of water. Post ECT values of ear volume & compliance was found to be reduced but not significant in ECT fit as well as ECT unfit cases, as compared to the pre ECT values of these parameters. Group-II consisted of 10 asymptomatic aviators (mean age 32 ± 6.03 years) with preexisting healed middle ear pathology. The aviators in this group were also given ear clearance test and were observed for development of any symptoms. Pre and post ear clearance test tympanometry was recorded, to find out range of middle ear pressure in subjects with preexisting middle ear pathology who were able to successfully complete the test. Out of 20 tested ears in this group 14(70%) had positive values of MEP ($+14.6 \pm 16.78$) mm of water with 14.28% of these having MEP values more than +25 mm of water and the rest of 6 ears(30%) having negative values of

MEP (-13.0 ± 8.02 mm of water). Range of MEP in this group was from - 25 to +65 mm of water. The difference in pre and post ECT values of Volume & Compliance of ear drum was not significant. Four subjects (three in Gp I and one in Gp II) 3.3% of all subjects who had MEP in currently accepted range, could not clear ECT.

The study thus brought out the range of the middle ear pressure in healthy Indian aviators and also the range of the MEP which can be accepted for safe flying as confirmed by successful ear clearance test in altitude simulator. These results have been discussed and suitable recommendations are made. Also the protocol for ear clearance test being followed in IAF vis-à-vis other countries has been discussed.

Keywords: Tympanometry, Altitude Simulator, Middle Ear Pressure & Eustachian Tube Patency.

MOTIVATION, PERSONALITY AND LOCUS OF CONTROL IN INDIAN MILITARY PILOTS

Kochhar RR, Joseph C

Introduction: - Motivation and personality are two attributes, which are of importance for aviators to maintain optimal personal effectiveness, flying proficiency and safety in aviation. There are hardly any studies on motivational needs, personality and locus of control (LOC) in Indian military pilots. The aim of this research has been to study the motivational need structure, personality and LOC in Indian military pilots.

Methods: - Ninety male pilots in the age group of 20-42 years participated in the study. Thirty healthy pilots each were from the fighter and helicopter streams. Thirty medically unfit pilots presently not flying were also included. All subjects were assessed using a demographic inventory, Edwards Personal Preference Schedule (EPPS), Neuroticism Extraversion and Openness Personality Inventory Rating (NEO-PIR) and Levenson's LOC questionnaires. Variables were analyzed using the Student's 't' test and ANOVA.

Result: - The descriptive data showed that the pilots in general were within the normal range of the average adult population on all variables, excepting on the variable of dominance in which they were higher.

Discussion: - Indian military pilots were lower in achievement and higher in affiliation needs when compared to results of previous studies, which is suggestive of a cross cultural variation. The pilots were found to be internal in their LOC. This study showed that the Indian pilot's motivational need structure and LOC were unchanged by medical categorization, aircraft stream and most demographic variables. On the other hand personality variables were significantly related to medical categorization and demographic variables.

Keywords: Military pilots.

STRESS IN AVIATION – NEW CHALLENGES AND STRATEGIES

Surg Lt Cdr SS Mohapatra

Introduction: In modern era of aviation, psychosocial stress involving aircrew, ground crew and other supportive staff in a flying organization has imposed a great challenge to safe and efficient flying. Depending upon the 'constraints' & 'demands' and the stress-coping skill an individual could be "Relaxed", "Eustressed" or "Distressed" and perform accordingly. This study is an effort to assess the Coast guard personnel involved in flying task in an air station and to teach them various techniques of Stress Management.

Material & Methods: A total of 112 coast guard personnel including 33 aircrew have participated in the study. The psychosocial stress coping ability was assessed by employing Psychosocial Stress Coping Inventory by Cyberia and Shrink. The Stress Management Workshop was conducted by a team of two psychologists and one aviation medicine specialist. One day long workshop encompassed audio-visual presentations appraising Stress in Aviation organization and imparting practical training emphasizing Cognitive Behavioral Appraisal, Breathing Technique and Tranquility. The personnel were advised to put the training into practices in their daily routine both in home and work place. A feed back questionnaire survey based upon the subjective feeling was conducted after one month.

Results: The psychosocial stress coping assessment revealed that out of 112 coast guard personnel, 24 (21.45%) were having "Relax"; 53 (47.32%) were having "Eustress" and 35 (31.25%) were having "Distress" type of stress coping skills. Similarly, out of 33 aircrew 06 (18.2%) were having "Relax", 17 (51.5%) were having "Eustress" and 10 (30.3%) were having "Distress" type of stress coping skills and thus the aircrew group is comparable with the study group.

