

Neural substrates of autobiographical memory retrieval in unilateral temporal lobe epilepsy: an fMRI study

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Objective: Neuroimaging of autobiographical memory (AM) retrieval suggests this memory process specifically activates the hippocampus, as part of a predominantly medial memory network. This converges with evidence that hippocampal damage is associated with AM impairments. One neuroimaging study investigated AM in a case of bilateral hippocampal damage¹, finding activation of residual hippocampal tissue. Patients with temporal lobe epilepsy provide an opportunity to investigate the impact of unilateral hippocampal damage on the neural substrates of AM retrieval.

Methods: Participants in this event-related fMRI study included eight left (LTLE) and seven right (RTLE) temporal lobe epilepsy patients (lateralization based on EEG criteria), and fourteen age-matched controls. During scanning, participants retrieved specific AMs on the basis of cues provided in a pre-scan interview and completed two control tasks (sentence completion and size discrimination). Only trials on which AMs were subsequently reported as successfully retrieved were included in analyses.

Results & Discussion: A random-effects contrast of AM retrieval to control tasks was performed for each group (Figure 1). Controls activated the previously described AM network, including bilateral hippocampus, parahippocampus, and retrosplenial cingulate. LTLE patients activated some regions of this network (e.g., bilateral posterior cingulate, right parahippocampus) but there was no evidence of hippocampal engagement. In contrast, RTLE patients showed activity in bilateral hippocampus as well as many components of the AM network.

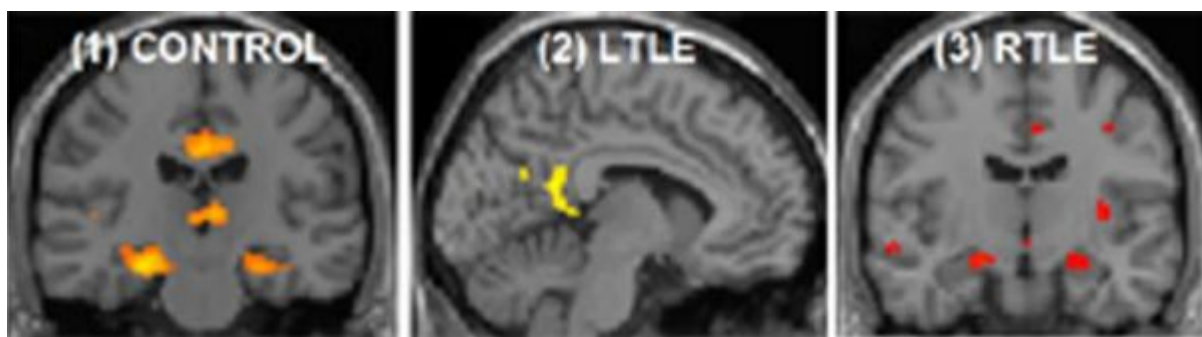


Figure 1. Regions activated during AM retrieval for each group

Group-level random-effects analyses were performed to compare patterns of activity associated with AM retrieval (Figure 2). Controls exhibited significantly more activity than LTLE participants in the hippocampus and parahippocampal gyrus bilaterally. LTLE patients showed more activation than controls in the left middle frontal and right supramarginal gyri. There were no regions in which controls showed significantly greater activation than the RTLE group. However, RTLE patients

exhibited more activity than controls in bilateral anterior cingulate, left medial frontal gyrus, right posterior cingulate and middle temporal gyrus.

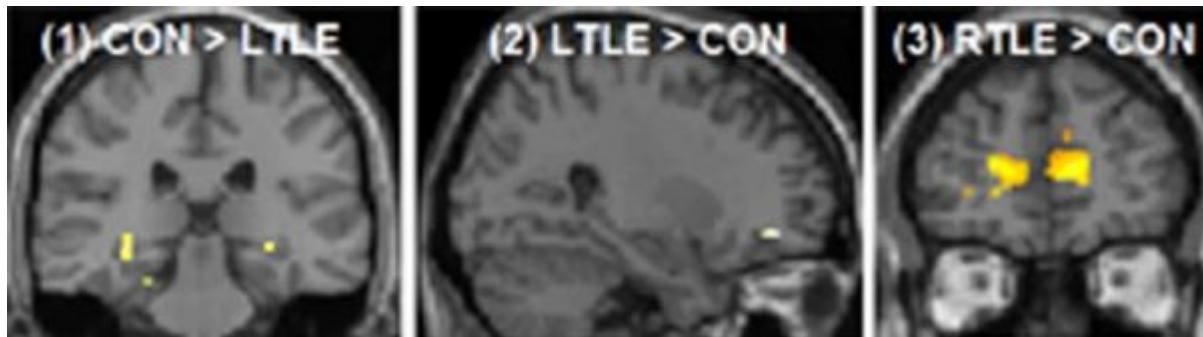


Figure 2. Regions differentially activated by controls and patients during AM retrieval: (1) bilateral hippocampus; (2) left middle frontal gyrus; (3) bilateral middle frontal gyrus.

Conclusions: These results indicate alterations in the neural network supporting AM retrieval in the context of unilateral medial temporal damage. An overall decrease in left and right medial temporal activation (as well as left neocortical engagement) was seen in left TLE patients whereas the medial activations were not depressed in right TLE cases. This pattern is consistent with the hypothesis² that the left hippocampus plays a leading role in AM retrieval, perhaps initiating engagement of medial temporal circuitry. Thus when dysfunctional, the remainder of the network is downregulated, even when patients can retrieve AMs. Alternatively, the reduced activation in LTLE may reflect greater bilateral compromise to MTL in this group, an impoverishment in the qualitative aspects of recollective retrieval that modulate MTL activity³, or a slowness in retrieval impacting the ability of the canonical HRF to characterize their activation.

References & Acknowledgements: ¹Maguire et al. (2001), *Brain*, 124, 1156-1170.

²Maguire & Frith (2003), *Brain*, 126, 1511-1523.

³Addis et al. (2004), *Hippocampus*, 14, 752-762.