

FUNCTIONAL MRI AND MEMORY IN TEMPORAL LOBE EPILEPSY

Memory Lateralization in Medial Temporal Lobe Epilepsy Assessed by Functional MRI

Golby AJ, Poldrack RA, Illes J, Chen D, Desmond JE, Gabrieli JD

Epilepsia 2002;43(8):855–863

PURPOSE: To determine the utility of functional magnetic resonance imaging (fMRI) in preoperative lateralization of memory function in patients with medial temporal lobe epilepsy (MTLE).

METHODS: Nine patients with MTLE underwent standard preoperative assessment including video-EEG and intracarotid amytal testing (IAT). fMRI was performed while subjects encoded four types of stimuli (patterns, faces, scenes, and words). Activation maps were created for each subject representing areas more active for novel than for repeated stimuli. Regions of interest were drawn around the MTL in individual subjects, suprathreshold voxels were counted, and an asymmetry index was calculated.

RESULTS: In eight of nine subjects, lateralization of memory encoding by fMRI was concordant with that obtained from the IAT. Group-level analysis demonstrated greater activation in the MTL contralateral to the seizure focus, such that in the left MTLE group, verbal encoding engaged the right MTL, whereas in the right MTLE group, nonverbal encoding engaged the left MTL.

CONCLUSIONS: fMRI is a valid tool for assessing of memory lateralization in patients with MTLE and may therefore allow noninvasive preoperative evaluation of memory lateralization. fMRI revealed that memory encoding may be reorganized to the contralateral MTL in patients with MTLE.

operative evaluation for epilepsy surgery. Originally, the IAP memory test was developed to predict the risk of amnesia in patients undergoing temporal lobectomy for intractable epilepsy. Modern structural imaging techniques have largely supplanted this role. However, the utility of the IAP memory test has evolved to include the prediction of less severe but clinically significant declines in anterograde declarative memory function and to predict the probability of postoperative seizure freedom. The IAP is an invasive procedure with risks to the patient. Functional magnetic resonance imaging (fMRI) offers the possibility of obtaining similar information without the risks associated with IAP. Several fMRI studies have shown good concordance with the IAP for determination of language lateralization, which would allow substitution of fMRI for IAP in most patients for language lateralization, but fMRI language tasks have not reached a point at which they can reliably determine intrahemispheric distribution of language, especially in regard to “necessary” regions as opposed to “activated” regions.

Development and application of reliable fMRI memory tasks in patients with epilepsy has lagged behind fMRI language-lateralization tasks. Only a few studies have examined fMRI memory results on an individual basis in patients with epilepsy. Detre et al. (1) compared IAP memory results and fMRI for a scene memory task in nine temporal lobe epilepsy patients; activation asymmetries in the parahippocampal region concurred with IAP results in all nine patients. Jokeit et al. (2) found concordance of epileptic focus to fMRI memory for a covert navigation task in 90% of 30 patients with temporal lobe epilepsy. The same group also showed that the fMRI response is decreased by an antiepileptic drug (AED) (3). In the present study, Golby et al. add to these preliminary data by examining fMRI activations for novel compared with repeated stimuli of four different types in nine patients with temporal lobe epilepsy. They found concordant results to IAP memory in eight of the nine patients. In the patient whose fMRI and IAP were discordant, the fMRI results also were contrary to the findings of hippocampal sclerosis and seizure onset. The reason for discordance was not clear.

Although the findings of studies to date are promising, fMRI memory tasks cannot be used alone to predict postoperative memory deficits based on the present data. There is a need for larger sample sizes with postoperative follow-up to determine the ability of fMRI to predict postoperative mem-

COMMENTARY

Since the 1950s, the intracarotid amobarbital procedure (IAP) or Wada test has been used to assess lateralization of language and memory functions in patients undergoing pre-



ory on an individual-patient basis. The added value of fMRI results compared with other preoperative assessments must be determined. In addition, several methodologic problems must be addressed. Any clinically useful task should include a measure of patient performance in the magnet. Further, the effects of variations across fMRI memory tasks and analysis techniques should be ascertained.

by Kimford J. Meador, M.D.

References

1. Detre JA, Maccotta L, King D, Alsop DC, Glosser D, D'Esposito M, Zarahn E, Aquirre GK, French JA. Functional MRI lateralization of memory in temporal lobe epilepsy. *Neurology* 1998;50:926–932.
2. Jokeit H, Okujava M, Woermann FG. Memory fMRI lateralizes temporal lobe epilepsy. *Neurology* 2001;57:1786–1793.
3. Jokeit H, Okujava M, Woermann FG. Carbamazepine reduces memory induced activation of mesial temporal lobe structures: a pharmacological fMRI-study. *BMC Neurol* 2001;1:6.