Double-Dissociation between the mechanism leading to impulsivity and inattention in Attention Deficit Hyperactivity Disorder

Masafumi Sanefuji, Michael Craig, Valeria Parlatini, Mitul A. Mehta, Declan G. Murphy, Marco Catani, Leonardo Cerliani, Michel Thiebaut de Schotten

Cortex, (June 2016)
DOI: http://dx.doi.org/10.1016/j.cortex.2016.06.005.

Abstract

Two core symptoms characterize Attention Deficit Hyperactivity Disorder (ADHD) subtypes: inattentiveness and hyperactivity-impulsivity. While previous brain imaging research investigated ADHD as if it was a homogenous condition, its two core symptoms may originate from different brain mechanisms. We, therefore, hypothesized that the functional connectivity of cortico-striatal and attentional networks would be different between ADHD subtypes. We studied 165 children (mean age 10.93 years; age range, 7-17 year old) diagnosed as having ADHD based on their revised Conner’s rating scale score and 170 typical developing individuals (mean age 11.46 years; age range, 7-17 year old) using resting state functional fMRI. Groups were matched for age, IQ and head motion during the MRI acquisition. We fractionated the ADHD group into predominantly inattentive, hyperactive-impulsive and combined subtypes based on their revised Conner’s rating scale score. We then analyzed differences in resting state functional connectivity of the cortico-striatal and attentional networks between these subtypes. We found a double dissociation of functional connectivity in the cortico-striatal and ventral attentional networks, reflecting the subtypes of the ADHD participants. Particularly, the hyperactive-impulsive subtype was associated with increased connectivity in cortico-striatal network, whereas the inattentive subtype was associated with increased connectivity in the right ventral attention network. Our study demonstrated for the first time a right lateralized, double dissociation between specific networks associated with hyperactivity-impulsivity and inattentiveness in ADHD children, providing a biological basis for exploring symptom dimensions and revealing potential targets for more personalized treatments.