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Human Physiology in Space (2)

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ADAPTIVE CHANGES IN THE PARAMETERS OF THE CARDIOVASCULAR SYSTEM DURING THE ACUTE PERIOD OF ADAPTATION TO WEIGHTLESSNESS AND DURING THE PERIOD OF RECOVERY AFTER SHORT-TERM SPACE FLIGHT

Abstract

The purpose of the space scientific experiment which was carried out by UAE astronaut was obtaining scientific data on the adaptation of the circulatory system to the conditions of the initial period of weightlessness and during recovery to Earth's gravity. The following physiological signals were recorded, processed and analyzed during the experiment: electrocardiogram, impedance cardiogram, seismocardiogram, spatial ballistocardiogram (along three linear axes and three axes of rotation) and pneumotachogram. Those signals allow us to detect individual changes in central hemodynamics, heart rate variability and cardiac function at rest, in addition to changes occurring during various breathing tests (including fixt breathing test, inspiratory and expiratory breath holds). Active orthostatic tests were performed before the flight and after the landing. The space flight participant conducted: • 2 pre-flight sessions on training and base data collection (-117 -35 days before the flight); • 1 experimental in-flight session (on the 5th day of the flight); • 2 post-flight sessions (on +2 and +5 days after the landing). The data that was collected included statistics about the functional state of the cardiovascular system (regulatory, energy and hemodynamic characteristics) during the short flight of 7 days 21 hours along with data for estimation of orthostatic intolerance in the initial period of recovery and rehabilitation on Earth. The parameters of the force and energy of heart contractions, a quantitative assessment of the degree of regulatory systems tension and their functional reserve in the initial period of weightlessness were obtained and adaptation risks were assessed (HRV-analysis is used in the traditional way based on parameters in the time and frequency range). Through analysis, the degree of tension of regulatory mechanisms does not exceed critical values. However, the in-flight stroke volume exceeds the pre-flight level. At the same time, the energy consumption for moving one liter of blood in microgravity is not

considerable, but reduced in comparison with the preflight data. The duration of breath holding under weightless conditions increases significantly. There are no signs of orthostatic intolerance after returning to Earth.