Unique white matter microstructural patterns in ADHD presentations—a diffusion tensor imaging study

Alena Svatkova, Igor Nestrasil, Kyle Rudser, Jodene Goldenring Fine, Jesse Bledsoe and Margaret Semrud-Clikeman

HUMAN BRAIN MAPPING (May 2016)
DOI : 10.1002/hbm.23243

Abstract

Attention-deficit/hyperactivity disorder predominantly inattentive (ADHD-PI) and combined (ADHD-C) presentations are likely distinct disorders that differ neuroanatomically, neurochemically, and neuropsychologically. However, to date, little is known about specific white matter (WM) regions differentiating ADHD presentations. This study examined differences in WM microstructure using diffusion tensor imaging (DTI) data from 20 ADHD-PI, 18 ADHD-C, and 27 typically developed children. Voxel-wise analysis of DTI measurements in major fiber bundles was carried out using tract-based spatial statistics (TBSS). Clusters showing diffusivity abnormalities were used as regions of interest for regression analysis between fractional anisotropy (FA) and neuropsychological outcomes. Compared to neurotypicals, ADHD-PI children showed higher FA in the anterior thalamic radiations (ATR), bilateral inferior longitudinal fasciculus (ILF), and in the left corticospinal tract (CST). In contrast, the ADHD-C group exhibited higher FA in the bilateral cingulum bundle (CB). In the ADHD-PI group, differences in FA in the left ILF and ATR were accompanied by axial diffusivity (AD) abnormalities. In addition, the ADHD-PI group exhibited atypical mean diffusivity in the forceps minor (FMi) and left ATR and AD differences in right CB compared to healthy subjects. Direct comparison between ADHD presentations demonstrated radial diffusivity differences in FMi. WM clusters with FA irregularities in ADHD were associated with neurobehavioral performance across groups. In conclusion, differences in WM microstructure in ADHD presentations strengthen the theory that ADHD-PI and ADHD-C are two distinct disorders. Regions with WM irregularity seen in both ADHD presentations might serve as predictors of executive and behavioral functioning across groups.