Strain- The Heart of the Matter

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SPACE LIFE SCIENCES
SUMMER INSTITUTE
Introduction:

Originally from beautiful Northing Michigan.

Graduated in 2007 from Central Michigan University with a Bachelors in Health Fitness In Preventative and Rehabilitative medicine.

Graduated in 2010 from Texas A&M University with a Masters in Exercise Science.
Summer Objectives

- Become overall knowledgeable in echocardiography

- Identify basic cardiac structures and function measures
  Novel cardiac function measures (tissue Doppler, speckle tracking)

- View ultrasound acquisition during bed rest

- Analysis of echocardiography images
  Demonstrate reliability in analyzing longitudinal strain
  Setup spreadsheet for speckle tracking data
  Analyze longitudinal strain bedrest data in Q-lab at 7 timepoints (BR-2, BR7, 21, 31, 70, +0, +3)
  Analyze Q-lab output in Matlab
  Compile longitudinal strain results
  Twist analysis (time permitting)
Background: Space Flight & Cardiovascular Effects

- Fluid Shift towards the head
- Decrease in overall blood & plasma volume
- Atrophy of the LV
- Reduction of LV chamber size
- Decrease LV end diastolic volume (EDV)
- Reduction of LV chamber size
Study Background:

- **Objective:** Identify how much exercise is needed to maintain pre-bedrest / pre spaceflight strength, minimize any flight complications and reduce time required to reacclimate to Earth’s gravity.

- **Subjects volunteered to participate in a 70 day 6° head down tilt (HDT) study at UTMB hospital in Galveston.**

  HDT are used to study microgravity for several reasons:

  1. Allows subjects to experience atrophy of lower extremities from disuse
  2. Allows scientist to study the fluid shifts and the subject’s cardiovascular & physiological effects
  3. Allows several studies to be measured & conducted simultaneously in a safe and monitored environment

- **Throughout those 10 weeks, subjects were either in an exercise or control group**
Exercise Modalities

Bed Rest

VS

Spaceflight
Echo Timeline & Methodology

- Each subject had a total of 7 echoes over a span of 75 days, 70 of which were spent in HDT.
- Phillips Q-Lab Cardiac Analysis was used to analyze all 133 echoes.
- 4 Chamber echoes were used to measure strain and track the movement of the LV.

N=19

[Image of heart diagram]
Longitudinal Strain: The change in the sarcomere length within the walls of the left ventricle (LV)
LONGITUDINAL STRAIN OVER TIME
Why is this important?

Never before has cardiac strain been monitored at set time points throughout spaceflight or bed rest study.

Once we clearly understand this technique, protocols can be formulated for astronauts to use on the ISS as both a diagnostic and monitoring tool.

Echoes could have the possibility to predict & monitor heart health, cardiac strength, endurance, and overall rate of muscle degradation.

Also, echoes can act as an additional factor in determining exercise prescriptions and effectiveness.
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