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4 Tesla MRI for Detecting Effects of Cerebrovascular Disease

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Background: To improve the diagnosis of dementia due to cerebrovascular disease (CVD), either alone or in combination with Alzheimer disease (AD), the effects of CVD on brain anatomy, function, and metabolism must be understood. The objective of this pilot study was to explore the advantage of high field MRI to detect subtle brain alterations, specifically age-related atrophy of hippocampal subfields and cortical hypoperfusion.
Method: Twelve healthy controls (age range: 24-77 years) were studied using a 4T MR system. Structural MRI included T2-weighted turbo spin echo with 0.4 x 0. 4 mm2 inplane and 2 mm slice resolution. Two raters traced the entorhinal cortex, subiculum, CA1, CA2 and a CA3/CA4/dentate gyrus compound. Brain perfusion was acquired using pulsed arterial spin labeling (ASL) MRI at 2.4 x 2.4 x 4 mm3 resolution, registered to structural MR images, and spatially normalized for voxel-wise statistical analysis.
Results: The entorhinal cortex and CA1 sections in both left and right hippocampus correlated with age while other subregions showed no age dependency. Correlations between hypoperfusion and age were found in the right superior and frontal gyrus, the caudate nucleus, and bilaterally in the anterior cingulate.
Conclusions: These preliminary results suggest that MRI at very high resolution can detect differential atrophy in hippocampal subfields, which might be of value for separating CVD from other types of dementia and normal aging. Furthermore, the pattern of age-related hypoperfusion sharply contrasts with the prominent pattern in AD, suggesting that ASL-MRI could also have diagnostic value. However, these initial results need to be confirmed on a larger cohort of subjects. In addition to structural and perfusion MRI, diffusion tensor imaging (DTI), which detects ultrastructural white matter changes and MR spectroscopic imaging, which measures brain metabolites provide supplementary information for studies of CVD.