Diffusion tensor imaging studies of attention-deficit/hyperactivity disorder: meta-analyses and reflections on head motion

Yuta Aoki, Samuele Cortese, Francisco Xavier Castellanos

Journal of Child Psychology and Psychiatry, 2017
DOI: 10.1111/jcpp.12778

Abstract

Background
Diffusion tensor imaging studies have shown atypical fractional anisotropy (FA) in individuals with attention-deficit/hyperactivity disorder (ADHD), albeit with conflicting results. We performed meta-analyses of Whole-brain voxel-based analyses (WBVBA) and tract-based spatial statistics (TBSS) studies in ADHD, along with a qualitative review of TBSS studies addressing the issue of head motion, which may bias results.

Methods
We conducted a systematic literature search (last search on April 1st, 2016) to identify studies comparing FA values between individuals with ADHD and typically developing (TD) participants. Signed differential mapping was used to compute effect sizes and integrate WBVBA and TBSS studies, respectively. TBSS datasets reporting no between-group motion differences were identified.

Results
We identified 14 WBVBA (ADHDn = 314, TDn = 278) and 13 TBSS datasets (ADHDn = 557, TDn = 568). WBVBA meta-analysis showed both significantly lower and higher FA values in individuals with ADHD; TBSS meta-analysis showed significantly lower FA in ADHD compared with TD in four clusters: two in the corpus callosum (isthmus and posterior midbody), one in right inferior fronto-occipital fasciculus, and one in left inferior longitudinal fasciculus. However, four of six datasets confirming no group-differences in motion showed no significant between-group FA differences.

Conclusions
A growing diffusion tensor imaging (DTI) literature (total N = 1,717) and a plethora of apparent findings suggest atypical interhemispheric connection in ADHD. However, FA results in ADHD should be considered with caution, since many studies did not examine potential group differences in head motion, and most of the studies reporting no difference in motion showed no significant results. Future studies should address head motion as a priority and assure that groups do not differ in head motion.