Anatomical characterization of ADHD using an atlas-based analysis: A diffusion tensor imaging study

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Abstract

Purpose:
To examine brain diffusion characteristics in paediatric patients with attention-deficit hyperactivity disorder (ADHD) using diffusion tensor imaging (DTI) and an atlas-based anatomical analysis of the whole brain and to investigate whether these images have unique characteristics that can support functional diagnoses.

Materials and Methods:
Seventeen children with ADHD and ten control subjects (all age-matched) underwent MRI scans. The Institutional Ethics Board approved this study. Morphometric analysis was performed using MrıStudio software. The diffusion images were normalised using a linear transformation, followed by large deformation diffeomorphic metric mapping (LDDMM). For 189 parcellated brain regions, the volume, fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD), and radial diffusivity (RD) were measured.

Results:
Children with ADHD were found to have increased in the body of lateral ventricle volumes compared to the control. Increased MD was found in the deep grey matter, amygdala, thalamus, substantia nigra, and also the cerebellum left and right side. Increased RD was found in the deep grey matter, caudate, thalamus, substantia nigra and hippocampus left and right side compared to the control. Significant elevated FA was found in the bilateral splenium of the corpus callosum in ADHD patients.

Conclusion:
Children with ADHD display abnormal diffusion characteristics and anatomical features compared to healthy controls. DTI can provide sensitive information on the integrity of white matter (WM) and intra-WM structures in ADHD.