

Distinct Patterns of Atrophy of Hippocampal Subfields in Alzheimer's Disease (AD) and Mild Cognitive Impairment (MCI)

Mueller SG, Schuff N, Raptentsetsang S, Stables L, Weiner MW

Background: The hippocampus is not a homogeneous structure but divided into several subfields with distinctive histological characteristics and functions, which are differently affected by aging and Alzheimer's disease. Therefore, volumetric measurements of individual hippocampal subfields might allow for a better distinction between aging and AD than measurement of hippocampus as a whole. High-resolution images at 4T depict details of the internal structure of the hippocampus sufficiently to allow for in vivo volumetry of different hippocampal subfields.

Objectives: 1. To determine patterns of neuron loss in hippocampal subfields in AD, MCI.

Methods: 58 subjects (37 cognitively elderly controls (mean age: 73.4 ± 6.3), 8 MCI (mean age 76.7 ± 6.9 and 13 AD (mean age 75.7 ± 7.8) were studied on a 4T magnet with following sequences: 1. High resolution T2 weighted fast spin echo for manual marking of hippocampal subfields on five consecutive slices: ERC, subiculum, CA1, CA1&CA2 transition zone (CA1&CA2), CA&dentate gyrus (CA3&DG) and hippocampus (sum of CA1, CA1&CA2, CA3&DG) and. 2. T2 weighted image for calculation of the total intracranial volume. ANOVA followed by post hoc analyses was used to test for group differences of subfield volumes normalized to total intracranial volume.

Results: Table 1 shows that AD had significantly ($p < 0.05$) smaller volumes of ERC, subiculum, CA1 CA1&CA2 and hippocampus than controls but not of CA3&DG. Compared to MCI, AD had smaller volumes of ERC and subiculum but not of CA1, CA1&CA2 and hippocampus. When MCI were compared to controls, CA1&CA2 but none of the other subfields were significantly smaller (cf. Table 1). **Conclusions:** The finding that AD patients have significant volume loss in ERC, subiculum, CA1 and CA1&CA2 but not in CA3&DG is consistent with histopathology. In MCI, the volume loss was most pronounced in CA1&CA and was similar in magnitude to the change found in AD consistent with early pathology in this region. These preliminary findings suggest that measurements of hippocampal subfields might be a very sensitive measure for diagnosis of early AD and for monitoring of treatment effects.