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New Brain-Imaging Technique Detects Early Stages of MCI, AD

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June 26, 2007 (Washington, DC) — Researchers at the University of Hong Kong have shown that magnetic resonance elastography (MRE) may be a valuable tool in the detection and diagnosis of early-stage Alzheimer's disease (AD) and mild cognitive impairment (MCI).

The work was presented as a poster here at the Alzheimer's Association 2007 International Conference on Prevention of Dementia by coinvestigators Geng Li, MD, PhD, from the Jockey Club MRI Center and the division of neurology, department of medicine, at the University of Hong Kong, and Edward S. Yang, PhD, director of the Jockey Club MRI Engineering Center at the University of Hong Kong.

Dr. Yang talked with Medscape about the origins of this approach. "The technique was developed 12 years ago by the Mayo Clinic," he said. It uses an acoustic wave that is generated and passed through the brain to assess the viscoelastic properties of the tissue. It has also been used in liver, kidney, and breast tissues. Previous work had used a dental bite to generate the mechanical wave, but for their own investigations, they have developed a driver that induces the wave from behind the head.

"Normal people have a very structured brain," Dr. Yang observed. Healthy brain tissue is stiff, which means the elasticity is higher, he explained. In a diseased brain, however, the structure is changed, and as a result, the wave transmission through it becomes more diffuse.

The goal of this study was to investigate the use of MRE for detection and diagnosis of dementia and to establish a range of brain viscosity and elasticity for normal, MCI, and AD brains. The study used a 3-tesla GE MRI scanner at the Beijing Neurosurgical Institute. A homemade transducer produced the mechanical oscillation, typically using an excitation frequency of 40 Hz for in vivo measurements. Components of the resultant mechanical waves in brain tissue were measured with the modified spin-echo pulse sequence developed by the Mayo Clinic.

Dr. Li noted that the equipment is not available commercially and is currently used only in clinical trials. "But I think in the near future some companies are trying to develop something," he added.

This primary study reported results from 11 subjects: normal (n=4), MCI (n=2), and AD (n=5), with brain stiffness quantified in kilopascals (kPa; 1 pascal = 1 newton/m²). The score of each subject on the Mini Mental State Examination (MMSE) is shown for comparison.

They report that brain stiffness tended to be lower in MCI patients than in normal subjects and was even lower in most AD patients.

Mean Brain Stiffness by MRE in Normal, MCI, and AD Subjects

Subject	MMSE	Mean Brain Stiffness (kPa)	
		White Matter	Gray Matter
Normal	28	6.799	2.585
Normal	26	7.824	2.842
Normal	30	8.978	2.345

Normal	24	7.235	2.399
MCI	20	5.611	2.081
MCI	21	6.393	2.633
AD	18	5.789	1.411
AD	15	5.223	2.065
AD	13	4.414	1.428
AD	14	4.180	1.202
AD	10	2.041	1.108

Drs. Li and Yang see the technique as potentially valuable for the early detection and diagnosis of MCI and AD. "Meanwhile, the technique can help us to understand the pathology of the disease, monitor disease progression, and test the effect of drug treatment," they conclude.

Medscape also spoke with William Goure, PhD, vice president of business development at Acumen Pharmaceuticals, in San Francisco, California, who expressed interest in the MRE study. He noted that in most cases when a person is diagnosed with AD, the damage is so severe that it might be possible to stabilize disease but the opportunity for a cure is past.

"The holy grail for all of us in the Alzheimer's disease business is 2-fold: to identify a diagnostic tool that predicts a person's potential to develop AD, and to develop therapeutics that will prevent the disease. . . . To the extent that we can identify methods of predicting Alzheimer's disease or the prevalence of AD way before people actually get it, the opportunity of having effective therapeutic interventions to save people from Alzheimer's disease goes up significantly."

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