FUNCTIONAL MRI PREDICTS NAMING DEFICITS AFTER TEMPORAL LOBECTOMY

Use of Preoperative Functional Neuroimaging to Predict Language Deficits from Epilepsy Surgery

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BACKGROUND: Left anterior temporal lobectomy (L-ATL) may be complicated by confrontation naming deficits.

OBJECTIVE: To determine whether preoperative functional magnetic resonance imaging (*f*MRI) predicts such deficits in patients with epilepsy undergoing L-ATL.

METHODS: Twenty-four patients with L-ATL underwent preoperative language mapping with *f*MRI, preoperative intracarotid amobarbital (Wada) testing for language dominance, and pre- and postoperative neuropsychological testing. *f*MRI laterality indexes (LIs), reflecting the interhemispheric difference between activated volumes in left and right homologous regions of interest, were calculated for each patient. Relations between the *f*MRI-LI, Wada language dominance, and naming outcome were examined.

RESULTS: Both the *f*MRI-LI ($P < .001$) and the Wada test ($P < .05$) were predictive of naming outcome. *f*MRI showed 100% sensitivity and 73% specificity in predicting significant naming decline. Both *f*MRI and the Wada test were more predictive than age at seizure onset or preoperative naming performance.

CONCLUSIONS: Preoperative *f*MRI predicted naming decline in patients undergoing left anterior temporal lobectomy surgery.

COMMENTARY

Identification of brain regions important for language expression plays a crucial role in preoperative evaluation of patients with intractable epilepsy. Conventional techniques, such as the intracarotid amobarbital (Wada test), as well as more invasive methods, such as intraoperative or prolonged subdural cortical mapping, have technical and clinical disadvantages; at best, the Wada provides hemispheric data. Recently, neuroimaging approaches, particularly functional magnetic resonance imaging (*f*MRI), have begun to be explored and validated as alternative procedures (1).

In this study, Sabsevitz and colleagues present data from 24 patients who had language mapping, by using *f*MRI and Wada testing for language dominance, before left anterior temporal lobectomy as well as pre- and postoperative neuropsychological testing. They used a semantic decision task, in which patients were presented with names of animals and asked to identify whether they are "found in the United States" and "used by humans." In earlier studies, this task had led to left-lateralized activation in areas previously implicated in language processing, including frontal, temporal, and parietal association cortices (2).

The results from Sabsevitz et al. showed that language lateralization on either the Wada or *f*MRI predicted postoperative decline on the Boston naming test; a high level of agreement was found between *f*MRI and the Wada test. The temporal lobe *f*MRI laterality index was a better predictor than was the frontal lobe laterality index. Age at seizure onset and age at first neurologic event were not significant predictors of postsurgery language impairment, suggesting that "functional reorganization" might not be an important factor in this patient group. The authors point out that recent use of more sensitive postoperative testing paradigms has increased detection of post–anterior temporal lobectomy naming impairment. These more sensitive measures may facilitate predictions of cognitive outcome. Previous studies had shown that *f*MRI reading paradigms can identify language dominance in frontal and temporal areas (3). Thus it may be possible to use *f*MRI for intrahemispheric localization as well as simply for lateralization.

However, several issues will have to be addressed in additional studies before *f*MRI can become a standard clinical procedure. As Sabsevitz et al. point out, *f*MRI explained only 41% of the variance in postoperative language function. Patients in their study underwent a tailored anterior temporal lobectomy with language stimulation, and resection size may have been an

important predictor of outcome. Changes in antiepileptic drug (AED) therapy might affect differences between pre- and postoperative neuropsychological performance and must be considered in studies on the effects of surgery. Preoperative *f*MRI activation patterns might be influenced by AEDs as well. Although age at seizure onset was not a significant predictor of postoperative deficits, epilepsy duration might play a role and should be evaluated in future studies. *f*MRI paradigms vary among investigators (as do Wada techniques), and a standard approach has not yet been developed. Several tasks may need to be used to assess specific brain regions. Current analytic techniques are laborious. Data comparing cortical mapping with *f*MRI, as opposed to the Wada test, are only beginning to emerge (4). Only a few studies have investigated memory in patients with epilepsy. It is likely, though, that *f*MRI eventually will replace invasive preoperative cognitive evaluation because it is noninvasive, can be repeated easily, is simple to perform with children, and multiple stimuli can be presented during a single scanning session. Moreover, clinical experience and technical advances will increase its value.

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References

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