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A RE-EVALUATION OF THE EARLY EFFECTS OF WEIGHTLESSNESS

Abstract

The adaptation to weightlessness is often described as a response to a headward fluid shift that occurs when entering microgravity. This headward fluid shift is thought to be analogous to the fluid shift that occurs when moving from upright to the six-degree head down tilt (6HDT) position on Earth. Problems exist with this analogy. For the venous system, pressures do not increase in weightlessness compared to the supine values on Earth as they do in 6HDT. Data from Kirsch et al. on the first Spacelab mission and from Buckey et al. on the Spacelab Life Sciences 1 and 2 missions, showed that peripheral and central venous pressures are below supine values upon entering microgravity. A possible explanation for this is the removal of tissue weight and tissue compressive forces that increase the compliance of the venous system. A similar effect may occur on the arterial side of the circulation. Head down tilt leads to an increase in blood pressure with a reflex suppression of sympathetic activity and a reduction in circulating norepinephrine levels. Data from parabolic flight (Iwase et al.) and measures taken on short duration space missions tend to show reduced blood pressures compared to supine and increases in sympathetic activity to blood vessels combined with elevated norepinephrine levels. Twenty-four-hour blood pressure recordings in long duration spaceflight show reduced systolic and mean blood pressures compared to preflight measures. Taken together spaceflight results suggest that focusing on the fluid shift that occurs in weightlessness and considering it to be analogous to fluid shifts that occur on Earth with may 6HDT be ignoring other important aspects of weightlessness such as effects on both the venous and arterial systems from the loss of tissue weight.