



# CrossRoads INSTITUTE™

DEDICATED TO THE ART AND SCIENCE OF HUMAN POTENTIAL

## **Imaging Children With ADHD**

American Medical Association  
12/4/2003

Children with attention deficit-hyperactivity disorder (ADHD) may have significantly altered levels of important neurotransmitters (biochemicals that carry signals to and from cells) in the frontal region of the brain, according to a study publishing in the December issue of the *Journal of Neuropsychiatry and Clinical Neurosciences*.

"Our data show children with ADHD had a two-and-half-fold increased level of glutamate, an excitatory brain chemical that can be toxic to nerve cells," said lead author Helen Courvoisie, M.D., assistant professor, division of child and adolescent psychiatry, department of psychiatry and behavioral sciences at the Johns Hopkins Medical Institutions, Baltimore. "The data also suggest a decreased level of GABA, a neuro-inhibitor. This combination may explain the behavior of children with poor impulse control."

Dr. Courvoisie spoke today at an American Medical Association media briefing on advances in neurology in New York.

"Children with ADHD have problems that are associated with the part of the brain called the frontal lobes," said Dr. Courvoisie. "The frontal lobes are like the 'boss of the brain,' responsible for what we call executive functioning — telling the brain and body what to do." This area regulates impulse control, attention, movement and elaborating on thoughts.

The study used a variation of magnetic resonance imaging (MRI) technology to measure the level of six metabolites (any substance produced by metabolism) in a small portion of the frontal lobe section of the brains of 16 children, 6 to 12 years old. "The MRI machine is reprogrammed so that instead of creating pictures, it allows us to explore whether there are alterations in brain metabolites in children with ADHD," said Dr. Courvoisie.

Eight of the children had been previously diagnosed with hyperactive type ADHD at the University of North Carolina at Chapel Hill. They were compared with study participants that showed no signs of ADHD, who were matched according to age and sex. "There are three types of ADHD: attention-deficit, hyperactive and combined type," explained Dr. Courvoisie. "We focused on the hyperactive type to try to get the clearest picture of what was going awry with their executive function."

"There is a partial malfunctioning of this 'boss of the brain' in ADHD," said Dr. Courvoisie. "I describe it as having a poor manager, like the pointy-headed boss in the Dilbert cartoons — he doesn't know what he's doing, he can't run a good company and everyone becomes frustrated."

ADHD is characterized by difficulty concentrating and paying attention, and a high degree of restless and impulsive behavior. Although the problems may be less pronounced in adulthood, it is often a lifelong condition.

There are three classifications of ADHD, which is based on the relative amount of attention deficit versus hyperactivity:

- \* Inattentive type: predominately attention problems, such as failing to pay attention, being careless, having difficulty attending to tasks, being forgetful and easily distracted, etc.

- \* Hyperactive type: predominately problems with hyperactivity, such as excessive fidgeting, restlessness, impulsive behavior, talking excessively, interrupting others, etc.

- \* Combined type: shows signs of both attention deficit and hyperactivity without having predominate characteristics of either

"The great increase in the diagnosis of ADHD has created some controversy," said Dr. Courvoisie. "It is important to understand and identify the underlying neurology of ADHD so that children with ADHD can be appropriately treated. There are real deficiencies —these are not just fidgety kids."

Understanding real differences in the workings of the brains of children with ADHD could ultimately help target and improve treatment and diagnosis, according to Dr. Courvoisie.