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Predicting cognitive decline with baseline hippocampal volume and rate of hippocampal atrophy

Antao Du[1], Norbert Schuff[1], Linda L. Chao[1], William J. Jagust[2], Joel H. Kramer[3], Bruce R. Reed[2], Bruce L. Miller[3], Helena C. Chui[4], Michael W. Weiner[1]

[1] VA Medical Center, San Francisco, San Francisco, CA, USA; [2] University of California, Davis, Davis, CA, USA; [3] University of California, San Francisco, San Francisco, CA, USA; [4] University of Southern California, Los Angeles, CA, USA. Contact e-mail: antao@itsa.ucsf.edu

Background: Because the hippocampus, a central structure for normal memory function, is an early site of Alzheimer's disease (AD), hippocampal volume at baseline or rate of volume change may predict subsequent cognitive decline. **Objectives:** To determine the extent to which hippocampal baseline volume or atrophy rate are related to cognitive decline in cognitively normal (CN) and mild cognitively impaired (MCI) subjects. **Methods:** Seventy-one CN and 39 MCI subjects were studied longitudinally with interscan period of 2.6 ± 1.2 years. CN subjects had cognitive dementia rating (CDR) scores of zero. MCI subjects had CDR of 0.5. Eleven CN and 12 MCI subjects, whose CDR scores increased at the time of their second MRI, were classified as cognitive decliners. Thirteen CN and 19 MCI had subcortical lacunes at first MRI. Hippocampal volume was measured on T1-weighted MRI. Logistic regression and receiver operator characteristics (ROC) were used to predict cognitive decline. **Results:** Decliners had smaller hippocampal volumes at baseline ($F(1,100) = 14.5$, $p < 0.001$) than non-decliners, after accounting for group, presence of subcortical lacunes, age and sex. Furthermore, decliners had higher rates of hippocampal atrophy ($F(1,100) = 46.9$, $p < 0.001$) than non-decliners, after accounting for group, presence of subcortical lacunes, age and sex. As expected, high rates of hippocampal atrophy were inversely correlated with small baseline volumes ($r = -0.48$, $p < 0.001$). Using baseline volume yielded a 79% overall classification and an area under ROC curve of 0.70 between decliner and non-decliner. Using atrophy rate yielded an 82% overall classification and an area under ROC curve of 0.82 between decliner and non-decliner. Furthermore, atrophy rate was significantly better ($p < 0.001$) than baseline volume in differentiating between decliner and non-decliner. **Conclusions:** Although atrophy rate and baseline volume of hippocampus are correlated, atrophy rate is better than baseline volume in predicting cognitive decline.