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CORRELATION OF CHANGES IN AORTIC STIFFNESS WITH OTHER PARAMETERS OF CARDIOVASCULAR HEALTH AFTER 60-DAY HEAD-DOWN BED REST

Abstract

Some reports support an increased aortic stiffness following long-duration exposure to weightlessness. However, the underlying mechanisms remain poorly understood. Here, we studied how microgravity-induced changes in aortic pulse wave velocity (PWV) and its equivalent corrected for blood pressure (CAVI) were correlated to changes in other parameters, following exposure to -6 head-down-tilt bed rest (HDBR).

24 subjects (8 females) were investigated during 60-day HDBR (AGBRESA study). They were distributed into three groups, with different countermeasures, but previous analyses have shown that these groups had no impact on the studied parameters. These parameters include: PWV and CAVI assessed by 4D-flow MRI, orthostatic tolerance time (OTT) measured with a standardized lower body negative pressure protocol, the heart rate variability parameter LF/HF, the baroreflex sensitivity parameter BRS_down,

as well as the body height. They were measured before and at the end of the HDBR period. OTT was not normally distributed, so it was log-transformed. Paired comparisons were performed using Wilcoxon signed-rank tests with results expressed as median [first quartile; third quartile]. Spearman correlation analyses were performed, with results expressed as correlation coefficient R and 95% confidence interval. Statistical significance was considered for $p<0.05$.

OTT and BRS_down decreased during HDBR (-467 [-763; -131] s and -5.9 [-9.1; -3.7], respectively, both $p<0.001$), while PWV and CAVI increased (+0.86 [+0.52; +1.46] m/s and +1.14 [+0.54; +2.95], respectively, both $p<0.001$). The height and LF/HF also increased (+2.8 [+1.8; +4.0] cm, $p<0.001$ and +0.42 [+0.08; +1.28], $p=0.005$, respectively). After removing one outlier, log(OTT) was negatively correlated with PWV (R=-0.50 [-0.76; -0.10], $p=0.008$) and CAVI (R=-0.57 [-0.80; -0.20], $p=0.002$). There was a positive correlation between BRS_down and height (R=0.35 [-0.07; 0.67], $p=0.047$), and a trend for positive correlation between BRS_down and CAVI (R=0.34 [-0.10; 0.67], $p=0.057$). There was also a trend for negative correlation between height and PWV (R=-0.34 [-0.67; 0.10], $p=0.056$), while a trend for positive correlation was observed between LF/HF and CAVI (R=0.29 [-0.17; 0.65], $p=0.098$).

Following exposure to microgravity, the increased sympathovagal balance may contribute to an increased aortic stiffness. Apparently, the latter is also impacted by changes in height and associated changes in baroreflex sensitivity, potentially linked to a stretch of the aorta. Previous studies hypothesized that an increased stiffness may help preserve orthostatic tolerance postflight. Here, the results show the opposite, meaning either that this hypothesis must be re-evaluated, or that different changes occur in the aorta and in the other vessels.