MEG Analysis of Neural Interactions in Attention-Deficit/Hyperactivity Disorder

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Abstract

The aim of the present study was to explore the interchannel relationships of resting-state brain activity in patients with attention-deficit/hyperactivity disorder (ADHD), one of the most common mental disorders that develop in children. Magnetoencephalographic (MEG) signals were recorded using a 148-channel whole-head magnetometer in 13 patients with ADHD (range: 8–12 years) and 14 control subjects (range: 8–13 years). Three complementary measures (coherence, phase-locking value, and Euclidean distance) were calculated in the conventional MEG frequency bands: delta, theta, alpha, beta, and gamma. Our results showed that the interactions among MEG channels are higher for ADHD patients than for control subjects in all frequency bands. Statistically significant differences were observed for short-distance values within right-anterior and central regions, especially at delta, beta, and gamma-frequency bands (p<0.05) Mann-Whitney U test with false discovery rate correction). These frequency bands also showed statistically significant differences in long-distance interactions, mainly among anterior and central regions, as well as among anterior, central, and other areas. These differences might reflect alterations during brain development in children with ADHD. Our results support the role of frontal abnormalities in ADHD pathophysiology, which may reflect a delay in cortical maturation in the frontal cortex.