Age-related connectivity differences between attention deficit and hyperactivity disorder patients and typically developing subjects: a resting-state functional MRI study

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Abstract

Attention deficit and hyperactivity disorder (ADHD) is a disorder characterized by behavioral symptoms including hyperactivity/impulsivity among children, adolescents, and adults. These ADHD related symptoms are influenced by the complex interaction of brain networks which were under explored. We explored age-related brain network differences between ADHD patients and typically developing (TD) subjects using resting state fMRI (rs-fMRI) for three age groups of children, adolescents, and adults. We collected rs-fMRI data from 184 individuals (27 ADHD children and 31 TD children; 32 ADHD adolescents and 32 TD adolescents; and 31 ADHD adults and 31 TD adults). The Brainnetome Atlas was used to define nodes in the network analysis. We compared three age groups of ADHD and TD subjects to identify the distinct regions that could explain age-related brain network differences based on degree centrality, a well-known measure of nodal centrality. The left middle temporal gyrus showed significant interaction effects between disease status (i.e., ADHD or TD) and age (i.e., child, adolescent, or adult) (P < 0.001). Additional regions were identified at a relaxed threshold (P < 0.05). Many of the identified regions (the left inferior frontal gyrus, the left middle temporal gyrus, and the left insular gyrus) were related to cognitive function. The results of our study suggest that aberrant development in cognitive brain regions might be associated with age-related brain network changes in ADHD patients. These findings contribute to better understand how brain function influences the symptoms of ADHD.