Standard anatomic resections of the dominant temporal lobe for mesial temporal lobe epilepsy (MTLE) pose a potential risk to language function. Indeed, most but not all studies have reported language deficits, including verbal naming and verbal memory loss, following dominant anterior temporal lobectomy (1–7). The rationale for routine language mapping in dominant temporal resections is that performing a “tailored” resection that avoids identified language sites will minimize postoperative language deficits.

Using intraoperative cortical stimulation mapping (8), Ojemann and colleagues have found that while there is a wide degree of interindividual variability, language sites tend to cluster in the perisylvian regions, particularly in the posterior inferior frontal gyrus and middle and posterior superior temporal gyrus (9,10). The relative paucity of anterior temporal language sites has led to the adoption of “standard” anteromesial temporal resections for dominant-hemisphere MTLE without undue concern for postoperative aphasia. Typically, this involves removal of the anterior ~4 cm of middle and inferior temporal and fusiform gyri and radical resection of the medial structures (hippocampus, parahippocampal gyrus, and amygdala) (11). The controversy arises over whether intraoperative language mapping will help to identify and preserve essential language sites in the subpopulation of MTLE patients with anterior temporal language sites (8).

There are no studies demonstrating that tailored resection based on intraoperative language mapping leads to better language outcome. In contrast, a multicenter
study found no postoperative difference in visual naming between patients who were
mapped with visual naming compared to those who underwent standard resections
without mapping (12). Furthermore, there was no difference in visual naming between
patients in whom the superior temporal gyrus was spared or removed (12). However,
the exclusive language outcome measure in this and most studies was visual object
naming, and potential language deficits resulting from auditory naming or comprehen-
sion sites were not studied.

While most studies have been done with language “sites” identified by stimula-
tion-induced naming errors or speech arrest, other language tasks identify distinct
sites (13). For example, recent studies using cortical stimulation mapping have iden-
tified an anatomic dissociation of auditory and visual naming in the lateral temporal
cortex, with auditory naming sites located more anterior (14,15). In fact, nearly all
sites identified in the most anterior 4 cm of temporal lobe were “auditory-only” sites
not sensitive to visual naming (14). Thus, testing auditory rather than visual naming
may be more appropriate in the pre- and postoperative evaluation of language func-
tioning in MTLE patients undergoing standard anteromesial resection (16). In addi-
tion, these studies further call into question the utility of standard mapping based on
visual object naming, as patients who undergo intraoperative mapping solely with
visual naming tasks may decline postoperatively and experience “word-finding” def-
icits related to the auditory-naming sites.

Furthermore, there is evidence that resection of identified language sites may
still not lead to persistent language deficits. For example, while electrical stimulation
of the basal temporal language area leads to global aphasia, resection produces no
long-lasting language changes (17,18).

Thus, identification of a language site by electrical stimulation mapping does not
necessarily imply that it is “essential” to language function. Finally, patients who have
resection of only the mesial temporal lobes in selective amygdalohippocampectomy
may have significant changes in verbal memory, calling into question whether map-
ping of the lateral temporal surface is sufficient in attempts to avoid these deficits (19).

Awake language mapping is clearly not appropriate in many cases. For example,
it is poorly tolerated in patients younger than 10 years of age. In a multicenter study of
82 children under 17 years of age undergoing temporal lobectomy for unilateral TLE,
the largest cognitive outcome study to date in the pediatric age group, only 10% (eight
patients) experienced significant postoperative decline in verbal function (20). Interest-
ingly, of these eight patients, three had undergone right temporal lobectomy. Therefore,
this study offers little support for the use of awake language mapping in the pediatric
population for dominant anteromesial temporal resections. Other patient populations
in which language mapping is difficult or impossible include those with psychiatric pro-
blems or developmental delay. Awake mapping is also difficult in the setting of medical
comorbidities such as obesity, sleep apnea, smoking, and other pulmonary problems.
Having a patient awake during such procedures has theoretical increased risk, as patients
may have seizures or move unexpectedly during a procedure.

Extraoperative mapping of language cortex may serve as a useful adjunct to or
replace intraoperative mapping entirely (21). Subdural or epidural grid electrodes
can be implanted over putative language cortex. Advantages of awake extraoperative
mapping include that it allows for a more extensive mapping protocol, may be
repeated on different days, and can be done with no sedating medications that might
cloud the interpretation of results (21–23).

Disadvantages include infection risk, lower spatial resolution, and the require-
ment for an additional surgical procedure for electrode implantation.
Functional imaging methods may eventually be sufficient to map language functions noninvasively. Several studies have used positron emission tomography (PET) to compare areas activated during auditory and visual naming, and also to directly compare PET to cortical stimulation mapping (24). Functional magnetic resonance imaging (fMRI) has also been used to map language noninvasively and has been correlated to stimulation mapping (25–28). In general, the concordance between sites identified by cortical stimulation and fMRI has been good, with fMRI identifying many more additional sites (26) (but see Ref. 29). A recent important study provides the first evidence that fMRI can predict postoperative naming deficits following left anterior temporal lobectomy (30).

Thus, the available data indicate that in many patient populations, awake language mapping for standard anteromesial temporal resections for MTLE is not necessary. Whether it may be useful in a select subpopulation of patients to tailor resection and improve postoperative language outcome is still an unproven hypothesis. Newer neuropsychological and stimulation mapping data strongly suggest that if intraoperative mapping is employed, then auditory rather than visual naming may be more sensitive and specific in the identification of anterior temporal language sites. Modality-specific language testing before and after surgery combined with detailed language outcome studies will help elucidate the exact contribution of the anterior temporal lobe to language function. Preoperative evaluation with functional imaging may also prove of benefit in localization of language functions.

Ultimately, what matters most following anterior temporal lobectomy is its demonstrated beneficial effect in properly selected patients on seizure control and long-term psychosocial outcome, including return to work, functional independence, and quality of life (31–33).

REFERENCES


