Increase or decrease of fMRI activity in adult attention deficit/ hyperactivity disorder – does it depend on task difficulty?

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Abstract

Background: Attention deficit/hyperactivity disorder (ADHD) has been shown to affect working memory, and fMRI studies in children and adolescents with ADHD report hypoactivation in task-related attentional networks. However, studies with adult ADHD patients addressing this issue as well as the effects of clinically valid methylphenidate (MPH) treatment are scarce. This study contributes to closing this gap.

Methods: Thirty-five adult patients were randomized to six weeks of double-blind placebo or MPH treatment. Patients completed an fMRI n-back task both before and after the assigned treatment, and matched healthy controls were tested and compared to the untreated patients.

Results: There were no whole-brain differences between any of the groups. However, when specified regions of interest were investigated, the patient group showed enhanced BOLD responses in dorsal and ventral areas before treatment. This increase was correlated with performance across all participants and with ADHD symptoms in the patient group. Furthermore, we found an effect of treatment in the right superior frontal gyrus, with MPH-treated patients exhibiting increased activation, which was absent in the placebo-treated patients.

Conclusions: Our results indicate distinct activation differences between untreated adult ADHD patients and matched healthy controls during a working memory task. These differences might reflect compensatory efforts by the patients, who are performing at the same level as the healthy controls. We furthermore found a positive effect of MPH on the activation of a frontal region of interest. These observations contribute to a more thorough understanding of adult ADHD and provide impulses for the evaluation of therapy-related changes.