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14,000 feet produces a SaO_2 of about 60% when the alveolar partial pressure of carbon dioxide (P_ACO_2) is 40 mmHg; mild hyperventilation which reduces the P_ACO_2 to 30 mmHg increases the SaO_2 to 85%; and moderate hyperventilation producing a P_ACO_2 of 20 mmHg raises the SaO_2 to 93%. Although hyperventilation markedly increases the SaO_2 the associated changes in cerebral blood flow decrease the PO_2 of the cerebral venous blood and hence intensify the cerebral hypoxia. Thus, the SaO_2 of an individual exposed to hypoxic hypoxia may be within acceptable limits (93% to 95%) when the P_IO_2 of the inspired gas is that of air at an altitude as high as 15,000 feet and the delivery of oxygen to the brain is significantly impaired. Extreme caution should therefore be exercised in deducing the adequacy of the P_IO_2 from the measurement of SaO_2 alone either in flight or in the assessment of oxygen delivery systems.

[2]
CARDIOVASCULAR DATA ACQUISITION USING IMPEDANCE CARDIOGRAPHY DURING SIMULATED FLIGHT

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Introduction: Impedance cardiography (IC) has long been used for the determination of key cardiovascular variables such as stroke volume and cardiac output. One of the benefits of IC is its non-invasive nature. This feature makes it potentially very useful for the in-flight acquisition of cardiovascular data in pilots. The purpose of this study was to evaluate the practical use of IC as a data acquisition technique during simulated flight. **Methods:** 5 subjects were recruited for this experiment. Each subject flew 2 sorties in a full-motion flight simulator. The sortie consisted of a standard take-off and departure, a normal circuit, a missed approach, some limited manoeuvring and then a final landing. Stroke volume and cardiac output were measured non-invasively via a small, subject-mounted IC device, with band electrodes fitted to the lower neck and lower thorax. The Kubicek equation was used to derive stroke volume from the ensemble-averaged data. **Results:** All of the subjects were able to complete the flying task with no detriment. They all reported that the impedance cardiography device did not interfere with their ability to manipulate the controls of the simulator. Furthermore, the IC device did not interfere with any of the electrical signals in the simulator. The physiological data collected were of high quality, and allowed the determination of stroke volume and cardiac output throughout each simulated flight. **Conclusions:** The results of this technical evaluation demonstrate that it is possible to use IC to determine important cardiovascular variables during full-motion simulated flight, with no adverse consequences to the pilot's ability to fly the aircraft. Impedance cardiography thus has tremendous applications in the field of aerospace physiology research, particularly for in-flight acquisition of cardiovascular data.

[3]
FITNESS TO FLY IN PILOTS AFTER CATHETER ABLATION OF ATRIAL FIBRILLATION

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Introduction: Atrial fibrillation (AF) presents one of the cardiological problems related with difficult licencing decisions. The recently introduced catheter technique with circumferential ablation of the pulmonary veins in patients with paroxysmal or persistent AF provides a promissing therapeutic procedure. But follow-up data, including success rate and consequences for decision of fitness to fly, in pilots having undergone such a procedure, are lacking. **Methods:** The follow-up of all pilots, in whom a catheter ablation of the pulmonary veins (CA) had been performed by the same interventionist in two university hospitals between 2002 und 2004, was retrospectively analysed. **Results:** Six male subjects, 1 commercial and 5 private pilots, mean age 58.5 years (46-64), underwent CA. Four of them had paroxysmal and 2 persistent AF, 5 were unfit to fly. In all patients, no underlying cardiac pathology was present. The procedure CA was uncomplicated in 5 patients; in 1 patient a cardiac tamponade occurred, managed by pericardiocentesis. During the follow-up period until April 2005 there was no reoccurrence of AF in 3 pilots; 2 pilots had a second CA because of reoccurrence of AF, and this CA was successfull in both; 1 pilot with previous persistent AF showed paroxysmal AF, he died in an aircraft accident, the cause of which was not medical*. Another pilot stopped flying for nonmedical reasons; the 4 remaining pilots were declared fit to fly without restriction. **Conclusions:** 1) A curative success rate of CA has been achieved in 50% in this small group of pilots with AF; the rate was markedly increased by a second CA where necessary. 2) Most of these pilots could regain pilot's activity. 3) CA is a therapeutic procedure which may be considered in pilots with AF resistent to drug therapy, but the indication for CA should still be made on an individual basis.
* Information received by Prof. U. Sigwart, Division of Cardiology, H.U.G., Geneva; Switzerland