Conclusion 47.3% of the study group is having desired type of stress coping skill. 31.5%, which belonged to "Distress" group are prone for the negative stress response and hence need to acquire the stress management technique. 21.4% of the study group is having "Relax" type of stress coping skill. Such personnel being at the minimal level of arousal are also required to be trained in the stress management techniques in order to augment their performance level.

STUDY OF PERCEIVED STRESS AND PREDICTION OF STRESS RESISTANCE OF CANDIDATES SEEKING COMMISSIONED RANKS IN THE FLYING BRANCH OF INDIAN AIR FORCE

Ms Kuhu Ganguly

Stress is the state of the organism in which the individual perceives that his integrity is threatened and devotes energy for its protection. General Adaptation Syndrome Psychological stress is a broader term and is defined in terms of perceived environmental situations which threaten the gratification of needs. Following the perception of a stress there occurs routine coping and its failure leads to appropriate adaptation. Psychological stress results due to the demands that tax or exceed available resources as appraised by the person. Hence stress is a relational concept, a balance between the demands and the power to deal with them with minimum destructive cost. Research with aircrew have identified financial, maladjustment, employment and harm to be major stress areas. Hardiness is viewed as a personality constructs and is an intervention to increase stress resistance. Hardiness facilitates an active, optimistic and self determined form of coping with stressful life events.

The present study was taken up with a view to establish the stress reaction and prediction of stress tolerance of male and female aspiring commissioned officers at the entry level at Air Force Selection Board. The present study emphasises the cognitive approach to the study of stress. Stress and coping being cognitive, affect is a product of how the individual appraises the situation.

The sample consisted of 29 male Pilot Aptitude Battery Test passed and 10 female Pilot Aptitude Battery Test passed candidate seeking commissioned rank in the Flying branch matched in qualification and age. The TAT protocols were analysed in order to specify broad perceived stress areas. Hardiness scale by Kobasa was administered to all the candidates to predict stress resistance. Hardiness facilitates an active, optimistic and self determined form of coping with stressful life events. Results were computed qualitatively and quantitatively. At the quantitative level of analysis, hardiness construct the means are insignificant. The females have better control over their circumstances than the males. On line with Averills model of stress resistance female candidates have the perception of having definite influence through exercise of imagination, knowledge, skill and choice.

In analysing the challenge score the males have performed better than the female. This component of hardiness indicates that the anticipation of change is interesting incentives for growth rather than threat to security. In total all females and 28 male candidates have shown the hardiness construct their personality. TAT analysis has revealed that males have perceived maximum stress in employment, financial and career. Females have perceived in career, marriage, pregnancy and employment. Further research needs to be carried to test comparative stress endurance in larger sample.

ACKNOWLEDGEMENT AND DETECTION OF POST-TRAUMATIC STRESS DISORDER IN AN AIRLINE COMPANY: PRESENT INVENTORIES AND PROSPECTIVE

Dr Monique CANTEGRIL, Pr Alain PAYEN

The Health Services of Air France, has had to deal with a great number of flying staff who have been suffering from Psychic Distress Syndrome immediately following the crash of the Air France Concorde and the events of September 11th. For many of them, those events caused to flared up a previous Post-traumatic stress disorder. Several Air France Health Services Staff have received special training for Trauma and its treatment.

In the Airline Industry, the flying staff encounter the risk and reality of death through a variety of circumstances during their "working day". Such circumstances include, in-flight technical faults, terrorist acts, the expiration of a passenger during flight, the witnessing of an airliner crash.

If the PTSD does exist among Pilots, it is less common among Flight Attendants, for whom the perception of technical risk is different.

Different clinical observations have shown a polymorphism of behaviours in a crew who has experienced the same event, as well as the varying developmental evolutions of the Trauma in each individual. Following any traumatic event, a group meeting for debriefing and counselling must be organized for all airline employees. After any dramatic event, a prompt and targeted response to assist all employees seems to facilitate the evolution of the prognosis.

Moreover, event recognition through administrative channels (accident reporting documentation), professional cadres, and social liaisons will foster a positive evolution of the traumatic psychosis, and help towards identifying individuals with greater needs, who in turn can be quickly directed to specialized medical professionals.

Finally, it is certain that a more complete technical training program for the Flight Attendants would provide positive support, and minimize the impact of PTSD incited by any technical fault or accident. Furthermore, extending trauma risk awareness and management to other units of the Airline Company would facilitate better organised response and assistance, in the short and long term, to flight crews who have just experienced an exceptional event.

Key words : Post-traumatic stress disorder, PTSD, debriefing, Aircrew