Memory Loss after Left Anterior Temporal Lobectomy in Patients with Mesial Temporal Lobe Sclerosis

Verbal Memory Outcome in Patients with Normal Preoperative Verbal Memory and Left Mesial Temporal Sclerosis

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PURPOSE: Previous studies have shown that structural integrity (i.e., presence/absence of mesial temporal sclerosis (MTS)) of the left mesial temporal lobe is associated with verbal memory outcome following left anterior temporal lobectomy (ATL). However, the functional integrity of the left temporal lobe, as exemplified by preoperative verbal memory performance, has also been associated with verbal memory outcome following surgery. We investigated the risk of verbal memory loss in patients with known structural abnormality (i.e., left mesial temporal sclerosis by MRI) and normal preoperative verbal memory performance who undergo left ATL.

METHODS: Seventeen patients with left temporal lobe epilepsy, MRI-based exclusive left MTS, and normal preoperative verbal memory were identified. Normal verbal memory was defined as performance on *both* Acquisition (learning across trials 1–5) and Retrieval (long delayed free recall) portions of the California Verbal Learning Test (CVLT) above a *T* score of 40 (>16‰). Postoperative verbal memory outcome was established by incorporating standardized regression-based (SRB) change scores.

RESULTS: Postoperative declines across both CVLT Retrieval *T* scores and Acquisition *T* scores (average 20% and average 15% declines from baseline scores, respectively) were measured for the group. The average CVLT Retrieval SRB change score was −2.5, and the average CVLT Acquisition SRB change score was −1.0. A larger proportion of patients demonstrated postoperative declines on Retrieval scores than Acquisition scores (64.7% vs. 17.6%, respectively).

CONCLUSIONS: Even in the presence of left MTS, patients exhibiting normal presurgical verbal memory are at risk for verbal memory declines following ATL. These results suggest that the functional integrity of the left mesial temporal lobe may play an important role in the verbal memory outcome in this patient group.

COMMENTARY

On September 1, 1953, Dr. William Beecher Scoville performed bilateral mesial temporal lobe resections on the patient HM, by suctioning via a supraorbital approach. The resection extended 8 cm beyond the anterior tips of the temporal lobes. The severe postoperative amnesia in this patient, combined with observations in several other cases, led to the realization that the mesial temporal lobes are critical for the formation of new episodic memories (1). Prior to modern imaging techniques, a few cases of dense postoperative amnesia were reported after unilateral anterior temporal lobectomy. As a consequence, the intracarotid amobarbital procedure (i.e., the Wada test) was modified not only to assess language lateralization but also to provide an indication of the functional integrity of each temporal lobe based on memory performance (2). With advances in preoperative evaluation techniques, severe postoperative amnesia following unilateral anterior temporal lobectomy now is exceedingly rare. However, patients are still at risk for a clinically significant reduction in the ability to recall recent memories. Currently, the risk can be predicted with reasonable accuracy (3) and is higher when the following factors are present:

- Anterior temporal lobectomy on the language dominant side,
- No hippocampal atrophy or sclerosis on the side of proposed resection,
- A higher preoperative memory performance,
- Seizure onset at an older age,
- Surgery performed at an older age,
- Functional assessments (e.g., the Wada test) that suggest greater residual preoperative function of the left temporal lobe.

Thus, the risk would be highest for patients undergoing left temporal lobectomy with left cerebral language dominance, absence of left hippocampal atrophy/sclerosis, high baseline verbal

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memory, absence of unilateral left positron emission tomography (PET) temporal lobe hypometabolism, and the presence of high memory performance with right intracarotid amobarbital injection but low memory performance with left injection. Furthermore, the occurrence of memory decline is greater if the patient is not seizure-free, postoperatively.

The absence of hippocampal atrophy/sclerosis is a strong predictor of postoperative memory decline (4). In a regression analysis, the absence of hippocampal atrophy/sclerosis was the second strongest predictor of verbal memory decline, second only to left language dominant resection (5). However, other factors, such as preoperative verbal memory performance and Wada test results, contributed to independent variances of the risk in the regression analysis.

Patients with left hippocampal sclerosis frequently have coexistent preoperative poor verbal memory performance, but they may dissociate. The probability of memory loss when risk factors dissociate is less clear. LoGalbo et al. examined a select group of 17 patients with intractable epilepsy undergoing left temporal lobectomy. The patients all had left mesial temporal sclerosis but also had normal preoperative verbal memory. Overall, the group showed reduced verbal memory performance postoperatively. According to standardized regression-based change scores, delayed free recall on a standard verbal memory measure (i.e., the California Verbal Learning Test [CVLT]) was reduced 2.5 on average (out of a possible maximum of 16). The *T* score for the CVLT-delayed recall was reduced in 13 of the 17 patients, and the decline was greater than 1 standard deviation in 7 patients. The reduced verbal memory in these seven patients could certainly be considered clinically significant. Additional studies are needed with larger sample sizes to fully define the patient population at risk and improve the prediction for individual patients.

Any therapeutic decision involves balancing benefits and risks. In the case of intractable temporal lobe seizures, the benefits of surgery include possible freedom from seizures and the resultant effects on quality of life. The benefits also include reduction in the risks related to ongoing intractable epilepsy: reduced employment opportunities, inability to drive, sudden unexplained death in epilepsy (SUDEP), and progressive cognitive decline stemming from ongoing seizures (6,7). The risks of temporal lobectomy include memory loss, naming difficulties, superior quadrantanopsia, and other risks associated with craniotomy. The consideration of risks and benefits must be individually based and include input from the patient. For example, a risk of decline in verbal memory—or even an actual decline similar to that of the patients in the LoGalbo et al. study—is acceptable to some patients to obtain the benefits of seizure freedom.

The findings of LoGalbo et al. demonstrate that the risk of postoperative memory decline is not predicted by the presence of hippocampal sclerosis alone. Their findings also highlight the need for preoperative functional assessments to compliment the EEG and imaging studies. The localization of dysfunction not only provides predictive information on the risk of resection on cognitive function but also contributes to estimating the probability of obtaining seizure freedom. Multiple functional measures are available: neuropsychological testing, Wada test, PET, functional MRI, magnetic resonance spectroscopy, and magnetoencephalography; yet, the relative role of each of these measures in preoperative functional assessments is unclear, and some measures are still in development. Thus, there is a need for further research to improve functional measures and define their independent contribution to the preoperative evaluation for epilepsy surgery.

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