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Author: Prof. Roman Baevsky
Institute for Biomedical Problems, Russian Federation

Mrs. Anna Chernikova
RF SRC - Institute of Biomedical Problems of the RAS, Russian Federation
Dr. Irina I. Funtova
Institute for Biomedical Problems, Russian Federation
Prof. Jens Tank
Hannover Medical School, Germany

# THE PROCESS OF ADAPTATION OF THE CARDIOVASCULAR SYSTEM TO THE CONDITIONS OF WEIGHTLESSNESS. PROBABLITY ESTIMATION OF THE RESULTS OF HEART RATE VARIABILITY ANALYSIS,

**Abstract**

Introduction. Processes of cardiovascular system adaptation to conditions of weightlessness are directed to establish a balance between the organism and the environment. Optimization of the cardiovascular system under conditions of long term space flight is provided by vigorous changes of autonomic cardiovascular control. Heart rate variability (HRV) analysis is a practical and easy to use method to assess this process. Methods. HRV analysis was used by means of the device "Pneumocard" onboard the ISS since January 2007. Data from 10 Russian cosmonauts measured during long term space flights are presented. RR-interval data were transmitted from the ISS for further analysis via Internet. Results. HRV analysis describing the vegetative cardiovascular control in crew members has clearly shown a wide range of normal variations, individual dynamics of changes which are essentially connected with the type of vegetative regulation, high dependence on the stage of space flight during which the measurement was carried out. Thus, the analysis and the interpretation of HRV data must be realized on an individual basis. In order to meet these criteria we developed a probability approach for HRV analysis. The approach is based on four functional states of an organism: 1) physiological normal, 2) prenozological state, 3) premorbid state, 4) pathological state (Baevsky, 1979; Grigoriev, Baevsky, 2007). Using flight materials available to the present time, a system was developed to estimate the probabilities that the data points to one of the four functional states. The final result, being in one of the four functional states is based on the greatest probability. Therefore, the probability values can be used as criteria. Based on our HRV analysis data we were able to develop a ranking of 10 conditional categories with different risk to develop pathological changes. Using the developed algorithm of probabilities the transition process from the state of physiological normal into a prenozological state or premorbid state during different stages of space flight was carried out.. In 4 crew members the probability of the prenozological state was 0,17, in 4 crew members -0,40 and in 2 crew members -0,46. The conditional categories of risk obtained in members was 1,4; 2,7 and 3,0 respectively. Thus, the category of risk during long term space flight was very low.. The conclusion. Our probability approach to an estimation of risk to develop pathological regulatory pattern can be useful for prognostic purposes. It can be recommended for medical control of cosmonauts during space flight.