Medical Xpress

Pioneer biomarker test to diagnose or rule out Alzheimer's disease

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A test capable of confirming or ruling out Alzheimer's disease has been validated and standardized by researchers at the University of Pennsylvania School of Medicine. By measuring cerebrospinal fluid (CSF) concentrations of two of the disease's biochemical hallmarks - amyloid beta42 peptide and tau protein - the test also predicted whether a person's mild cognitive impairment would convert to Alzheimer's disease over time. Researchers were able to detect this devastating disease at the earliest stages, before dementia symptoms appeared and widespread irreversible damage occurred. The findings hold promise in the search for effective pharmaceutical therapies capable of halting the disease.

Honing in on a previously suggested pathological CSF biomarker signature, a team of Penn Medicine researchers, led by Leslie M. Shaw, PhD, Co-Director of the Penn Alzheimer's Disease Neuroimaging Initiative (ADNI) Biomarker Core, found evidence of neuron degeneration - marked by an increase in CSF concentration of tau proteins - and plaque deposition, indicated by a decrease in amyloid beta42 concentration. In addition, people with two copies of the genetic risk factor for Alzheimer's disease, APOE ε4 , had the lowest concentrations of amyloid beta42, compared to those with one or no copies. The study appears in the online edition of the *Annals of Neurology*.

"With this test, we can reliably detect and track the progression of Alzheimer's disease," said Dr. Shaw. "Validated biomarker tests will

improve the focus of Alzheimer's clinical trials, enrolling patients at earlier stages of the disease to find treatments that can at least delay -and perhaps stop- neurodegeneration. In addition, prevention trials can test methods to delay or block mild cognitive impairment from converting to full-blown Alzheimer's."

Further validation studies of this research test system are underway. Additional work is needed to develop additional biomarkers, as well as identify more genetic risk factors that will help distinguish Alzheimer's from other neurodegenerative diseases characterized by cognitive impairments.

"Thanks to the dedicated researchers and volunteers who participated in this and other Alzheimer's disease studies through the Penn Alzheimer's Disease Core Center and at ADNI trial sites around the US and Canada, we have validated a test where a safe, simple lumbar puncture can provide information to confirm suspected Alzheimer's disease and predict the onset of the disease," said John Q. Trojanowski, MD, PhD, Director of the Penn Alzheimer's Disease Core Center. "Using this technique, we will further our understanding of how the disease progresses and what we can do to stop Alzheimer's disease before it starts."

About the Study

Cerebral spinal fluid samples contributed by 410 ADNI volunteers at 56 sites across the U.S. and Canada were included in this study. To independently establish threshold values for these biomarkers, cerebrospinal fluid samples from 52 Penn Memory Center volunteers with normal cognition and 56 people with confirmed Alzheimer's disease based on post-mortem autopsy diagnosis were also measured. The test was based on the multiplexed xMAP microbead immunoassay system, with reagents provided by Innogenetics.

When compared with normal, healthy adults of the same age, a pattern of changes emerged in people with mild cognitive impairment or Alzheimer's disease. In this group, tau concentrations increased, while amyloid beta42 levels decreased as the disease progressed.

• The test was 87 percent accurate overall (80 percent or above is considered clinically useful).
• In the CSF samples from those with autopsy-confirmed Alzheimer's disease, the amyloid beta42 concentration threshold was most sensitive and detected Alzheimer's disease at a rate of 96.4 percent.
• The test accurately ruled out Alzheimer's disease in 95.2 percent of the subjects.
• The test positively predicted the conversion from mild cognitive impairment to Alzheimer's disease at a rate of 81.8 percent.

Data used in preparing this article were produced by the Alzheimer's Disease Neuroimaging Initiative (ADNI) Biomarker Core at Penn or obtained from the ADNI database (www.loni.ucla.edu/ADNI). Many ADNI investigators contributed to the design and implementation of ADNI or provided information but did not participate in the analysis of the data presented here or in the writing of this report. A complete list of ANDI investigators is available at http://www.loni.ucla.edu/ADNI/Collaboration/ADNI_Authorship_list.pdf.

Source: University of Pennsylvania School of Medicine