[4]
LONGITUDINAL IHD RISK FACTOR STUDY IN MILITARY PILOTS

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Introduction: It is known that cardiovascular diseases are responsible for over 50% of total mortality in Hungary. Consequently, the early diagnosis of such diseases and detection of their risk factors is of fundamental importance in public health. Regarding that pilots are also part of the population, it is vital to clarify the respective risk factors in their cases as well. Cardiovascular diseases are among the causes of grounding of 10% of pilots. **Methods:** The individual and joint incidences of ischaemic heart disease (IHD) factors measured or taken during regular annual screening of fitness were determined in five age groups of a total of 250 active military pilots, on the basis of 10-year old (baseline), 5-year-old and current data. In addition, we determined the 5-year risk of coronary artery disease (CAD), and the risk of cardiovascular disease (CVD) for 10 years in comparison to individuals with normal risk.
The IHD risk factors in the studied population were as follows: positive family history (taken during annual evaluation): 25%; smoking: 31%; physical inactivity: 24%; obesity: 40%; total cholesterol: 53%, HDL cholesterol: 13%; high total cholesterol levels associated to low HDL cholesterol levels: 5%; high blood pressure in 15%, pathologic ECG deviations: 1%. With ageing, incidence was constant or decreased for all risk factors, while the occurrence of more than one risk factors at a time is more frequent. **Results:** The 5-10-year risk of cardiovascular diseases (the 5-year risk of coronary artery disease [CAD], and the 10-year risk of cardiovascular disease [CVD]) is below 2.5% in 50% of pilots, and does not exceed 15-20% in the group with the highest risk either. The indices calculated by complex risk calculation methods are getting worse in the groups aged 25-50 years, but they improve with age over 50. **Conclusion:** The underlying causes probably are (1) the increasing role of a stricter check of physical condition within the evaluation of fitness for service in the army, (2), a change in lifestyle owing to effective propaganda, and (3) officially permitted use of medication to reduce lipid levels and blood pressure. Continuous monitoring of the risk of cardiovascular diseases is not only used in the evaluation of fitness for service, but also as a tool of prevention, because pilots with increased risk can be kept in service by appropriate drug therapy and, accordingly, by reducing the risk of actual occurrence of the cardiovascular disease.

[5]
SHOULD STATINS BE IN AIRCREW WATER?
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Background: The losses of trained aircrew due to coronary artery disease is significant for the individual and for military services. Aggressive treatment of risk factors such as smoking, hypertension, with exercise and diet have been implemented in most military and civilian aviation communities. The clinical impact of the statin class of drugs continues to expand. A particular risk is low HDL in the presence of normal or near-normal total cholesterol and LDL. In primary prevention of coronary artery disease, should aircrew with low HDL and slightly elevated cholesterol and LDL be placed on a Statin as first line treatment? **Methods:** The US Army database (AEDR) will search for aircrew with cholesterol of ≤ 200, LDL ≥ 160, and HDL < 40. This review will encompass 85,000 aircrew in the database with lipids documented. A review of the cardiovascular status, to include drug therapy (niacin, fibrates, or statins) will be presented. Data is not available for aircrew intolerance to statins.
Discussion: Statens are known to have significant impact on the individual lipid profile. Pleiotrophic effects are rapidly being discovered ranging from improved endothelial function, prevention of Alzheimer's, an anti-inflammatory effect (hsCRP) and most recently colon cancer prevention. It would be suggested that statins be used in individuals with lipid profiles unresponsive to the usual risk factor modification. **Conclusions: 1.** Critical review of lipid status of military and civil aircrew should be conducted to identify individuals with low HDL and normal or high LDL risk. **2.** Treatment utilizing a statin as primary prevention should be considered for aircrew at risk.

SESSION 2

[6]
PASSENGER & CREW HEALTH IN AVIATION
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The House of Lords Report: "Air Travel and Health" was published in November 2000 after an extensive inquiry throughout the aviation community into the relationship between the various aspects of the cabin environment in commercial aircraft and the health of passengers and crew. One of the report's recommendations to Government was that a central source be given responsibility for advising government on the issues relevant to aviation health. The Aviation Health Unit (AHU) was formed on 1 December 2003 and is based at Gatwick within the CAA. The subject 'aviation health' encompasses a wide range of individual topics, such as deep vein thrombosis, cabin air quality, transmission of