Neural hyperactivity related to working memory in drug-naive boys with attention deficit hyperactivity disorder.

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Abstract

BACKGROUND:
Impaired working memory is thought to be a core feature of attention deficit hyperactivity disorder (ADHD). Previous imaging studies investigating working memory in ADHD have used tasks involving different cognitive resources and ignoring the categorical judgments about objects that are essential parts of performance in visual working memory tasks, thus complicating the interpretation of their findings. In the present study, we explored differential neural activation in children and adolescents with ADHD and in healthy controls using functional magnetic resonance imaging (fMRI) with the categorical n-back task (CN-BT), which maximized demands for executive reasoning while holding memory demands constant.

METHODS:
A total of 33 drug-naive, right-handed male ADHD without comorbidity (mean age 9.9±2.4years) and 27 right-handed, healthy male controls (mean age 10.9±2.7years) were recruited in the present study. Event-related fMRI was used to study differences in brain activity during the CN-BT between the two groups.

RESULTS:
The two groups did not differ in their accuracy in the CN-BT, although the ADHD patients showed significantly shorter reaction times to correct responses than did the controls. During the CN-BT, both ADHD patients and controls showed significant positive and negative activation by the correct responses, mainly in the sensory-motor pathways and the striato-cerebellum circuit. Additionally, the ADHD patients showed significantly higher activation in the bilateral globus pallidus and the right hippocampus compared with the controls. There was also a positive correlation between hyperactivation of the left globus pallidus and the reaction time to correct responses in ADHD.

CONCLUSIONS:
In contrast to controls, ADHD patients showed neural hyperactivation in the striatum and mediotemporal area during a working memory task involving categorization. Hyperfunction in these areas might be the pathophysiological foundation of ADHD, related to the deficits of working memory and the impulsive symptoms.