Altered brain structural networks in attention deficit/hyperactivity disorder children revealed by cortical thickness.

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Abstract

This study investigated the cortical thickness and topological features of human brain anatomical networks related to attention deficit/hyperactivity disorder. Data were collected from 40 attention-deficit/hyperactivity disorder children and 40 normal control children. Interregional correlation matrices were established by calculating the correlations of cortical thickness between all pairs of cortical regions (68 regions) of the whole brain. Further thresholds were applied to create binary matrices to construct a series of undirected and unweighted graphs, and global, local, and nodal efficiencies were computed as a function of the network cost. These experimental results revealed abnormal cortical thickness and correlations in attention deficit/hyperactivity disorder and showed that the brain structural networks of attention deficit/hyperactivity disorder subjects had inefficient small-world topological features. Furthermore, their topological properties were altered abnormally. In particular, decreased global efficiency combined with increased local efficiency in attention deficit/hyperactivity disorder children led to a disorder-related shift of the network topological structure toward regular networks. In addition, nodal efficiency, cortical thickness, and correlation analyses revealed that several brain regions were altered in attention deficit/hyperactivity disorder patients. These findings are in accordance with a hypothesis of dysfunctional integration and segregation of the brain in patients with attention deficit/hyperactivity disorder and provide further evidence of brain dysfunction in attention deficit/hyperactivity disorder patients by observing cortical thickness on magnetic resonance imaging.