Mapping the neuroanatomic substrates of cognition in familial attention deficit hyperactivity disorder

Muster R, Choudhury S, Sharp W, Kasparek S, Sudre G, Shaw P.

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Abstract

BACKGROUND:
While the neuroanatomic substrates of symptoms of attention deficit hyperactivity disorder (ADHD) have been investigated, less is known about the neuroanatomic correlates of cognitive abilities pertinent to the disorder, particularly in adults. Here we define the neuroanatomic correlates of key cognitive abilities and determine if there are associations with histories of psychostimulant medication.

METHODS:
We acquired neuroanatomic magnetic resonance imaging data from 264 members of 60 families (mean age 29.5; s.d. 18.4, 116 with ADHD). Using linear mixed model regression, we tested for associations between cognitive abilities (working memory, information processing, intelligence, and attention), symptoms and both cortical and subcortical volumes.

RESULTS:
Symptom severity was associated with spatial working memory (t = -3.77, p = 0.0002), processing speed (t = -2.95, p = 0.004) and a measure of impulsive responding (t = 2.19, p = 0.03); these associations did not vary with age (all p > 0.1). Neuroanatomic associations of cognition varied by task but centered on prefrontal, lateral parietal and temporal cortical regions, the thalamus and putamen. The neuroanatomic correlates of ADHD symptoms overlapped significantly with those of working memory (Dice’s overlap coefficient: spatial, p = 0.003; verbal, p = 0.001) and information processing (p = 0.02). Psychostimulant medication history was associated with neither cognitive skills nor with a brain-cognition relationships.

CONCLUSIONS:
Diagnostic differences in the cognitive profile of ADHD does not vary significantly with age; nor were cognitive differences associated with psychostimulant medication history. The neuroanatomic substrates of working memory and information overlapped with those for symptoms within these extended families, consistent with a pathophysiological role for these cognitive skills in familial ADHD.