Structural and Functional Brain Abnormalities in Attention-Deficit/Hyperactivity Disorder and Obsessive-Compulsive Disorder - A Comparative Meta-analysis

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Importance
Patients with attention-deficit/hyperactivity disorder (ADHD) and obsessive-compulsive disorder (OCD) share impaired inhibitory control. However, it is unknown whether impairments are mediated by shared or disorder-specific neurostructural and neurofunctional abnormalities.

Objective
To establish shared and disorder-specific structural, functional, and overlapping multimodal abnormalities in these 2 disorders through a voxel-based meta-analytic comparison of whole-brain gray matter volume (GMV) and functional magnetic resonance imaging (fMRI) studies of inhibition in patients with ADHD and OCD.

Data Sources

Study Selection
Whole-brain voxel-based morphometry (VBM) or fMRI studies during inhibitory control comparing children and adults with ADHD or OCD with controls.

Data Extraction and Synthesis
Voxel-wise meta-analyses of GMV or fMRI differences were performed using Seed-based d-Mapping. Regional structure and function abnormalities were assessed within each patient group and then a quantitative comparison was performed of abnormalities (relative to controls) between ADHD and OCD.

Main Outcomes and Measures
Meta-analytic disorder-specific and shared abnormalities in GMV, in inhibitory fMRI, and in multimodal functional and structural measures.

Results
The search revealed 27 ADHD VBM data sets (including 931 patients with ADHD and 822 controls), 30 OCD VBM data sets (928 patients with OCD and 942 controls), 33 ADHD fMRI data sets (489 patients with ADHD and 591 controls), and 18 OCD fMRI data sets (287 patients with OCD and 284 controls). Patients with ADHD showed disorder-contrasting multimodal structural (left $z = 1.904$, $P < .001$; right $z = 1.738$, $P < .001$) and functional (left $z = 1.447$, $P < .001$; right $z = 1.229$, $P < .001$) abnormalities in bilateral basal ganglia/insula, which were decreased in GMV and function in patients with ADHD relative to those with OCD (and controls). In OCD patients, they were enhanced relative to controls. Patients with OCD showed disorder-specific reduced function and structure in rostral and dorsal anterior cingulate/medial prefrontal cortex (fMRI $z = 2.113$, $P < .001$; VBM $z = 1.622$, $P < .001$), whereas patients with ADHD showed disorder-specific underactivation predominantly in the right ventrolateral prefrontal cortex ($z = 1.229$, $P < .001$). Ventromedial prefrontal GMV reduction was shared in both disorders relative to controls.

Conclusions and Relevance
Shared impairments in inhibitory control, rather than representing a transdiagnostic endophenotype in ADHD and OCD, were associated with disorder-differential functional and structural abnormalities. Patients with ADHD showed smaller and underfunctioning ventrolateral prefrontal/insula-striatal regions whereas patients with OCD showed larger and hyperfunctioning insular-striatal regions that may be poorly controlled by smaller and underfunctioning rostro/dorsal medial prefrontal regions.