

Regional Analysis of Longitudinal MAP-MRI Changes following Mild Traumatic Brain Injury

Mihika Gangolli^{1,2,3}

Neil Perkins⁴

Luca Marinelli⁵

Peter J. Basser¹

Alexandru Avram¹

1. Section of Quantitative Tissue Imaging and Sciences, The *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, Bethesda, Maryland USA
2. The Military Traumatic Brain Injury Initiative (MTBI²), Uniformed Services University of the Health Sciences, Bethesda, Maryland USA
3. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc., Bethesda, MD USA
4. Division of Population Health Research, The *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, Bethesda, Maryland USA
5. Global Research, General Electric, Niskayuna, NY, USA

Cross-sectional MRI studies of mild traumatic brain injury (mTBI) often yield conflicting findings with poor clinical correlations. This pilot study uses Mean Apparent Propagator MRI (MAP-MRI) to explore tissue microstructural changes following mTBI. Eighteen mTBI patients (ages 15-50) and 13 healthy controls underwent MR scans at four timepoints (within 72 hours, 5-10 days, 15-29 days, 83-97 days post-trauma). Region of interest (ROI) based Bland-Altman analysis identified MAP-MRI metrics as outliers in key regions of interest (ROIs) including the pallidum, corpus callosum and thalamus. Random forest classification distinguished mTBI subjects from controls with 11.46% testing error rate and 80% prediction accuracy using the six ROI/parameter combinations with highest influence and Youden's Index (J) = 0.15. This study highlights the potential of cross-sectional and longitudinal analyses of MAP-MRI for the diagnosis and prognosis of mTBI.