SPACE LIFE SCIENCES SYMPOSIUM (A1)
Human Physiology in Space (2)

Author: Dr. Alexander Chouker
University of Munich, Germany, achouker@med.uni-muenchen.de

Dr. Matthias Feuerecker
University of Munich, Germany, matthias.feuerecker@med.uni-muenchen.de
Dr. Martina Heer
Germany, martina.heer@dlr.de
Mr. Luis Beck
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, Luis.Beck@dlr.de
Dr. Ines Kaufmann
University of Munich, Germany, ines.kaufmann@med.uni-muenchen.de
Dr. Gustav Schelling
Germany, gschell@med.uni-muenchen.de
Dr. Manfred Thiel
Germany, mthiel@med.uni-muenchen.de

EFFECTS OF HYPO- NORMO- AND HYPERBARIC PRESSURE ON OXYGENATION, METABOLIC AND IMMUNE RESPONSES IN HUMANS DURING SHORT TERM HEAD DOWN TILT AT - 6 DEGREES

Abstract

Background: It has been reported in individuals subjected to head-down tilt (HDT)in order to mimic microgravity induced cardiovascular changes upon central blood volume loading, that there is indirect evidence for local circulatory hypoxia. Despite the identified tentative development of moderate tissue hypoxia under microgravity conditions, the issue of whether a resulting hypoxia does affect further physiological systems, alike energy metabolism (e.g. adenosine turnover) and immune properties has not been addressed before. **Goals:** Against this background we tested in a standardized earth bound model the effect of HDT on the level of oxygenation, on plasma concentrations of adenosine and on the potential impact of these conditions on acute immune function changes in man. **Methods:** Eight male healthy volunteers (mean age: 25 yrs, mean height: 181,2cm; mean weight: 79,7kg) participated in the study performed at the German Aerospace Center (DLR) in Cologne, Germany. The "Simulation Facility for Occupational Medicine Research"(AMSAN)provides ideal conditions for isolation, environmental and nutritional control. The study design included an adaptive phase (prior to intervention) and an cross-over interventional phase (3 days with one day break in between); the entire stay of the participants in the experimental facility was 10 days. During the interventions every participant layed down in -6 head down tilt for 30 minutes prior to pressurization of the "iron lung". The protocol included on separate days, respectively, three different arms of pressurization for 60 minutes: no pressure (normobaric control), hyperbaric (+15cmH2O)and hypobaric (-15cmH2O) interior. Capillary blood was taken from the earlobe and underwent standard blood gas analyses. Venous blood samples where taken at a similar time point in addition to quantify the blood concentrations of adenosine by dual column switching HPLC together with enumerative and functional assays for the assessment of adaptive and innate immune functions as determined by flow cytometry. **Results & Conclusion:** We observed i)capplilary blood oxygen tension were lowest under +15cm H2O pressurized (PcapO2: hyperbaric <normobaric<hypobaric) conditions

in HDT, and ii) PcapO2 was inversely proportional to blood levels of energie-rich nucleotides (ATP) degradation product adenosine and its metabolite inosine. Descriptive and correlation analyses on the possible effects on immune changes were preformed. In summary, the importance and scientific value of short term bedrest protocols under selective, variable pressurization during HDT are discussed, expecially in the light of hypoxia and immune research for space research and clinical settings. **Acknowledgements:** We thank the DLR for study-and financial support(50WB0719).