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Novel Imaging Technique Shows Abnormal Brain Anatomy in Children with ADHD

Media Contacts:	Doug Dusik or Maureen Morley	(630) 590-7762
	Doug Dusik (630) 571-7845 ddusik@rsna.org	Maureen Morley (630) 590-7754 mmorley@rsna.org

At A Glance

(Nov. 29, 2004)

- * Researchers have identified anatomical brain abnormalities in children with ADHD.
- * Most of the structural anomalies were found in the fiber pathways that facilitate communication between the frontal lobe and cerebellum.
- * Stimulant medications may help in the normalization of the affected fiber pathways.

CHICAGO - Children with attention deficit hyperactivity disorder (ADHD) display anatomical brain abnormalities beyond chemical imbalance, according to research presented at the annual meeting of the Radiological Society of North America (RSNA). Stimulant medications prescribed to balance brain chemistry appear to normalize some of these brain irregularities, a second study reported.

"We found abnormality of the fiber pathways in the frontal cortex, basal ganglia, brain stem and cerebellum," said lead author of both studies, Manzar Ashtari, PhD., associate professor of radiology and psychiatry at North Shore-Long Island Jewish Health System in New Hyde Park, N.Y.

"These areas are involved in the processes that regulate attention, impulsive behavior, motor activity, and inhibition—the key symptoms in ADHD children," Dr. Ashtari said. "They are also known to be part of a bigger circuit in the brain that establishes communication between the frontal lobe and cerebellum."

According to the National Institute of Mental Health (NIMH), ADHD affects 3 to 5 percent of children in the United States. Children with

ADHD have difficulty controlling their behavior or focusing their attention.

Using diffusion tensor imaging (DTI) to compare 18 children with diagnosed ADHD with 15 control children to evaluate the brain's white-matter fiber development, Dr. Ashtari's team found differences in the brain fiber pathways that transmit and receive information among brain areas.

"Typically ADHD is described as a chemical imbalance, but our research has shown that there may also be subtle anatomical differences in areas of the brain that are important in this disorder," said co-principal investigator Sanjiv Kumra, M.D., a psychiatrist at the Zucker Hillside Hospital in Glen Oaks, N.Y.

In the second study, the researchers found that children who had received stimulant treatment for ADHD had fewer white matter abnormalities than children who did not receive medication.

Patients consisted of two groups, each comprised of 10 children with ADHD. The first group had not taken medication or had been minimally exposed to medications. The second group was exposed to stimulants for an average of 2.5 years. Each of these groups was compared with 10 age- and gender-matched controls. The medicated ADHD children exhibited a normalization effect in fiber pathways of several brain areas.

"The findings from this small, cross-sectional study indicate that the therapeutic effect of stimulants may involve a brain normalization process," Dr. Kumra said.

Most people diagnosed with ADHD in childhood continue to have problems in adolescence and adulthood. "Despite progress in the assessment, diagnosis and treatment of ADHD, this disorder and its treatment have remained controversial," said co-author of the stimulant study, Andrew Adelman, M.D. "This study is yet further proof that children with ADHD differ at a neurobiological level as compared to children without the disorder." Dr. Adelman is chief of developmental and behavioral pediatrics at Schneider Children's Hospital in New Hyde Park, N.Y.

Dr. Ashtari said further studies with larger patient groups must be conducted before offering parents advice for diagnosis or treatment.

Co-authors are Babak Ardekani, Ph.D., Shree Bhaskar, M.D., Tana Clarke, B.S., and Joseph Rhinewine, M.A. (DTI study only). The research was sponsored by an NIMH grant.

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Abstracts:	<ul style="list-style-type: none">• Diffusion Tensor Imaging of Children with Attention Deficit/Hyperactivity Disorder• Stimulant Medications and Brain Normalization Effect in Treated ADHD Patients: A Preliminary Diffusion Tensor Imaging Study
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820 Jorie Blvd, Oak Brook, IL 60523-2251 || (630) 571-2670 || fax (630) 571-7837
U.S. and Canada: Main (800) 381-6660, Membership (877) RSNA-MEM (776-2636)