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THE PROSPECTS FOR MYOCARDIUM ENERGY METABOLISM STUDIES IN SPACE FLIGHT

Abstract

Introduction. According to numerous investigations, ECG changes occurring in long-duration space missions point to energy metabolism shifts in the myocardium. The present-day noninvasive methods of ECG signal handling enable one to extract additional information about the functional status of the myocardium and to identify the earliest displays of electrophysiological remodeling. One of the recent methods is ECG dispersion mapping (DM ECG) clinical significance of which is being evaluated actively. Index Myocardium, a key DM parameter, provides indirect data on mean energy resources of cardiomyocytes. Being nonspecific, it is instrumental in effective observation of concealed dynamics or detection of incipient pathologies. At present it is known that the method can be used largely in screening for identification of those who need a more profound investigation. However, understanding of the DM ECG diagnostic capabilities and applicability could be expanded significantly. It is planned that experiment COSMOCARD designed around the DM ECG will get going aboard the ISS in 2014. Method. The DM ECG method depends on analysis of low-amplitude oscillations within the 5-30 microvolt range. The principle parameter – index Myocardium – is an integral of the sum of alternations over the P-QRS-T cycle in 3 standards leads. It reflects the total dispersion in percent to the greatest possible extent of dispersion changes of electrosignal and generally does not exceed 15-20%. The experiment will involve a device of the same name for uninterrupted 24-hr ECG recording (Holter monitoring). Results. Screening investigations of essentially healthy people were effective in preclinical diagnostics of initial cardiac pathologies and showed fairly high sensitivity and specificity in the norm-pathology distinction. DM ECG was trialed in experiment with 5-day immersion, where it picked up energy-metabolism changes in the myocardium emerged by the end of the experiment. In the experiment with extended isolation, DM ECG proved to be a source of information about fatigue and overstrain. Conclusion. Space experiment COSMOCARD has been designed to supply new scientific data on changes in the myocardium electrophysiological characteristics, to demonstrate electrical heterogeneity of the myocardium, and to relate them to vegetative regulation of blood circulation, which will expand our knowledge of how the human body adapts to the spaceflight environment. These findings could be used for enhancement of the crew medical monitoring system, evaluation of their bodies' functional states and predicting tolerance of orthostatic and physical stresses at the beginning of readaptation to the gravity.