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New brain marker shows promise for predicting future Alzheimer's disease

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Duke University Medical Center researchers have used imaging technology to identify a new marker that may help identify those at greatest risk for cognitive decline and the development of Alzheimer's disease.

The study focused on people with mild cognitive impairment (MCI), a condition that affects an estimated four to five million individuals in the United States. People with MCI are at increased risk for developing Alzheimer's disease in the future and approximately 30-50 percent of MCI subjects will develop Alzheimer's if followed over a three- to five-year period.

Duke researchers used functional magnetic resonance imaging, also known as fMRI, on people with MCI to track regions of the brain that become active or inactive when participating in tasks that involve memory. They then followed these individuals over time to document progression to Alzheimer's.

"A single baseline fMRI measure of deactivation could help predict which individuals will convert to Alzheimer's over the next several years," said the study's lead author, Jeffrey R. Petrella, M.D. "On the other hand, the fMRI scans of MCI subjects who did not convert looked more like those of healthy normal people, and could therefore be reassuring," said Petrella, who is director of the Alzheimer's Imaging Research Laboratory and associate professor of radiology at Duke.

The results of this study, published in PLoS ONE, focus on an area of the brain known as the posteromedial cortex, which has recently been implicated in personal memory.

"Our theory is that the posteromedial cortex may be our brain's 'cruise control' that normally deactivates when we are trying to remember things, so resources can be sent to other areas of the brain that encode memories. However, in people with mild cognitive impairment or Alzheimer's disease, the deactivation does not happen and the posteromedial cortex remains active," said Dr. Petrella.

The process of brain deactivation is similar to some other common bodily functions. For example, when a person is participating in a marathon, the gastrointestinal system temporarily turns off so blood can be redirected to areas which need it more, namely the muscles that are keeping the runner in motion.

In this study, researchers conducted fMRI scans on 75 people, including 34 with mild cognitive impairment, 13 with Alzheimer's disease and 28 with normal cognition. Study participants completed standard neuropsychological testing and were monitored with fMRI while performing a memory task matching names and faces. Patients were then followed for three and a half years to determine how their cognition changed over time.

"At present we treat all people with mild memory loss the same, even though some MCI subjects may convert in a year and others may take five years," said study co-author P. Murali Doraiswamy, M.D., chief of the division of biological psychiatry at Duke. "This is because there is no single test that can definitively predict who will develop late-onset Alzheimer's or not. The ability to probe brain circuits at a deeper level may help us diagnose risk with greater certainty."

The researchers found that approximately a third of the MCI subjects converted to Alzheimer's in three and half years after their initial scans. The conversion to Alzheimer's was determined by study doctors using routine clinical and memory tests. fMRI level of deactivation was found to significantly predict which MCI subjects converted to Alzheimer's.

While other studies have focused on the brain's ability to turn on certain regions, this research determined that losing the ability to turn off a region of the brain may be a more sensitive marker of future cognitive decline

"The Holy Grail in this field is to predict with 100 percent accuracy whether a 50-year old who forgets names will get dementia or not. We are not there yet but are inching closer and closer everyday. The combination of genetic, biochemical and imaging biomarkers will soon become the gold standard," said Doraiswamy.

Dr. Petrella added, "Although we tend of think of Alzheimer's as a disease causing shrinkage of discrete memory centers, at its earliest stages it really disrupts neural circuits. The diagnostic tests of the future will examine not just structure but also the interplay between the many nodes in the brain's memory circuits."

Source: Duke University