SEMANTIC MEMORY IS MORE IMPAIRED IN DOMINANT THAN IN NONDOMINANT TEMPORAL LOBE EPILEPSY

Heike Schmolck1,2, Jay Foreman1,2, Amit Verma2-3, Ian Goldsmith2-3, Michele K.York1,2, Harvey Levin4, Daniel Yoshor4, Eli M. Mizrahi2,3, and Paul Schulz1,2

1Neurology CareLine, Michael DeBakey VAMC; 2Department of Neurology, Baylor Comprehensive Epilepsy Center and 3Department of Neurosurgery, Baylor College of Medicine; Houston, TX

Introduction

Bilateral damage to the anterolateral temporal cortex (LTC) leads to impairment in semantic memory (SM). This has been demonstrated in the neurodegenerative disorder Semantic Dementia. A study with postencephalitic patients demonstrated that bilateral structural lesions produce impairment, which correlates with the extent of damage (Schmolck et al., 2002). To determine the contribution of the dominant versus the nondominant LTC for SM, we are studying patients with intracarotid temporal lobe epilepsy (TLE) before and after anterior temporal lobectomy (ATL).

The term Semantic Memory was introduced by Endel Tulving in 1972 to differentiate the memory for lexical knowledge, which is the vast amount of information we acquire and store about our environment throughout our lifetime, from distinct events defined by a temporal and spatial context (episodic memory). While bilateral damage to the hippocampal formation causes severe impairments in episodic memory (e.g. Squire et al., 2004), it does not cause impairment of language comprehension or semantic memory. In contrast, more extensive bilateral temporal lobe damage, including damage to the lateral temporal cortex, impairs the ability to give definitions of common animals and objects (Schmolck et al., 2002). In a prior study, we showed that there is a direct relationship between the degree of impairment on tests of semantic memory and the extent of LTC damage (Schmolck et al., 2002). Also, severe neurodegenerative atrophy of the lateral infrotemporal cortex (Semantic Dementia, or Temporal Variant of Fronto-Temporal Dementia) causes deterioration of semantic knowledge (e.g. Hodges et al., 1992; Garrard et al., 1997; Muns et al. 2001).

There are only limited data concerning the effect of longstanding TLE or epilepsy surgery on semantic memory. In a large cohort of left anterior temporal lobectomy (ATL) patients, there was a significant decline in confrontation naming, and more extensive lateral surgical resection was associated with a higher risk of subsequent impairment (Herrman et al., 1999). Auditory Naming (which gives semantic information to elicit a response) causes more impairment than confrontation naming and may be highly specific to the difficulties experienced by TLE patients clinically (e.g. Bell et al., 2005). Difficulties that go beyond the retrieval of object names after left ATL have also been found (e.g. synonym judgment; Glosser and Donofrio 2001). One study assessed semantic memory in TLE patients before surgery using a definition paradigm, and found significant impairments. However, due to the relatively small sample size, predictors could not be identified (Bell et al., 2001). Our goal is to compare semantic memory in left versus right TLE patients, and the impact of surgery on both groups. In addition to this cross-sectional approach, we also have a prospective study arm comparing semantic memory before and after surgery in the same patient cohort.

Study Goals (ongoing study)

1. Do temporal lobe epilepsy patients have semantic memory deficits?
   A. Do patients with dominant temporal lobe foci have greater deficits than patients with non-dominant foci?
   B. What are the predictors or risk factors for impairment, such as age of seizure onset, length of seizure disorder, age at seizure intractability, or type and number of seizures?
   C. Will a detailed analysis of patient responses give a better characterization of the nature of the semantic deficits?

2. Does anterior temporal lobectomy have an independent effect on semantic memory in temporal lobe epilepsy?
   A. If there is an effect, is it different in magnitude between dominant and nondominant anterior temporal lobectomy?