Right Ventricular Tissue Doppler in Space Flight

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Space Normal Right Ventricle
First Right-Venticle Tissue Doppler from ISS

Subset of data from SDTO “Bracelet-M”

Russian Countermeasure
  - Medical prevention strategy for reducing fluid shifts in microgravity in long-duration crew
  - Acute change in effective circulating volume
Transpulmonary gradient of 5 mmHg to drive blood flow across pulmonary circulation

RV contraction peaks early in systole (brief) drops rapidly

RV ejection into a low-impedance pulmonary circulation

RV diastolic volume 20-30% > LV despite lower diastolic pressure

Compliant
Imaging difficulties

- Difficult to assess mass & volumes due to geometry
Methods

- Remote Guidance
  - Communication 1.8- to 2-second delay between operator on board the ISS and expert instruction mission control.

- Operator
  - Astronaut on colleague astronaut crewmembers
  - Operators utilizing a self-scanning technique

- Nine sessions with and without Braslet
Tissue Doppler Spectrum

- Tissue Doppler spectrum registers movement of a given sample of cardiac tissue throughout the cardiac cycle
RV Tissue Doppler

- **Systolic Velocity**
- **Early Diastolic**
- **Late Diastolic**
Rt Tei Index

- IVCT + IVRT / ET
- Myocardial Performance

Summary of Results

Space Normal % Change Right Ventricle Parameters after Preload Reduction

% CHANGE
-30 -25 -20 -15 -10 -5 0 5
S' E' A' IVCT ET IVRT Rt Tei HR
Summary

- Unique data: acute preload change on RV
- Space Normal Tei index larger in microgravity than normal Tei index (< 0.3)
- Tissue Doppler can be performed by crew with high fidelity
- Need larger sample for better fidelity on Space Normal RV function
- More image data for RV Mass and Volume