TRANSIENT MRI CHANGE ASSOCIATED WITH A SINGLE HYPOBARIC EXPOSURE – PRELIMINARY RESULTS

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INTRODUCTION

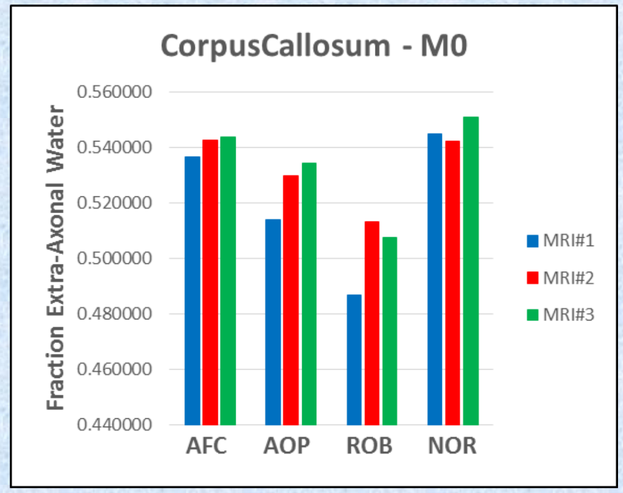
We have previously reported subcortical white matter hyperintensities (WMH) occurring in two groups repetitively exposed to occupationally non-hypoxic hypobaria. Historically, neurological injury was believed to be secondary to gas bubble occlusion of arterioles. However, both the focal and the generalized white matter changes demonstrated on magnetic resonance imaging (MRI) suggest additional work is required for an understanding of patho-physiology. We proposed examining transient MRI changes occurring in response to a single occupational exposure to hypobaria.

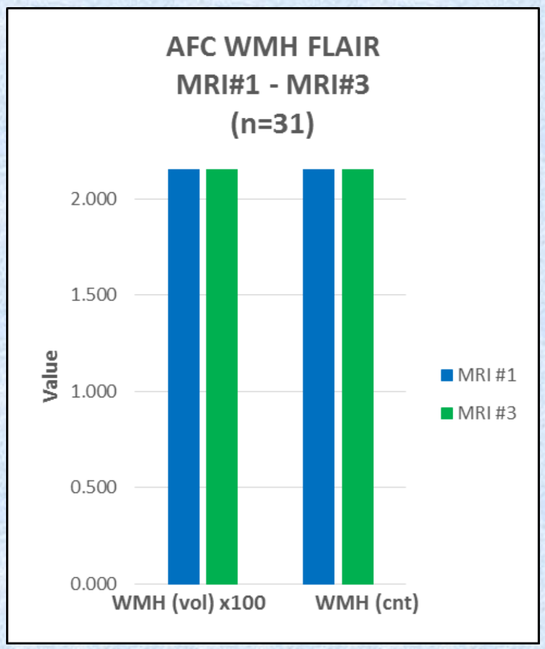
METHODS

All subjects were active duty U.S. Air Force personnel undergoing occupationally required exposure. The four limbs are hypobaric hypoxic, hypobaric normoxemic, hypoxic normobaric, & control. Subjects undergo 7 days of no hypobaria (>2k feet) or alcohol exposure with MRI 24 hours prior to occupational exposure, 24 hours after exposure, and 72 hours after exposure. Imaging was performed at the Wilford Hall Ambulatory Surgical Clinic, Lackland AFB using a Siemens 3T Verio scanner with 32-channel head coil with sequences as previously described. Measurement of fluid-attenuated inversion recovery, diffusion tensor imaging, cerebral arterial blood flow, Q-space, cortical thickness, and spectroscopy was performed as previously reported. Additionally, inflammatory markers (TNF-α, IFN-γ, IL-6, S100B) and microparticles were examined immediately prior to exposure, immediately after exposure, 24 hours after exposure, and 72 hours after exposure. The t-test was used for parametric parameters while Wilcoxon was used for non-parametric parameters.

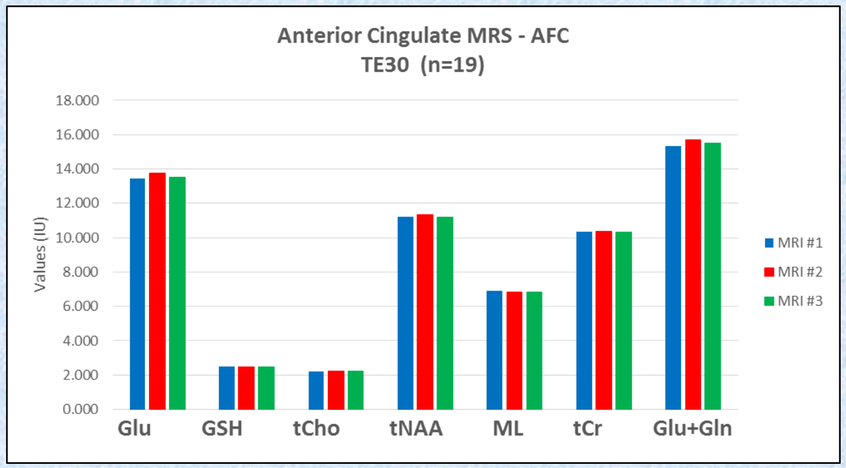
RESULTS

No acute change in WMH burden was noted, with aircrew WMH burden at time of initial altitude chamber training no different from our previously measured controls. A trend toward up-regulation of glutamate and glutamine in the anterior cingulate and a trend toward up-regulation of white matter > gray matter cerebral blood flow is noted. A trend toward increased Q-space fluid is observed post-exposure. A trend toward recovery by 72 hours is noted.





Cerebral Blood Flow	
Subject mL/100 g/min	*Average*
Avg WM #1 AFC	*7.382*
Avg WM #2 AFC	*7.724*
Avg WM #3 AFC	*7.638*



CONCLUSION

Preliminary results suggest an up-regulation of metabolic activity (as measured by magnetic resonance spectroscopy) with up-regulation of corresponding cerebral blood flow suggesting transient injury. Increased extra-cellular fluid as measured by Q-space supports a hypothesis of transient inflammatory change. Current results are preliminary and additional study is required.