HIPPOCAMPAL CA1 VOLUME CORRELATES WITH THE KNOWN NEUROANATOMICAL CORTICAL AND SUBCORTICAL PROJECTIONS OF THE HIPPOCAMPUS: A VALIDATION STUDY

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Background: Neuroanatomical studies have shown that different hippocampal subfields project to distinct extrahippocampal cortical and subcortical brain regions. Recently, we reported a method to measure hippocampal subfield volumes in high resolution images acquired at 4 Tesla in normal aging but the biological significance of these findings has been uncertain. To validate this method, we examined the relationship of different hippocampal subfields with other brain regions.
Objective: To determine the relationship between different hippocampal subfields volumes and gray matter volume (GM) and perfusion in brain regions with known hippocampal projections.
Methods: 45 subjects (30 cognitively elderly controls (mean age: 66.7 (7.6)), 6 MCI (mean age 75.17 (7.6) and 9 AD (mean age71.7 (5.8)) were studied on a 4T magnet and the following sequences acquired: 1. High resolution T2 weighted fast spin echo for manual marking of hippocampal subfield: ERC, subiculum, CA1, CA1&CA2 transition zone, CA&Dentate Gyrus .2. T1 weighted gradient echo sequence for segmentation in EMS and voxel-based morphometry and 3. Arterial spin labeling perfusion MRI in a subset of this population (21 Controls, 4 MCI and 4 AD). SPM2 was used to perform a correlation analysis and a partial correlation for subfields and perfusion in the group as a whole and in the control group alone.
Results: In the total population, CA1, but none of the other subfields, positively correlated with GM in the inferior and lateral temporal lobe and posterior and midline thalamic nuclei. Controls showed additional correlations in the posterior and mid cingulate but smaller correlations in the thalamus. In addition, CA1 was highly correlated with perfusion in the lateral temporal lobes and the orbito-frontal fronto-opercular regions and posterior and anterior cingulate in the total population. (cf. Figure 1a and b).
Conclusion: The brain regions showing positive structural and functional correlations with CA1 volume in this study are consistent with the known projections of CA1 (Gloor P, 1997) and thus provide in vivo validation of our method for subfield quantification. Taken together these results suggest that measurement of hippocampal subfields is a valid and sensitive approach to investigation of normal aging and early AD.