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NEWS

RSNA Press Release

Microscopic Brain Damage Detected in Early Alzheimer's Disease

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At A Glance

- New computer-aided analysis technology can depict early cellular changes in Alzheimer's disease (AD), before brain atrophy becomes visible.
- This new technology may allow researchers to learn more about how AD develops and how to better treat it.
- More than 4.5 million Americans suffer from AD.

OAK BROOK, Ill.—Researchers have developed a new computer-aided analysis technique to identify early cellular damage in Alzheimer's disease (AD). The study is featured in the October issue of *Radiology*.

"With increasing longevity among the population, the incidence of AD is expected to rise rapidly, creating a great burden not only for patients and their families, but also for society," said Min-Ying Su, Ph.D., author and associate professor in the Department of Radiological Sciences & the Tu and Yuen Center for Functional Onco-Imaging at the University of California at Irvine. "Our methods may enable earlier diagnosis of AD, allowing earlier intervention to slow down disease progression," she added.

As AD progresses, cell membranes in the brain may be damaged, allowing water molecules to move throughout the brain more freely. This phenomenon can disrupt neural processes and cause neuron cells to die, leading to brain atrophy. This process of cellular damage causes an increase in the "apparent diffusion coefficient," or ADC, which is a measurement used to study the distribution of water in the brain.

Thirteen elderly patients with mild cognitive impairment (MCI) were enrolled in Dr. Su's study. Patients with MCI are at high risk for developing AD. These 13 patients and 13 elderly control subjects underwent magnetic resonance imaging (MRI) of the brain and performed recall tasks. On MRI images, ADC values were measured in gray- and white-matter regions by using the computer-aided analysis program. Findings were compared between patients and healthy controls.

The computerized mapping technique allowed researchers to evaluate ADC values in large regions of the brain. In patients with MCI, researchers identified regions of brain atrophy and increased water content in white-matter areas. Additionally, high ADC values were found in the hippocampus, temporal lobe gray matter and the corpus callosum, which

connects the two cerebral hemispheres. The ADC values in the hippocampus were significantly correlated with worse memory performance scores.

"The results have supported our objective to develop a computer-based analysis technique that can analyze different regions in the entire brain, to provide a comprehensive evaluation of cellular changes," Dr. Su said.

Until now, ADC values from gray matter in various lobes of the brain have not been reported, due to the difficulty of obtaining measurements in these regions. This new technology may allow researchers to learn more about how AD develops in the brain and to cultivate better treatment strategies for patients based on their individual cognitive needs.

"Patients with MCI who are very likely to progress to AD may start early treatment interventions, while patients who may remain stable with MCI can be spared from treatment and the associated side effects," added Dr. Su. "The diagnostic accuracy in identifying AD needs to be greatly improved."

AD is the most common form of dementia, affecting more than 4.5 million Americans. Patients diagnosed with AD have an average life expectancy of eight years after initial symptoms appear.

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The Radiological Society of North America (RSNA) is an association of more than 38,000 radiologists, radiation oncologists, medical physicists and related scientists committed to promoting excellence in radiology through education and by fostering research, with the ultimate goal of improving patient care. The Society is based in Oak Brook, Ill. (RSNA.org)

"Mild Cognitive Impairment: Apparent Diffusion Coefficient in Regional Gray Matter and White Matter Structures." Collaborating with Dr. Su on this paper were Kimberly M. Ray, M.D., Huali Wang, M.D., Ph.D., Yong Chu, Ph.D., Ya-Fang Chen, M.D., Alberto Bert, Ph.D., and Anton N. Hasso, M.D.