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ABNORMAL MITRAL VALVE-RELATED PARAMETERS FOLLOWING LONG-DURATION SPACEFLIGHT.

Abstract

INTRODUCTION. Pathology-induced left ventricular shape alterations, with increased left ventricular sphericity index, are determinants of mitral valve dysfunction. Long-term exposure to microgravity can lead to cardiac muscle atrophy and alter cardiac function. Furthermore, long-term exposure to microgravity has been shown to increase the left ventricular sphericity index. This research project investigates the impact of long-term spaceflight on mitral valve-related parameters.

METHOD. We conducted a before-after study on nine male cosmonauts, aged 44 ± 6 years, with a BMI of 26.28 ± 1.83 kg/m^2, spending an average of 247 days on the International Space Station (ISS) between 2020 and 2023. A cardiac MRI, without contrast agents, was performed at the Medical Educational and Scientific Center University Hospital in Moscow. Cosmonauts were scanned in the supine position using retrospective electrocardiography-gated multi-breath-hold balanced steady-state free precession cine sequences, including two-chamber (2CV) and four-chamber (4CV) views. Each slice comprised 25 cardiac phases. The procedure was repeated before (60 ± 30 days prior to launch) and after (6 ± 2 days after landing) ISS missions. CAAS MR Solutions 5.1.2. software was used for MRI data analysis. Mitral leaflet billowing (> 2 mm systolic protrusion) was assessed in the 2CV view, and a quantification was done if

the billowing was present. Mitral annulus diameter was assessed in end-systole and end-diastole in the two cine views. Statistical analysis employed paired t-tests ($p < 0.05$). Compliance with test conditions was ensured before analysis.

RESULT. Post-flight, billowing was present for five cosmonauts (with a systolic protrusion of 2.96 ± 0.91), without prolapse and without thickening of the leaflet. The mitral annulus diameter was statistically larger post-flight than pre-flight. This significant dilation was observed in end-systole and end-diastole, both in 2CV and 4CV.

CONCLUSION. This study shows alterations of the mitral valve after long-term exposure to microgravity. Moreover, billowing was present on five out of nine cosmonauts. This highlights additional alteration of the valve, however not systematically present on this cohort of cosmonauts. Subsequent investigations need to assess if those mitral modifications could lead to mitral valve regurgitation and if an even prolonged exposure to microgravity could worsen those alterations.