Brain abnormalities in attention-deficit hyperactivity disorder: a review.

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Abstract
AIM. To review the magnetic resonance imaging findings in child and adult attention-deficit hyperactivity disorder (ADHD).

DEVELOPMENT. Studies have shown that ADHD is characterised by multiple functional and structural neural network abnormalities including most prominently fronto-striatal, but also fronto-parieto-temporal, fronto-cerebellar and even fronto-limbic networks. Evidence from longitudinal structural imaging studies has shown that ADHD is characterised by a delay in structural brain maturation. This is reinforced by indirect evidence from cross-sectional imaging studies for more immature brain function as well as structural and functional connectivity patterns, which, however, needs corroboration by longitudinal studies. Dysfunction of the ventrolateral prefrontal cortex seems to be more pronounced in ADHD relative to other pediatric disorders and there is some evidence for differential abnormalities in the basal ganglia. A meta-analysis of stimulant effects on brain function shows that the most consistent mechanism of action of acute psychostimulant medication is the increased activation of the inferior prefrontal cortex and the basal ganglia. First attempts to use neuroimaging data to make individual diagnostic classifications of ADHD children based on pattern recognition techniques are promising but need replication across centres and scanners.

CONCLUSIONS. The last two decades of neuroimaging have shaped out biomarkers of ADHD. Future studies will need to focus on using this information for clinical translation such as using neuroimaging for individual diagnostic and prognostic classification or by using neuroimaging as a neurotherapy to reverse those brain function abnormalities that have been established over the last two decades of neuroimaging.