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Study discovers link between increased white matter and poor motor skills in children with autism

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A study published in the August issue of the journal *Brain* demonstrates, for the first time, an association between increased white matter volume and functional impairment in children with autism.

Findings from researchers at the Kennedy Krieger Institute in Baltimore, Md. reveal that in children with autism, increased white matter volume in the motor region of the brain predicts poorer motor skills. Conversely, in typically developing children, increased white matter volume predicts improved motor skills, with a similar association observed in children with attention deficit/hyperactivity disorder (ADHD). The relationship between increased white matter volume and functional impairment, which appears to be specific to autism, may be representative of global patterns of brain abnormality in autism that not only contribute to motor dysfunction, but also to deficits in socialization and communication that define the disorder.

Children with autism are typically motorically clumsy and awkward, similar to how they are socially clumsy and awkward. They often experience difficulties with basic motor control and with learning more complex motor skills, such as riding a tricycle, pumping their legs on a swing or buttoning, zipping and tying shoe laces. Additionally, high-functioning children with autism often excel in academic areas, such as math, as opposed to athletic activities, such as baseball. Because measures of motor function are highly quantifiable and reproducible,

they are much easier to study than measures of social and communication behavior. Motor signs can serve as markers for deficits in parallel brain systems important for control of socialization and communication.

Researchers utilized anatomic magnetic resonance imaging (aMRI) measures to study 76 children ages 8-12 years, including: 20 high-functioning children with autism; a control group of 36 typically developing (TD) children; and a clinical control group of 20 children with ADHD, a developmental disorder which, like autism, has been found to be associated with impairments in motor execution and control. Findings show a robust association between increased white matter volume and basic motor skill impairment in children with autism, which suggests that it may be a defining biological feature of the disorder. Results demonstrate that the association of increasing white matter volume and poor motor function appears to be specific to autism, as this association was not observed in the TD or ADHD groups.

“Carefully examining systems responsible for controlling simple aspects of behavior, such as basic motor control, can provide a window into understanding the systems that are responsible for control of more complex social and communicative behavior,” said Dr. Stewart H. Mostofsky, lead study author and a pediatric neurologist in the Department of Developmental Cognitive Neurology at the Kennedy Krieger Institute. “This finding is an important step forward and will guide future research into the abnormalities associated with socialization and communication that define the disorder.”

Motor impairments, such as those seen in autism, offer valuable insight into the neurologic basis of developmental disorders. This is especially critical for autism and other disorders where the neurologic basis is not well understood. The most consistent neuroimaging finding in children with autism is increased brain volume, which has been primarily

attributed to an increased volume of white matter (white matter consists of the connections between brain regions). To address the current lack of evidence showing that increases in white matter volume are associated with functional impairment in children with autism, researchers in this study examined associations between motor skills and white matter volume.

Researchers assessed participants' basic motor skills using a standardized motor examination for children, the Physical and Neurologic Examination of Subtle Signs (PANESS), which has been used in past studies to demonstrate basic motor skill impairments in children with autism and ADHD. With the PANESS, higher scores indicate poorer performance. Consistent with previous findings, children with autism had significantly poorer motor performance (higher PANESS scores) than TD controls. Researchers identified a strong positive correlation between total PANESS score and white matter volume, revealing that increased white matter volume predicted poorer motor skills in these children.

In contrast to the children with autism, TD children showed a significant correlation in the opposite direction, with increased white matter volume predicting better motor skills (lower PANESS scores). The correlation in children with ADHD was considerably different from the children with autism and similar to the TD group.

In the future, Dr. Mostofsky and his colleagues hope to examine correlations of brain structure with motor performance using imaging techniques, such as diffusion tensor imaging (DTI), which can provide additional information about white matter connections. Upcoming studies may also extend this research to younger children and investigate, from a developmental perspective, what contributes to impaired acquisition and learning of motor skills in children with autism. Additionally, the brain systems involved in motor skill learning appear to

be important for learning aspects of socialization and communication, including language. Future research that examines how these learning systems are affected in children with autism could therefore provide crucial information about the brain basis of the disorder and prove very valuable in guiding, and ultimately improving, therapy.

Source: Kennedy Krieger Institute

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