An Investigation of Differences in White Matter Tract Patterns in Alcohol Use Disorder: Standard Statistical and Covariance Analyses

Kelly Kolleck[1], Evgeny J. Chumin[2,3], Yu-Chien Wu[2,3], Mario Dzemidzic[2,3], Karmen Yoder[2,3,4]
[1]Indiana University School of Medicine; [2]Radiology & Imaging Sciences, IUSM; [3]Center for Neuroimaging, IUSM; [4]Stark Neurosciences Research Institute, IUSM

Background: Magnetic resonance imaging (MRI) studies have been used to demonstrate differences in white matter (WM) in the brains of individuals with alcohol use disorder (AUD). Alcohol use is known to be deleterious on WM integrity, and there are reports of an inverse relationship between WM fractional anisotropy (FA) and self-reported alcohol consumption. Still, the specific WM tracts which are affected remain unclear. This study sought to determine whether alcohol use differentially alters FA and neurite microstructure in WM regions of interest (ROIs). We used diffusion weighted MRI to compare metrics of WM integrity between non-treatment seeking individuals with AUD and social drinkers (SD).

Methods: Thirteen subjects with AUD and 21 SD underwent hybrid diffusion imaging (HYDI) on a 3T Siemens MRI scanner. HYDI data were processed with diffusion tensor imaging and Neurite Orientation Dispersion and Density Index (NODDI) modeling to produce parametric images of outcome metrics. All parametric images were converted to standard space before extraction of average parameter values from regions of interest defined by the John Hopkins University 1 mm WM atlas. For each metric, independent *t*-tests were used to test for group differences. Covariance analyses will be used to examine differences in covariance matrix structure between groups.

Results: Compared to social drinkers, participants with AUD had significantly lower FA, higher radial diffusivity, and higher orientation dispersion (OD) in subregions of the corpus callosum ($p<0.05$). AUD was also associated with higher OD in the cingulate gyri ($p<0.01$).

Conclusion: Individuals with AUD had significantly altered WM metrics in multiple tracts, consistent with previous research. This is also the first report of NODDI metrics in AUD; the higher OD may reflect WM disorganization. Ultimately, understanding the anatomic variance between groups will help to elucidate connectivity differences that may either predispose individuals to AUD and/or which are disrupted by chronic alcohol consumption.