Variation in brain development seen in infants with autism

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Patterns of brain development in the first two years of life are distinct in children who are later diagnosed with autism spectrum disorders (ASDs), according to researchers in a network funded by the National Institutes of Health. The study results show differences in brain structure at 6 months of age, the earliest such structural changes have been recorded in ASDs.

"The difference in the trajectory of brain development between the two groups was dramatic between 6 and 24 months," said senior author Joseph Piven, M.D., of the University of North Carolina, Chapel Hill (UNC). "This suggests that the period from 6 to 24 months- when behavioral studies suggest the symptoms of autism are first appearing- is a period of dramatic brain changes in ASDs."

ASDs involve communication and social difficulties as well as repetitive behavior and restricted interests. Many early behavioral signs of ASDs are not apparent until the first year of age. Typically, ASDs are diagnosed at age 3 or older. According to the U.S. Centers for Disease Control and Prevention, ASDs affect 1 of 110 children in the United States.

The study was published online in the *American Journal of Psychiatry*. First author Jason J. Wolff, Ph.D., also of UNC, conducted the research with Dr. Piven and members of the Infant Brain Imaging Study, which is funded through the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) Autism Centers of Excellence program. Additional funding was provided by the National Institute of Mental Health.

The researchers recorded brain images of 92 infants, all of whom had an older brother or sister with ASDs. Children who have an older sibling with ASDs have an increased risk of developing ASDs. The researchers used a technique known as diffusion tensor magnetic resonance imaging to track the children's brain development at 6 months, 1 year and 2 years.

As the brain develops, networks of neural circuits known as white matter fiber tracts form connections between the various brain areas. These white matter fiber tracts serve as conduits that convey information throughout the brain. For their study, the researchers identified specific connections throughout the brain, and measured the strength of these connections. When the children were 6 months of age, the researchers found that white matter connections for children who went on to develop ASDs were initially stronger than for those who did not develop autism.

The researchers recorded complete sets of images from each child. These sets of images were recorded at three intervals: when the children were 6 months, 12 months, and 24 months of age. In each set of images, 15 such white matter fiber tracts were recorded.

At 6 months, the intensity of these white matter connections was greatest in the group that later developed ASDs. However, by 24 months, the white matter connections in the children with ASDs had apparently failed to keep pace with those of the children who did not develop ASDs. At 12 months and 24 months, the children who did not have ASDs had stronger, more intense connections in 12 of the 15 white matter fiber tracts than did their counterparts who developed ASDs. The researchers interpreted these findings to indicate that coherent, organized information pathways developed faster in the children who did not have ASDs.

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