MedicalXpress

MRI studies point to brain connectivity changes in autism spectrum disorders

July 14 2015

Studies using magnetic resonance imaging (MRI) techniques are beginning to reveal differences in brain connectivity—the ways that different parts of the brain are connected to each other and work together—in people with autism spectrum disorders (ASD), reports a review in the *Harvard Review of Psychiatry*.

Some common themes are beginning to emerge from research on structural and functional brain connectivity in ASD, according to David Kennedy, PhD, and colleagues of University of Massachusetts Medical School. But much more work will be needed to learn how changes in brain connectivity contribute to the development of ASD, and how they're related to autism-related symptoms and behaviors.

Brain Connectivity in ASD—What the Research Shows So Far

In recent years, many studies have examined brain functioning and neural circuitry in people with ASD. Some studies use MRI techniques such as diffusion tensor imaging to analyze structural connectivity, reflecting "neuron-to-neuron connections" in the brain. Others use functional MRI to assess the functional connections between brain circuits. Dr. Kennedy and colleagues sought to "identify consistencies" in studies of brain connectivity in ASD to date.

The review identified 33 functional MRI studies of ASD, reflecting a

wide range of patient populations and study methods. Most of the studies found "some amount of either reduction or loss of local or long-distance connectivity" associated with ASD, the researchers write. Several studies reported reduced functional connections between the prefrontal cortex—an area involved in attention, self-control, and other "executive functions"—and other parts of the brain.

Thirty-six studies looked at structural connectivity of the brain in ASD. The findings were more consistent than the functional MRI studies, showing evidence of decreased connectivity—and increased "diffusivity"—in many areas of the brain white matter. So far, only a handful of studies have attempted to combine the findings of structural and functional MRI techniques.

About half of functional MRI studies tried to relate the functional connectivity findings to behavioral measures of ASD. Although many brain areas with reduced functional connectivity are known to be involved in the relevant behaviors, their true link to behaviour in ASD is still unknown.

"The addition of behavioral correlates to the structural or functional connectivity studies would be immensely valuable in order to distinguish which of the many structural and functional changes that have been identified have specific behavioural consequences," Dr. Kennedy comments. "However, this task is exceedingly complex since there are many relevant behaviors, served by many different brain circuits, and changes in any parts of an extended circuit can lead to alterations in its function."

Because of the wide variations between studies, it's difficult to confirm specific findings or draw general conclusions about brain connectivity in ASD. But the researchers identify several "convergent themes," including reduced long-range connections between different neural

networks, both within and between the two hemispheres of the brain. They also cite evidence of increased connectivity in deeper white matter areas—possibly compensating for reduced connectivity in other areas.

"Given the general findings for connectivity in autism, the next challenge is to generate more precise results and to determine whether those results can be correlated with the diverse symptomatologies and behavioral profiles of patients with autism," Dr. Kennedy and colleagues conclude. They note that several combined databases have been developed, enabling "big data" approaches to help in understanding the role of brain connectivity in ASD.

More information: "Connectivity in Autism: A Review of MRI Connectivity Studies" DOI: 10.1097/HRP.0000000000000072

Provided by Wolters Kluwer Health