

Estimating the impact of differences among protocols for manual hippocampal segmentation on Alzheimer's disease-related atrophy: Preparatory phase for a harmonized protocol

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Background

A harmonized procedure for manual hippocampal segmentation is required, since quantitative Magnetic Resonance Imaging (MRI) should help diagnosis and tracking of Alzheimer's disease (AD). A survey of segmentation protocols allowed to operationalize the landmarks variability into segmentation units (SUs). Here we aimed to quantify the impact of the differences among MRI-based hippocampal segmentation protocols on volume estimates of AD-related atrophy, in order to support evidence-based decisions for an internationally harmonized protocol.

Methods

We manually traced each SU within the right and left hippocampi of 31 controls (CTRL), 23 AD and 23 Mild Cognitive Impairment (MCI) patients taken from the Alzheimer's Disease Neuroimaging Initiative (ADNI) participants. MCI patients were subsequently converted to AD; all patients had abnormal Cerebrospinal Fluid (CSF) A β levels, and CTRL had normal CSF A β levels.

Results

The minimum hippocampal body (red in the Figure) accounted for over 68% of AD-related volume difference across groups ($p < 0.0005$); the left alveus/fimbria (yellow in Figure) for 7% ($p = 0.01$) and the right alveus/fimbria for 5% ($p = 0.35$); the subiculum (green in Figure) for about 5% bilaterally ($p = n.s.$); the tail (blue in Figure) for over 20% bilaterally ($p < 0.0005$).

Conclusions

The informative value for identifying AD-related atrophy differs across SUs. Its quantification may help a panel of experts to define which SU should be included in a harmonized protocol.