

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Human Physiology in Space (2)

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CENTRAL BLOOD PRESSURE AND PULSE WAVE VELOCITY BEFORE AND AFTER SIX MONTHS IN SPACE

Abstract**Purpose:**

Central aortic blood pressure and pulse wave velocity measurements are more predictive in terms of cardiovascular organ damage and risk compared with peripheral blood pressure. Such measurements, which have been proven useful in detecting early vascular aging on earth, have not been obtained after long term space missions. We applied an easy-to-perform, non-invasive, and wearable device to assess central blood pressure and other hemodynamic variables in cosmonauts.

Methodology:

We obtained oscillometric blood pressure measurement at the upper arm for determining central and peripheral blood pressure, heart rate, and pulse wave velocity (Mobil-O-Graph PWA, IEM, Germany) in eight cosmonauts before and after six months in space. In the supine position, we obtained multiple measurements at baseline (65-90 days before flight), four days (R+4) and eight days (R+8) after return. Written informed consent was given by all subjects.

Results:

Heart rate was 58.4 ± 6.5 bpm at baseline, 70.3 ± 5.2 bpm on R+4, and 66.2 ± 9.0 bpm on R+8 (both $p < 0.05$ compared with baseline). Peripheral systolic and mean blood pressure increased significantly on R+4 compared with baseline (systolic = 119.9 ± 13.4 vs. 134.1 ± 19.7 mmHg, $p < 0.05$; mean = 97.7 ± 10.8 vs. 107.7 ± 12.1 mmHg; $p < 0.05$) but did not differ from R+8. Analysis of central blood pressure revealed a non-significant rise in systolic, diastolic, and pulse pressure on R+4 ($p = 0.059$, $p = 0.1$, and $p = 0.175$ respectively) and on R+8 ($p = 0.094$, $p = 0.162$, and $p = 0.209$ respectively), with respect to baseline. After return, pulse wave velocity was non-significantly increased compared to baseline (baseline = 6.6 ± 0.8 m/s; R+4 = 7.2 ± 0.8 m/s, $p = 0.141$; R+8 = 7.1 ± 0.5 m/s, $p = 0.176$). All cosmonauts showed pulse wave velocities below 10 m/s, which is considered as the threshold heralding excess cardiovascular risk.

Conclusion:

The main finding is that, while heart rate and blood pressure were substantially increased following six months in space, central aortic blood pressure and pulse wave velocity did not show medically relevant

changes. The finding suggests that six months in space do not induce overt early vascular aging. Yet, larger and more long-term studies are required as space radiation may have a delayed effect on vascular health.