Magnetization transfer imaging identifies basal ganglia abnormalities in adult ADHD that are invisible to conventional T1 weighted voxel-based morphometry


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Abstract

In childhood, Attention Deficit Hyperactivity Disorder (ADHD) is reliably associated with reduced volume of the striatum. In contrast, striatal abnormalities are infrequently detected in voxel-based morphometry (VBM) neuroimaging studies of adults with ADHD. This discrepancy has been suggested to reflect the normalisation of striatal morphology with age and prolonged treatment of symptoms. If so, this would indicate that while striatal abnormalities are linked to symptom expression in childhood, they cannot explain the persistence of these symptoms in adulthood. However, this may not be the case. Instead, we hypothesized that the lack of evidence for striatal abnormalities in adult ADHD may reflect the poor sensitivity of typical (T1-weighted) neuroimaging to detect subcortical differences. To address this, we acquired both magnetization transfer (MT) saturation maps optimized for subcortical contrast, and conventional T1-weighted images in 30 adults with ADHD and 30 age, IQ, gender and handedness-matched controls. Using VBM of both datasets, we demonstrate volumetric reductions within the left ventral striatum on MT that are not observed on identically pre-processed T1-weighted images from the same participants. Nevertheless, both techniques reported similar sensitivity to cortical abnormalities in the right inferior parietal lobe. Additionally, we show that differences in striatal iron may potentially explain this reduced sensitivity of T1-weighted images in adults. Together, these findings indicate that prior VBM studies reporting no abnormalities in striatal volume in adult ADHD might have been compromised by the methodological insensitivity of T1-weighted VBM to subcortical differences, and that structural abnormalities of the striatum in ADHD do indeed persist into adulthood.