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Relationship between ADHD Symptoms and Vermis Activation Using Single-Photon Emission Computed Tomography (SPECT)

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Objective: It was hypothesized that externalized behavior symptoms (such as impulsive behavior or hyperactivity) may correlate with increased vermis activation, due to the known role of the vermis in body locomotion. Method: Three factors of interest in attention-deficit/hyperactivity disorder (ADHD) symptoms were used: disorganized, disorganization/impulsivity, and impulsivity. A curvilinear estimation regression analysis was conducted in SPSS-V21 using an outcome variable of regional cerebral blood flow (rCBF) *z*-score for eight vermis regions-of-interest (ROI), in 1323 children with ADHD diagnosis seen for medical evaluation. Activation was determined by differences between at-rest and concentration-task SPECT measures. Average participant age was 12, with 30% female, 47% Caucasian, 1.4% African-American, and 46% Asian. Results: In the regression, with $\alpha = .001$, associations were non-significant for disorganized or impulsivity factors. Disorganization/impulsivity and vermis rCBF were significantly associated in logarithmic curves. Results of further comparisons of five component items of the disorganization/impulsivity factor indicated significance for two: lacking attention to detail (over 8 ROI, $p \leqq .007$), and trouble maintaining organized workspace/living area (over 5 ROI, $p < .05$). Conclusion(s): This study found a relationship between ADHD-associated behavioral symptoms (disorganization/ impulsivity) and cerebellar vermis activation. This is clinically significant because the cerebellum is thought to mediate ADHD locomotor movement (hyperactivity), but not executive functions (organization); this possible mediation begs further research. Also, it suggests the validity of clinical behavior scales in measuring physiological ADHD phenomena. Future plans include exploration of parent- and self-reported clinical scale differences and associations with activation, and exploration of other ADHD scale factors and relationship to fronto-striatal-thalamic activation.

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