**BACKGROUND**

- Investigate how the spaceflight environment affects the cardiovascular system to aid in the improvement of astronaut health, develop countermeasures, and potentially benefit other populations on Earth.
- Models of spaceflight: head-down-tilt bed rest (HDTBR), parabolic flight, and hypovolemia.
- Study objective: retrospective data analysis to understand HDTBR effects on arterial mechanics as a spaceflight analog.

**HYPOTHESIS AND SPECIFIC AIMS**

**Hypothesis:**
- Cardiovascular Lab
  - Investigate how the spaceflight environment affects the cardiovascular system to aid in the improvement of astronaut health, develop countermeasures, and potentially benefit other populations on Earth.
  - Models of spaceflight: head-down-tilt bed rest (HDTBR), parabolic flight, and hypovolemia.
  - Study objective: retrospective data analysis to understand HDTBR effects on arterial mechanics as a spaceflight analog.

**Specific aim 1:**
- Investigate how the spaceflight environment affects the cardiovascular system to aid in the improvement of astronaut health, develop countermeasures, and potentially benefit other populations on Earth.

**Specific aim 2:**
- Define changes in arterial morphology and mechanics during HDTBR due to changing load and pressure profile.

**METHODS**

- Days analyzed: 5 days pre-(-5), after 60 days (60), 3 days post-(+3) HDTBR analyzed (healthy subjects):
  - Carotid Artery - 13 subjects (7M, 6F, mean age 35±8, weight 71±10 kg, and height 168±9 cm)
  - Brachial and Anterior Tibial Arteries - 11 different subjects (8M, 3F, mean age 34±8, weight 74±16 kg, and height 170±9 cm)
- Statistics: linear mixed model analysis

**RESULTS**

**Morphological Analysis**

- Intima Media Thickness (IMT)
  - Measured: arterial wall thickness (IMT), systolic diameter (SD), diastolic diameter (DD), systolic blood pressure (SBP), diastolic blood pressure (DBP), and pulse pressure (PP = SBP - DBP)

**Functional Analysis**

- Arterial deformation

**Pressure-Strain Elastic Modulus (PSE)**

- Stress-to-strain ratio

**Discussion**

- Carotid, brachial, and tibial arteries reacted differently to HDTBR. Previous studies have not analyzed the mechanical properties of the human brachial or anterior tibial arteries.
- After slight variations during bed-rest, arterial mechanical properties and IMT returned to pre-bed rest values, with the exception of tibial stiffness and PSE, which continued to be reduced post-bed rest while the DC remained elevated.
- The tibial artery remodeling was probably due to decreased pressure and volume. Resultsing implications for longer duration spaceflight are unclear.
- Arterial health may be affected by microgravity, as shown by increased thoracic aorta stiffness in other ground based simulations (Aubert).

**Limitations:**
- Small n value
- Imprecise boundary determination methods
- Formulas sensitive to small measurement differences
- Single, non-blinded analysis

**Acknowledgements**

Thank you to the Minority University Research and Education Program for funding this project and the NASA Johnson Space Center Cardiovascular Lab for their guidance.

**References**

- Aubert, A.E. Acta Cardiol. 2005. 60(2):129-137
- Hargens, A.R. J. Appl. Physiol. 2013. 113(9):2183-2192
- Hargens, A.R. J. Appl. Physiol. 2013. 113(9):2183-2192
- O'Rourke, M.F. Am J Hypertens. 2014. 27(5):493-501