INTRODUCTION

Verbal episodic memory decline occurs in roughly 30-50% of patients following left anterior temporal lobe resection (L-ATLR). Although seizure control is usually the primary consideration in epilepsy surgery, the availability of precise information regarding risks of memory decline can be helpful in many elective cases.

Predictors of verbal memory decline after L-ATLR include preoperative memory performance (better performance predicts greater decline), age at seizure onset (later onset predicts greater decline), hippocampal pathology (absence of sclerosis or atrophy on the operated side predicts greater decline), and Wada memory asymmetry.

We showed recently that language lateralization is also strongly predictive of verbal memory outcome (Binder et al., 2008). A numerical index of language lateralization, whether measured by fMRI or Wada, was more predictive of verbal memory outcome than the Wada memory test. The fMRI language lateralization index also improved the accuracy of prediction compared to prediction based solely on preoperative memory performance and age at seizure onset. Together these three variables accounted for roughly 60% of the variance in memory outcome in 60 L-ATLR patients.

Both left hippocampal volume and hippocampal volume asymmetry have been reported to have value in predicting memory outcome, in both univariate and multivariate prediction models (Trechery et al., 1993; Lineweaver et al, 2006). Here we assess whether these variables contribute independent predictive value beyond other available non-invasive predictors.

Hypothesis:

Larger left hippocampal volume and smaller right > left volume asymmetry predicts more severe verbal memory decline.

METHODS

Patients:
Participants were 58 left temporal lobe epilepsy patients treated with L-ATLR. Four other patients were excluded because of poor quality anatomical images. All patients were adults, age range 18-49, FSIQ > 70, and native English speakers.

Neuropsychological Assessment:
All patients underwent preoperative and 6-month postoperative standardized memory testing using the Selective Reminding Test. We focus here on a retention measure called Delayed Recall (DR). Change scores were computed by subtracting preoperative from postoperative raw scores.

fMRI and MRI:
Scanning was performed preoperatively on a 1.5T or 3T GE scanner. High-resolution (~1-mm cubic) T1-weighted anatomical volumes were acquired using an SPCG sequence. fMRI language mapping used a Semantic Decision – Tone Decision contrast (Binder et al., 2008).

RESULTS

Left hippocampal volumes (whole, anterior, posterior) were significantly smaller than their right homologues (paired t-tests, all p < .0001). Predictors of Outcome (Pearson’s r values):

<table>
<thead>
<tr>
<th></th>
<th>CLTR</th>
<th>DR</th>
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</thead>
<tbody>
<tr>
<td>Preop Score</td>
<td>.604***</td>
<td>.599***</td>
</tr>
<tr>
<td>Age at Epilepsy Onset</td>
<td>.284*</td>
<td>.329**</td>
</tr>
<tr>
<td>FMRI Language Lateralization</td>
<td>.449***</td>
<td>.255*</td>
</tr>
<tr>
<td>Left Hippocampal Volume</td>
<td>.308**</td>
<td>.281*</td>
</tr>
<tr>
<td>Whole Hippocampal Asymmetry</td>
<td>.308**</td>
<td>.181</td>
</tr>
<tr>
<td>Anterior Hippocampal Asymmetry</td>
<td>.312*</td>
<td>.115</td>
</tr>
</tbody>
</table>

***p < .0001, **p < .01, *p < .05 (all 1-tailed).

Multivariate Prediction Models:

CLTR Change:
Preop score and age at epilepsy onset together accounted for 41% of the variance in CLTR change (p < .0001).
Neither addition of hippocampal volume asymmetry nor left hippocampal volume improved the model.
Addition of the fMRI language lateralization index accounted for an additional 13% of the variance (p < .0001).

DR Change:
Preop score and age at epilepsy onset together accounted for 43% of the variance in DR change (p < .0001).
Neither addition of hippocampal volume asymmetry nor left hippocampal volume improved the model.
Addition of the fMRI language lateralization index accounted for an additional 7% of the variance (p = .012).

CONCLUSIONS

Like Wada memory asymmetry, hippocampal volume measures are only modestly predictive of verbal memory outcomes. They do not add independent predictive value after consideration of preoperative performance and age at epilepsy onset.

Like Wada memory asymmetry, hippocampal volumes reflect material-nonspecific hippocampal pathology. They do not necessarily indicate asymmetry of material-specific verbal memory systems.

Verbal memory outcome is strongly correlated with language lateralization, supporting recent claims that lateralization of verbal memory is more closely tied to language lateralization than to hippocampal pathology.

References:


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