USING MRI MEASURES OF ENTORHINAL CORTEX AND HIPPOCAMPAL SUBFIELDS TO ASSESS DIFFERENCES BETWEEN HEALTHY CONTROLS AND MILD COGNITIVELY IMPAIRED SUBJECTS

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Objective

Introduction

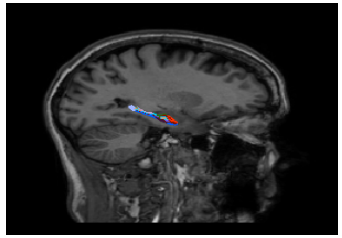
Alzheimer's disease (AD) is the most prevalent form of dementia and is marked by an insidious onset of cognitive deficits. Mild Cognitive Impairment (MCI) has been described as the intermediate stage between the expected, mild declines in cognition associated with normal aging and the more serious and pronounced decline in cognition seen in dementia. Neuropathological studies in the literature and imaging studies have established the involvement of the medial temporal regions in MCI and AD, particularly the entorhinal cortex and hippocampal formation. We have found that in AD both the hippocampal formation and the entorhinal cortex are consistently atrophic on MRI. However, in MCI only the entorhinal cortex displayed consistent atrophy. It is feasible that this differential finding is the result of a global measure of hippocampal volume that is insensitive to the isolated changes in specific hippocampal subfields. The goal of the study was to compare measures of entorhinal cortex thickness, hippocampal formation volume, and hippocampal subfield volumes between a set of healthy controls and subjects with MCI.

Participant Information

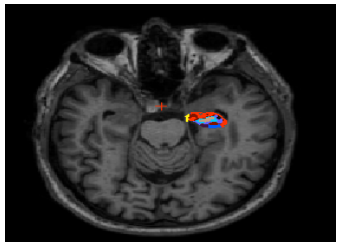
Participants were part of the Health Outreach Program for the Elderly (HOPE) study run through the Boston University Alzheimer's Disease Center (BU-ADC). For the purposes of this study, there were 19 control subjects and 23 MCI subjects.

Methods

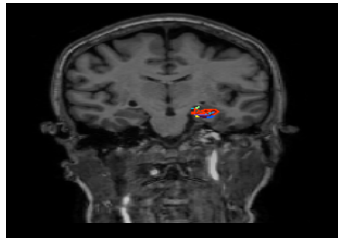
Participants were scanned at the Center for Biomedical Imaging (CBI) at the BU School of Medicine on a 3T Philips Achieva System with a 32-channel head coil. Brain morphometric measures were generated using FreeSurfer version 6.0. Classical between group analyses were conducted using independent samples t-tests. Predictive models were generated using nominal logistic regression in order to identify the measures that contribute independent variance to the predictor of group membership.



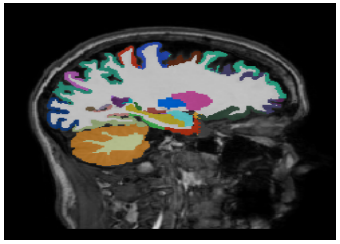
Sagittal view of Left Hippocampal Subfields



Axial view of Left Hippocampal Subfields

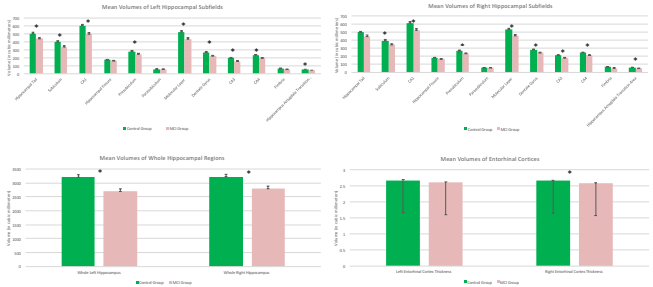


Coronal view of Left Hippocampal Subfields



Sagittal view of Left Entorhinal Cortex

Results



Graphs above showing comparison between controls subjects and MCI subjects for the indicated measures. Regions that reached significance ($p < 0.01$) are indicated with an asterisk (*).

Logistic Models

Source	FDR LogWorth	FDR PValue
left_Whole_hippocampus	0.687	0.20570
rh_entorhinal_thickness	0.619	0.24066
right_Whole_hippocampus	0.294	0.50800
lh_entorhinal_thickness	0.109	0.77871

Rsquared = 0.3014. JMP 13.0 Results

Source	FDR LogWorth	FDR PValue
left_parasubiculum	1.840	0.01445
left_hippocampal-fissure	1.840	0.01445
left_CA3	1.738	0.01828
left_CA1	1.738	0.01828
left_molecular_layer_HP	1.619	0.02406
left_presubiculum	1.331	0.04669
lh_entorhinal_thickness	1.323	0.04748
left_subiculum	1.203	0.06265
left_Hippocampal_tail	0.061	0.86917
left_GC-ML-DG	0.061	0.86917
left_fimbria	0.061	0.86917
left_CA4	0.061	0.86917
left_HATA	0.061	0.86917
left_Whole_hippocampus	.	.

Rsquared = 0.6844. JMP 13.0 Results

Source	FDR LogWorth	FDR PValue
right_parasubiculum	0.476	0.33447
right_presubiculum	0.476	0.33447
right_CA1	0.426	0.37516
right_CA3	0.426	0.37516
right_HATA	0.426	0.37516
rh_entorhinal_thickness	0.417	0.38275
right_molecular_layer_HP	0.198	0.63382
right_hippocampal-fissure	0.198	0.63382
right_Hippocampal_tail	0.198	0.63382
right_fimbria	0.147	0.71278
right_GC-ML-DG	0.072	0.84654
right_CA4	0.072	0.84654
right_subiculum	0.004	0.99042
right_Whole_hippocampus	.	.

Rsquared = 0.3961. JMP 13.0 Results

Summary

- Statistical differences exist in hippocampal subfields and the entorhinal cortex between healthy controls and MCI subjects.
- Only selected left hippocampal subfields contributed independent variance to the prediction model.