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Midbrain, striatal and amygdalar dopaminergic dysfunction in ADHD

Medical Studies/Trials

Published: Wednesday, 7-Jun-2006

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The brain's dopamine system, which has long been associated with reward learning and reward-related behavior, works differently in treated and untreated attention deficit hyperactivity disorder (ADHD) individuals, according to a study presented by German researchers at [SNM's 53rd Annual Meeting in San Diego](#).

"The significant difference we found between treated and untreated ADHD patients provides an important hint on the effect of the most commonly prescribed drug for this disease, which has long baffled and frustrated parents and physicians," noted Felix M Mottaghy, research fellow at University Ulm in Germany. Until this study, there has been no direct evidence pointing to the beneficial effect of methylphenidate (drugs like Ritalin) on the body's dopamine system, added the co-author of "Midbrain, Striatal and Amygdalar Dopaminergic Dysfunction in Attention Deficit Hyperactivity Disorder (ADHD)." For years, researchers have speculated that methylphenidate calms people with ADHD by amplifying the release of the neurotransmitter dopamine, improving attention and focus in those who have weak dopamine signals. "This is a very preliminary basic science study, initiated by Andrea G. Ludolph from the child and youth psychiatry department of the University Ulm; however, future studies of the dopamine system could aid differential diagnosis in hyperactive children," said Mottaghy.

The principal characteristics of ADHD are inattention, hyperactivity and impulsivity, and this condition can become apparent early in a child's life--sometimes as soon as preschool. Estimates indicate that there are as many as 2 million ADHD children (or 1 in every classroom of about 25 students) in the United States. With ADHD, there is an imbalance of several neurotransmitter systems, said Mottaghy. "The most affected seemed to be the dopaminergic system. Until now most studies focused on the so-called postsynaptic or receiving part of this system," he explained. "Our study shows that the beneficial effect of methylphenidate is received via 'normalization' of the dopamine system," he added. "We demonstrated that the brain's dopamine system--including midbrain, the striatum and the amygdala--is differentially modulated in treated and untreated ADHD patients with respect to healthy normal controls," noted Mottaghy. "Methylphenidate leads to a harmonization of the presynaptic dopaminergic neurons that could explain in part the beneficial effects of this central nervous system stimulant," he indicated.

The researchers used positron emission tomography (PET), a noninvasive brain scan, with 18F-DOPA, an imaging drug that is a precursor of dopamine. The University Ulm researchers also used statistic parametric mapping to obtain the statistical comparison of normalized and reoriented brain images, said Mottaghy. "It gives an impression of the distribution of differences within the brain comparing groups of patients or different conditions within one subject," he explained. Additional studies with more subjects need to be undertaken, said Mottaghy, including direct comparison of presynaptic and postsynaptic alterations in an age-matched patients group.

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