MedicalXpress

Hyperconnectivity found in brains of children with autism, study says

June 27 2013, by Erin Digitale

The brains of children with autism show higher-than-normal connectivity along many neural networks, a new study from the Stanford University School of Medicine has found.

The study's results may contribute to the development of a brain-based test that could be used to diagnose autism at an early stage. The findings, published June 26 in *JAMA Psychiatry*, were unexpected because they contradict prior reports of reduced brain connectivity in adults with autism.

"We found that in the brains of children with autism there is a surprisingly high level of hyperconnectivity," said Vinod Menon, PhD, senior author of the study. Menon is a professor of psychiatry and behavioral sciences at Stanford and a member of the Child Health Research Institute at Lucile Packard Children's Hospital.

Based on measurements taken when the brain was at rest—while study participants were awake but had their eyes closed—at least five major brain networks were hyperconnected in kids with autism. But the finding was not uniform across the brain; some networks were underconnected.

"We found that there are major differences in the way the brain is functionally organized in children with autism—in how different brain areas are talking to each other," Menon said. "The challenge is to figure out how these differences contribute to the complex profile of clinical symptoms that characterize autism."

The research team collected functional and structural magnetic resonance imaging scans from 20 children with autism and 20 typically developing children. Assessment of connectivity was based on observing whether different areas of the brain were activated simultaneously: "Spontaneous synchronization of brain signals across long distances is what underlies the hyperconnectivity we detected," Menon said.

Hyperconnected systems in the brains of children with autism included the salience, default mode, fronto-temporal, motor and visual networks. The salience network, which was the most heavily hyperconnected in autism, integrates information about outside stimuli with information about internal states, allowing the brain to decide which external stimuli to pay attention to. Menon's team suggests that the hyperconnected salience network may contribute to decreased interest in social interactions among children with autism.

The new study also raises the possibility that brain scans could someday be used to diagnose autism: It found that hyperconnectivity in the salience network distinguished children with autism with 83 percent accuracy. The team confirmed this finding with a second, independent set of brain scans from 15 children with autism and 15 typically developing children, which were obtained from a public database.

No diagnostic test based on biological markers currently exists for autism; at present, the diagnosis is based solely on observations of a child's behavior, which means that many children are diagnosed later than would be ideal.

"We are optimistic that the brain network metrics we have identified may be used to help in developing strategies for earlier diagnosis, leading to the possibility of earlier interventions," said Lucina Uddin, PhD, an instructor in psychiatry and behavioral sciences and the study's lead author.

The complete implications of brain hyperconnectivity in children with autism are not entirely clear. In the new study, for instance, the degree of hyperconnectivity in the salience network predicted the severity of a child's restricted and repetitive behaviors—such as intense focus on a particular object or interest—frequently seen in autism. "We think there might be a relative inability for certain types of external stimuli to engage the brain's attentional system," Menon said. "As a result, a child with autism may be engrossed in a narrow range of behaviors instead of adaptively responding to external stimuli. That's a hypothesis we plan to test."

It's possible that hyperconnectivity could also contribute to epileptic seizures, which are more common in individuals with autism than in the general population.

Future research could also explore whether hyperconnectivity explains unusual skills seen in some individuals with autism, such as outstanding mnemonic, mathematical or spatial abilities. "Whether hyperconnectivity can lead to exceptional skills, albeit in restricted domains, is an open question," Menon said. "We don't have answers to that yet."

More information: Brain-imaging data used in this study is available at fcon_1000.projects.nitrc.org/indi/abide

Provided by Stanford University Medical Center