Medical Xpress

Study shows hope for early diagnosis of Alzheimer's

April 13 2007

Research by faculty and staff at Rowan University, Glassboro, N.J.; the University of Pennsylvania School of Medicine; and Drexel University may lead to better diagnosis of early-stage Alzheimer's disease.

In a $1.1-million National Institutes of Health's National Institute on Aging study that team members conducted during the last three years, they determined early Alzheimer's could be diagnosed with a high rate of accuracy evaluating electroencephalogram (EEG) signals. The study may lead to an earlier diagnosis, and therefore earlier treatment and improved quality of life, for people at the earliest stages of the disease.

According to the Alzheimer's Association, the condition affects more than 5 million Americans, approximately 1.5 percent of the population. That number is only expected to grow. (For information on Alzheimer's disease, visit http://www.alz.org/documents/FSADFacts.pdf.)

Rowan University electrical and computer engineering associate professor Dr. Robi Polikar conducted the research with Dr. Christopher Clark, associate professor of neurology, associate director of the NIH-sponsored Alzheimer's Disease Center at Penn and director of the Penn Memory Center, and with Dr. John Kounios, a Drexel psychology professor.

"Individuals in the earliest stage of Alzheimer's disease are often not aware of their progressing memory loss, and family members often

believe the changes are simply due to aging," Clark said. "Even the patient's personal physician may be reluctant to initiate an evaluation until a considerable degree of brain failure has occurred. The advantage of using a modified EEG to detect these early changes is that it is non-invasive, simple to do, can be repeated when necessary and can be done in a physician's office. This makes it an ideal method to screen elderly individuals for the earliest indication of this common scourge of late life."

The researchers employed signal processing and automated neural network analysis of event related potentials (ERPs) of the EEG signals, monitoring how the patients' brains reacted to a series of auditory stimuli.

Clark's team conducted neuropsychological tests, including memory tests, of research subjects and evaluated their scores to decide whether they were suited for the study.

Kounios and his team acquired the EEG data from the participants. They used a specific protocol, called the "oddball paradigm with novel sounds," to collect the EEG signals, during which patients hear a series of low- and high-frequency tones as well as some novel sounds. Patients were asked to respond by pressing a button every time they heard the high frequency tone, also known as the "oddball" tone, which generates ERPs in the EEG. Generally, in the ERP of a person without Alzheimer's, that response registers a peak, the P300, about 300 milliseconds after the "oddball" tone. People with dementia, particularly Alzheimer's, may exhibit that peak much later than 300 milliseconds, show a much weaker peak or have no peak at all, according to Polikar. Kounios said the P300 signal is generated by areas of the brain that seem to be attacked at an early phase of Alzheimer's disease, but the results are not always conclusive.

Polikar and his students analyzed the data using sophisticated signal processing, pattern recognition and artificial intelligence techniques to explore the hypothesis that the entire ERP signal, not just the P300 indicator, reveals markers that previously have not been associated with Alzheimer's disease.

The teams conducted several experiments, ultimately evaluating the parietal and occipital regions of the brains of 71 patients, some already diagnosed with Alzheimer's and some without Alzheimer's. Their diagnostic accuracy rate was 82 to 85 percent using the EEGs (e.g., it matched evaluations conducted at Penn 82 to 85 percent of the time). Alzheimer's disease cannot be confirmed until a patient has died and his or her brain has been examined. Gold standard tests administered at world-class research facilities, such as Penn, have a 90-percent accuracy rate. However, most people are evaluated at community hospitals and clinics, where the diagnostic accuracy is estimated to be around 75 percent.

Though the study's accuracy rate is under that 90-percent figure, it still means the test potentially could have great value to physicians and patients and their families, and the results are particularly significant for patients who have limited access to teaching hospitals, where they may undergo six to 12 months of evaluation for a diagnosis.

"Currently, the state-of-the-art evaluation for Alzheimer's disease is only available to those who have geographic proximity and/or financial ability to access research hospitals, where expert neuropsychologists continuously interview patients and caregivers over six to 12 months to make a diagnosis," said Polikar, principal investigator on the project at Rowan. "But most people don't have access to such facilities and instead go to community clinics and hospitals. Our methodology involves just one 'snapshot' that in itself is highly accurate and will be especially beneficial in these locations."

"Modern engineering methods are enabling us to take EEG, an 80-year-old technique for measuring brain activity, and turn it into a cutting-edge tool for diagnosing Alzheimer's disease," Kounios added.

The team members hope that eventually they or other researchers will develop a hand-held device that can be used to conduct similar evaluations as those done by the Rowan/Penn//Drexel group.

“We don’t envision this replacing a neurologist,” Polikar said. “We hope it can serve as a first test for those folks who don’t have access to research facilities.” If the initial test indicates a possible problem, physicians could refer the patient to a research hospital for further evaluation.

“Our ultimate goal is to increase the number of patients who are diagnosed earlier so they can start treatment sooner and slow the progress of Alzheimer’s and improve their quality of life,” Polikar said.

Source: Rowan University

Citation: Study shows hope for early diagnosis of Alzheimer's (2007, April 13) retrieved 3 May 2024 from https://medicalxpress.com/news/2007-04-early-diagnosis-alzheimer.html