Effects of Head Down Tilt on Internal Jugular Vein Volume: Preliminary Results from the SPACE-COT Study.

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**BACKGROUND**

The VIIP Syndrome is thought to be related to cephalad fluid shifts and cerebral venous congestion due to the loss of the hydrostatic pressure gradient in microgravity. The internal jugular (IJ) veins are the main venous drainage pathway in the supine and head down tilt (HDT) positions, and are an important determinant of intracranial pressure (ICP). Using ultrasonography, we evaluated the immediate and short-term effects of HDT on IJ volumes in healthy subjects.

The effects of 0.5% carbon dioxide exposure on IJ volumes at 12º HDT was also examined.

**OBJECTIVES**

1. Determine the immediate effects of various HDT angles on IJ volume in healthy subjects.
2. Determine the effects of prolonged 12º HDT and 0.5% CO2 on IJ volumes.

**METHODS**

The study was approved by Baylor College of Medicine IRB and the Ethics Committee of the Medical Council of North Rhine, Germany and conducted at the German Aerospace Center (DLR) in Cologne, Germany.

Two campaigns were conducted for each subject. Each campaign consisted of a 24 hour baseline, ambient air period followed by 26 hours at 12º HDT +/- 0.5% CO2 atmosphere.

**RESULTS**

- **At baseline, Right IJ volume was measured 6 times, from supine to -30º HDT (in -6º increments) on an automated tilt table.**
- **The Right IJ volumes were also measured after 26 hours at 12º HDT.**
- **Right IJ was chosen, due to general dominance over the Left IJ (68% of population being dominant)1, and time constraints of the study.**
- **IJ vein volume was calculated by measuring the cross sectional area (CSA) of the right IJ at 4 equal intervals from the supraclavicular to submandibular region of the right lateral neck.**
- **Baseline IJ volumes were slightly higher during campaign 1 vs campaign 2 (p = 0.02).**
- **No significant difference between atmospheres on the change in IJ volume after 26 hours (p = .11)**
- **IJ interval 1 (supraclavicular) offers the biggest changes in IJ volume and is a stable, repeatable point for measurement between subjects.**
- **Baseline IJ volumes were slightly higher during campaign 1 vs campaign 2 (p = 0.02).**
- **This is possibly related to bed rest induced plasma volume loss during campaign 1 that carried over to campaign 2.**
- **The relationship between these findings and ICP changes in -12º HDT needs further evaluation.**

**CONCLUSION**

- **IJ vein volumes incrementally increased with steeper HDT angles (0 to -30º) during pre-bed rest tilt table testing.**
- **IJ volumes trended downward after 26 hours of 12º HDT in the presence of CO2 (p = .09) compared to ambient air (p = .58).**
- **No significant difference between atmospheres on the change in IJ volume after 26 hours (p = .11)**
- **IJ interval 1 (supraclavicular) offers the biggest changes in IJ volume and is a stable, repeatable point for measurement between subjects.**

**Disclosure**: This study was funded by the National Space Biomedical Research Institute and the Baylor College of Medicine Center for Space Medicine

**References**


**Figures**

- Fig 1. Cephalad fluid shifting in micro gravity
- Fig 2. Sonosite M-Turbo
- Fig 3. Change in IJ Volume with increasing HDT
- Fig 4. Change in IJ Volume in 12º HDT from Baseline to post bed rest by atmosphere
- Fig 5. CSA and various IJ intervals with increasing HDT