PREDICTION OF BLOOD FLOW AND PRESSURE IN MICROGRAV

Theme: SPACE -- Training/simulations/space analogues

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This research aims to deepen our understanding of how the human cardiovascular system adapts to microgravity. We employ a computational approach using zero-dimensional models to simulate cardiovascular system functioning, with a particular focus on the head vasculature. Recent studies suggest that prolonged exposure to weightlessness may trigger the onset of related pathologies in this area.
Our goal is to predict changes in blood flow and pressure within microgravity environments. To achieve this, physiological data is incorporated into a 0D cardiovascular model. The model is calibrated using Bayesian optimization techniques to accurately reflect conditions under terrestrial gravity before simulating microgravity scenarios. The optimized model serves as a benchmark for predicting the effects of microgravity on blood circulation and pressure, revealing significant physiological changes. This model provides a valuable tool for comprehending the effects of any hydrostatic changes in the context of space travel in understanding the effects of any hydrostatic changes in cardiovascular physiology.
The findings from these simulations enhance our understanding of the variations in blood flow and pressure between terrestrial and microgravity conditions. Additionally, efforts are made to customize the modeling process for individual subjects, utilizing a tailored optimization approach. This approach is not only crucial for the safety and well-being of astronauts but also significantly contributes to the field of aerospace medicine, providing valuable data that could be applied to improve medical care in similar environments. The code developed is completely developed in Python as open-source code.