



Resting Parietal Glucose Metabolism Related to Hippocampal Activation in Elderly Controls

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INTRODUCTION

- FDG-PET and fMRI studies have both demonstrated alterations in a distributed memory network, including the hippocampus and posteromedial cortices, in aging and early Alzheimer's disease.
- The association between resting glucose metabolism and neural response during memory tasks, as assessed with fMRI, remains to be fully elucidated.
- In this study, we investigated the relationship between resting FDG metabolism in the precuneus and fMRI activity in the hippocampus during an associative encoding memory paradigm in non-demented older adults.

RESULTS

Whole-brain map level analyses

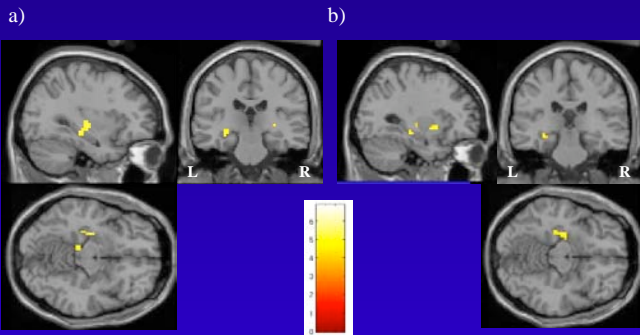
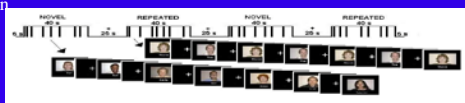


Figure 1. In whole brain map level analyses, FDG metabolism in both the (a) left and (b) right precuneus was significantly related to fMRI activation for the HCHvF contrast, with a peak in the left hippocampus (a) [-30 -27 -9] and (b) [-30 -27 -12] ($p > 0.0001$ uncorrected, extent = 5 contiguous voxels).

METHODS

Subjects

- Thirty-six normal older subjects recruited from aging study
- Subjects all classified as CDR 0 (MMSE = 29.05 +/- 0.75)
- Age (years): (73.92 +/- 6.95); Gender: 11M/ 25 F; Education (years): 16.4 +/- 2.68
- Underwent neuropsychological testing, fMRI task scan, FDG-PET resting scan, and PiB-PET scan



Face-name associative memory task

- 7 novel face name pairs/block, 2 blocks/run (84 total, each seen once)
- 2 repeated face name pairs/block, 2 blocks/run (each seen 42 times)
- Total of 6 experimental runs
- Timing of the images jittered within the blocks
- Subjects instructed to make a subjective decision as to whether the name "fit" the face and to remember the associated name

Imaging methods and data analysis

- 3.0T Siemens Trio; Gradient echo EPI: TR=2000, TE=30, FA= 90; 30 oblique slices (5mm skip 1mm), perpendicular to AC/PC
- fMRI data preprocessed in SPM2. SPM2 whole brain and region of interest (ROI) analysis utilized to explore magnitude of activation in the hippocampus (% signal change) from a contrast of High-Confidence Hits vs. Fixation (measure of successful encoding).
- PET: Both FDG-PET (ADNI protocol) and PiB-PET (40-60 minute summed images) were expressed as the SUVR (cerebellum).
- FDG group median split cut off is 1.14 FDG-SUVR; PiB-FLR group cutoff is 1.15 DVB

RESULTS

ROI analyses

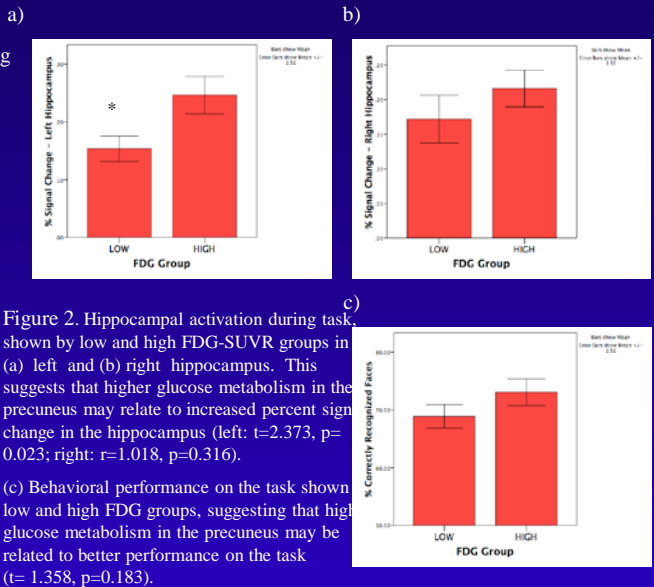


Figure 2. Hippocampal activation during task, shown by low and high FDG-SUVR groups in (a) left and (b) right hippocampus. This suggests that higher glucose metabolism in the precuneus may relate to increased percent signal change in the hippocampus (left: $t = 2.373$, $p = 0.023$; right: $r = 1.018$, $p = 0.316$). (c) Behavioral performance on the task shown low and high FDG groups, suggesting that high glucose metabolism in the precuneus may be related to better performance on the task ($t = 1.358$, $p = 0.183$).

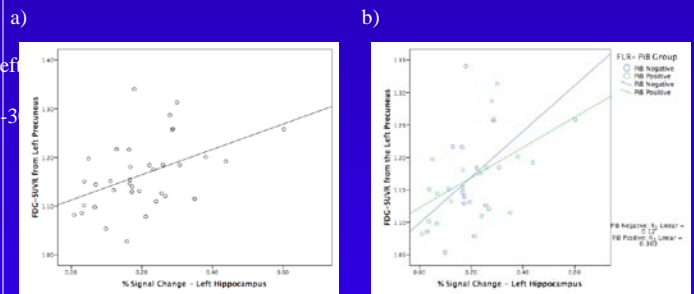


Figure 3. (a) Percent signal change was extracted from the AAL hippocampus and plotted against SUVR measures of glucose metabolism from the precuneus. There is an overall positive relationship between hippocampal activation and FDG metabolism in the precuneus ($r = 0.455$, $p = 0.005$) (b) are drawn separately by PiB group (amyloid positive or negative).

CONCLUSIONS

- Higher glucose metabolism in the precuneus is associated with increased hippocampal activity during successful memory encoding in a challenging memory task in clinically normal older individuals.
- These cross-modality findings support the critical interaction between these two key nodes of a distributed memory network in clinically normal older individuals.
- Ongoing PiB-PET studies are investigating the influence of early amyloid pathology on the relationship between default network metabolism and hippocampal activity.