

Krauss, G.L., Fisher, R., Plate, C., Hart, J., Uematsu, S., Gordon, B., and Lesser, R.P. (1996). 'Cognitive effects of resecting basal temporal language areas'. *Epilepsia* 37 (5), pp. 476-83.

INTRODUCTION

BTLA localized to fusiform gyrus of dominant temporal lobe and nearby regions

Anterior temporal lobectomy in epileptic patients can include BTLA;
postoperative verbal deficits could be attributed in part to removal of BTLA

Correlation of three factors in a large number of patients:

- 1) degree of language impairment produced by stimulating basal temporal regions
- 2) extent of basal temporal resection
- 3) postoperative verbal performance

Hypothesis: (3) correlates better with (2) than with extent of total resection

METHODS

Subjects

25 patients being considered for dominant temporal lobectomy because of a left dominant temporal lobe seizure focus

All patients were left-hemisphere dominant for language, none had basal temporal structural lesions prior to resection

Electrode Placement

64-100 subdural electrodes implanted in each patient

Electrodes covered:

- left posterior inferior frontal lobe
- anterior inferior parietal lobe
- perisylvian temporal lobe
- basal temporal lobe

Basal temporal electrodes in contact with:

- inferior temporal gyrus
- occipitotemporal gyrus
- variable amounts of parahippocampal gyrus

extended from near the temporal pole to about 8-9 cm posteriorly

Patients had an average of 8.8 (+/- 0.4) basal temporal electrodes (range 7-14)

Grids were left in place for 10-14 days

The following areas were resected:

- anterior temporal lobe
- amygdala and hippocampus
- a variable extent of the basal temporal area

Language Testing

Language tasks included:

- visual confrontation naming
- passage reading
- comprehension
- spontaneous speech
- auditory repetition
- naming to description
- single word reading

A minimum of two control and four stimulation trials at each site for each task

Responses considered abnormal when patients had two or more errors more with stimulation than without

Responses not coded if three or more errors occurred without stimulation

Errors defined as:

- incorrect choice or word
- no response
- more than a two-second delay in responding

Partially correct or ambiguous responses retested later

Patients defined as having a BTLA if they exhibited deficits at one or more basal temporal sites

Stimulation testing performed for 7-12 days with two blocks of testing for more than two hours every day

Testing began no sooner than three days after implantation

Trials containing afterdischarges of epileptiform activity discarded

Afterdischarges occurred at stimulation intensities averaging 0.7 milliamperes (mA) higher than those with functional deficits at the same sites

Patients monitored for epileptiform activity by recording from the electrode grids using 64 channels of EEG

In 21/25 patients, seizures involved basal temporal areas; the rest had seizures localized to anteromesial temporal electrodes

BTLA resected in patients with seizure foci in these areas;
BTLA spared in patients with seizure foci anterior or lateral to BTLA

Patients defined as having BTLA removed if one or more language sites were resected in the temporal base

Cognitive Testing

Performed pre-operatively and repeated more than six months after resection (mean 37.4 +/- 4.3 weeks)

Pre- and postoperative language tests that were comparable to those used during stimulation testing were:

- oral word reading
- Boston Naming Test

RESULTS

Stimulation

20 out of 25 patients (80%) exhibited a BTLA

Only correlation with existence of a BTLA was age of seizure onset (5 or older)

- 18 out of 19 with seizure onset at age five or older had BTLA
- 2 out of 6 with seizure onset at ages younger than five had BTLA

Stimulation of BTLA caused language interference in 33% of sites tested

Patterns of language deficits:

(by percentage of positive sites;

percentages of patients and sites tested claimed to be similar)

==> see Figure 1, p. 478

Confrontation naming	73%
Auditory comprehension	52%
Reading paragraphs	34%
Spontaneous speech	30%
Reading words	27%
Naming to description	25%
Auditory word repetition	13%

Deficits in only one language function at a given electrode:

(by percentage of positive sites)

Confrontation naming	14%
Auditory comprehension	7%
Spontaneous speech	5.4%
Reading paragraphs	2.7%
Naming to description	1.3%
Reading words	0%
Auditory word repetition	0%

28 separate combinations of language deficits:

(by percentage of sites involved)

Confrontation naming and auditory comprehension	11%
All language tests	9.6%
Confrontation naming, auditory comprehension, and reading words	9.6%
Confrontation naming, auditory comprehension, and reading paragraphs	5.4%

Most BTLA sites found in fusiform gyrus
also in anterior parahippocampal gyrus
and posterior inferior temporal gyrus

anterior border: about 1 cm posterior to the temporal pole
posterior border: all the way to the posterior border of the grid,
near the occipitotemporal junction

Functions not localized to any particular position in the fusiform gyrus

Effect of Left Temporal Resections on Cognitive Outcome

performance IQ (WAIS) increased
verbal IQ (WAIS) did not change significantly
recognition memory for words decreased significantly

Effect of Resection Size on Cognitive Outcome

extent of total resection did not correlate with post-operative deficits
except for oral word reading

removal of BTLA correlated better with deficits in confrontation naming
($p = 0.15$) better than did resection size ($p = 0.88$)

no correlation between pre-operative cognitive performance and resection size

patients with age of seizure onset under five years
had slightly lower pre-operative cognitive performance
(significant only for total IQ)
than those with later ages of seizure onset

no correlation between location of seizure foci
and occurrence or location of BTLA

DISCUSSION

Resection of BTLA associated with a decrease in confrontation naming

This correlated more with removal of BTLA than with overall size of resection

Resection of BTLA did not interfere with:

- verbal IQ
- performance IQ
- verbal learning
- word recognition
- reading
- comprehension

Why the authors argue that the BTLA is not linked to reorganization of the epileptic brain:

- 1) position of seizure foci did not influence location of BTLA
- 2) BTLA less common in patients with early age of seizure onset

BTLA may be involved in visually mediated language processing

But disruption not simply due to visual impairment, since different visually mediated tasks had different patterns of disruption

As much individual variation in BTLA sites as in other language areas (cf. Ojemann)

Why is BTLA resection not as devastating as damage to Broca's or Wernicke's areas?

- 1) BTLA connects to Wernicke's area via axonal projections, stimulation current spreads from one to the other

==> site specificity argues against this, since adjacent sites have similar axonal projections

- 2) pp. 482-483

- 3) BTLA involved in but not crucial to visually mediated language processing