Dopaminergic modulation of default mode network brain functional connectivity in attention deficit hyperactivity disorder

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Abstract

Introduction
Recent evidence suggests that attention deficit hyperactivity disorder (ADHD) is associated with a range of brain functional connectivity abnormalities, with one of the most prominent being reduced inhibition of the default mode network (DMN) while performing a cognitive task. In this study, we examine the effects of a methylphenidate dose on brain functional connectivity in boys diagnosed with ADHD while they performed a cognitive task.

Method
Brain functional connectivity was estimated using steady-state visual evoked potential partial coherence before and 90 min after the administration of a methylphenidate dose to 42 stimulant drug-naïve boys newly diagnosed with ADHD while they performed the A-X version of the continuous performance task (CPT A-X).

Results
Methylphenidate robustly reversed the transient functional connectivity increase in the A-X interval seen premedication to a postmedication decrease during this interval. In addition, methylphenidate-induced reductions in individual reaction time were correlated with corresponding reductions in functional connectivity.

Conclusion
These findings suggest that methylphenidate suppresses the increased functional connectivity observed in ADHD and that such suppression is associated with improved performance. Our findings support the suggestion that the increased functional connectivity we have observed in ADHD is associated with abnormal DMN activity. In addition, we comment on the significance of specific frequency channels mediating top-down communication within the cortex and the extent to which our findings are selectively sensitive to top-down intracortical communication.