
RSNA Press Release

Memory Loss Affects More of the Brain than Previously Thought

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OAK BROOK, Ill.—Memory loss associated with early Alzheimer's disease (AD) may be linked to altered activity in several areas of the brain, according to a study in the July issue of *Radiology*.

For the first time, researchers at Duke University Medical Center in Durham, N.C., used a special, high-field-strength, functional magnetic resonance imaging (fMRI) scanner to study the brain activity of people with amnesic mild cognitive impairment (MCI), a precursor to AD, and found altered functionality in both the frontal and temporal lobes of the brain. Previous studies looking at structural changes alone have shown evidence that brain atrophy in the earliest stages of AD tends to be restricted to the temporal lobe, a region critical to long-term memory formation.

"Involvement of both the frontal and temporal lobes in the earliest stages of AD suggests the possibility of a breakdown in the communication pathway between these two regions, which house short-term and long-term memory, respectively," said lead author Jeffrey R. Petrella, M.D., associate professor of radiology and director of Alzheimer's Disease Imaging Research Laboratory at Duke. "So in many ways the AD brain may be like a computer that is having problems with both its temporary files and its hard-drive files."

MCI affects an estimated 15 percent of the elderly population in the United States. Ten to 15 percent of people with MCI develop AD every year compared to one percent of the normal elderly population. Amnesic MCI is characterized by mild memory impairment and is often confused with ordinary age-related forgetfulness.

The researchers used 4-Tesla fMRI, which has a very strong magnetic field, to observe the brain activity of 20 elderly patients with amnesic MCI and 20 age-matched controls with no memory impairment during a memory task that tested memory formation and retrieval.

"It's like doing a treadmill test for heart patients, except this test puts your brain on a treadmill," Dr. Petrella said.

At A Glance

- Mild cognitive impairment (MCI) alters the function of both the frontal and temporal lobes of the brain.
- Communication between the short- and long-term memory centers may be disrupted by MCI.
- Up to 15 percent of elderly Americans may suffer from MCI, a likely precursor to Alzheimer's disease.

The test required 40 patients to recall names of familiar faces and to learn and recall unfamiliar face-name associations. All patients showed brain activation in several brain regions during the task, but, compared with the controls, the patients with MCI showed a lower level of activation in the prefrontal cortex (during formation and retrieval), left hippocampus (during retrieval) and left cerebellum (during formation) and an increased level of activation in the posterior frontal lobes (during retrieval).

"These findings suggest that we should be paying closer attention to frontal lobe function in detecting people at risk for AD and may also point to new preventive strategies," said co-principal investigator P. Murali Doraiswamy, M.D., chief of the Division of Biological Psychiatry in the Department of Psychiatry at Duke.

Both researchers caution that their findings are preliminary. They are in the process of completing a larger study to confirm these results and to examine their value as a diagnostic or predictive test. There have also been a number of previous fMRI studies in people with MCI, and researchers are working to put these findings together to develop a synergistic combination of memory testing, genetic and imaging studies that together can best predict early onset and monitor progression of AD.

"If memory problems are beginning to impact the day-to-day life of you and your family, you should undergo comprehensive testing by a physician, as memory loss can be caused by many underlying factors such as depression, thyroid problems and stress, and doesn't necessarily indicate early AD," Dr. Petrella said.

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"Mild Cognitive Impairment: Evaluation with 4-T Functional MR Imaging." Collaborating with Drs. Petrella and Doraiswamy on this paper were Sriyesh Krishnan, B.A., Melissa J. Slavin, Ph.D., Thanh-Thu T. Tran, B.S., and Lakshmi Murty, B.S.