Psychoradiologic Utility of MR Imaging for Diagnosis of Attention Deficit Hyperactivity Disorder: A Radiomics Analysis.

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Abstract

Purpose To identify cerebral radiomic features related to diagnosis and subtyping of attention deficit hyperactivity disorder (ADHD) and to build and evaluate classification models for ADHD diagnosis and subtyping on the basis of the identified features. Materials and Methods A consecutive cohort of 83 age- and sex-matched children with newly diagnosed and never-treated ADHD (mean age 10.83 years ± 2.30; range, 7-14 years; 71 boys, 40 with ADHD-inattentive [ADHD-I] and 43 with ADHD-combined [ADHD-C, or inattentive and hyperactive]) and 87 healthy control subjects (mean age, 11.21 years ± 2.51; range, 7-15 years; 72 boys) underwent anatomic and diffusion-tensor magnetic resonance (MR) imaging. Features representing the shape properties of gray matter and diffusion properties of white matter were extracted for each participant. The initial feature set was input into an all-relevant feature selection procedure within cross-validation loops to identify features with significant discriminative power for diagnosis and subtyping. Random forest classifiers were constructed and evaluated on the basis of identified features. Results No overall difference was found between children with ADHD and control subjects in total brain volume (1069830.00 mm³ ± 90743.36 vs 1079213.00 mm³ ± 92742.25, respectively; P = .51) or total gray and white matter volume (611978.10 mm³ ± 51622.81 vs 616960.20 mm³ ± 51872.93, respectively; P = .53; 413532.00 mm³ ± 41 114.33 vs 418173.60 mm³ ± 42395.48, respectively; P = .47). The mean classification accuracy achieved with classifiers to discriminate patients with ADHD from control subjects was 73.7%. Alteration in cortical shape in the left temporal lobe, bilateral cuneus, and regions around the left central sulcus contributed significantly to group discrimination. The mean classification accuracy with classifiers to discriminate ADHD-I from ADHD-C was 80.1%, with significant discriminating features located in the default mode network and insular cortex. Conclusion The results of this study provide preliminary evidence that cerebral morphometric alterations can allow discrimination between patients with ADHD and control subjects and also between the most common ADHD subtypes. By identifying features relevant for diagnosis and subtyping, these findings may advance the understanding of neurodevelopmental alterations related to ADHD.