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NEWS

RSNA Press Release

New Imaging Approach May Help Detect Milder Forms of Developmental Delay

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Magnetic resonance technology may provide early indications of delayed brain development

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This press release was distributed by the AMA Science News Department.

PHILADELPHIA—A new application of a relatively new type of magnetic resonance technology may help give earlier and more definitive diagnosis of delays related to brain development, according to an article in the October issue of *Radiology.* Christopher G. Filippi, M.D., assistant professor of radiology, New York Presbyterian Hospital-Weill Medical College of Cornell University in New York presented information from the study at the American Medical Association Science Reporters Conference today.

"While magnetic resonance (MR) imaging is an important part of the comprehensive evaluation of children diagnosed with developmental delay, the imaging is not sensitive enough to pick up the more subtle signs of those children with milder developmental delays," explains Dr. Filippi. "Magnetic resonance diffusion tensor imaging (MRDTI) is able to detect some signs of delayed brain maturation that aren't visible using regular MR imaging."

The children in the study were evaluated for developmental delays. One group was diagnosed as having an isolated developmental delay with no known cause. These children were compared with children of the same age who showed no signs of delay. All of the children in the study appeared to have normal brain structures according to the results of the MR examinations, however, the MRDTI detected difference in the brains of those who had been diagnosed with isolated developmental delays.

The study relied on the ability of MRDTI to evaluate the development of white fiber tracts. Myelin (a fatty substance that insulates nerve cells) is a major component of white fiber tracts. The increased formation of myelin in white fiber tracts is a key part of normal brain development. The myelination process in normal development is usually nearing its completion by age two. MR imaging has been used to determine signs of normal patterns of myelination and brain maturation, but MRDTI provides values that may help provide more

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detailed information (at a molecular level) about how far advanced this process is or if the process may be delayed. Normal brain maturation and myelination is associated with reduced water diffusion and increased diffusion anisotropy.

This study looked at data about the myelination process in particular brain structures using two measures provided by MRDTI. The first measure was the diffusion constant value (Dav), which gauges how much restriction to water diffusion is present in brain tissue. The other is a measure of anisotropy, which assesses the orientation of white matter fiber tracts. Diffusion anisotropy refers to the ability of water to move in certain directions depending on the orientation of the white matter fiber tracts surrounding it. Diffusion tensor is a mathematical description of diffusion.

In newborns, for example, the diffusion constant value should be high and the anisotropy should be low because there is an increased water content and fewer myelinated axons compared to adults. As the brain matures and myelination increases the Dav should decline and the anisotropy should increase. By the age of two these values begin to resemble those of adults because myelination is nearing completion.

"In this study, in children with developmental delay, we observed a statistically significant, persistent elevation in Dav and a persistent decrease in anisotropy values in almost all the white matter structures studied, while the normal children had unremarkable values for the Dav and anisotropy," Dr. Filippi explains.

"The great thing about MRDTI technology is that it may give us another tool with which to recognize and assess children experiencing developmental delays; more objectively and earlier," notes Dr. Filippi. "MRDTI could provide a great objective tool for research as well."

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Editor's Note: Dr. Filippi has received grant support from the RSNA Research and Education Fund (the study was completed during a time period in which he received an RSNA Scholars Grant). Dr. Filippi received an honorarium from the American Medical Association to speak at today's conference.

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