

Language processing in temporal lobe epilepsy and extra temporal lobe epilepsy using functional MRI

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Introduction: The temporal lobe is the most common “seizure focus” leading to temporal lobe epilepsy (TLE). However, epileptic seizures can be “extra temporal” or outside of the temporal lobe, originating in the frontal, parietal or occipital lobes (ETLE). Language dysfunction has been reported in TLE and ETLE patients¹. Functional neuro mapping corresponding to language areas may be of use in surgery planning in preoperative intractable epilepsy patients.

Methods: After obtaining the institute ethics approval, 10 consecutive patients with left temporal lobe epilepsy, 10 patients with extra temporal lobe epilepsy and 10 healthy controls were recruited (table 1). Standard diagnostic and exclusion criteria were followed. The language task consisted of naming, lexical, syntactic and syntactic-semantic. The visual cues were presented using a MR compatible binocular LCD goggles (NordicNeuroLab, Norway). The study was carried out using 1.5T MR scanner (Avanto, M/s. Siemens, Germany) using 12-channel head coil and single-shot echo planar imaging sequence with number of slices: 29, slice thickness 4.5 mm; TR: 2000 ms, TE: 24 ms, FOV: 230mm, resolution: 64x64 and total number of measurements: 256. The BOLD sessions were performed on patients prior to surgery. SPM8 was used for pre- and processing of the BOLD data, and one way anova for group analysis ($p < 0.005$, cluster threshold 5, Z score > 5).

Result: During naming task, BOLD activation (figure 1) was observed in right precentral gyrus, left posterior cingulate gyrus in LTLE group with respect to control and ETLE group. In control group, activation was observed in bilateral middle temporal gyrus, left superior temporal gyrus, left angular gyrus and right postcentral gyrus. We observed activation in left anterior cingulate gyrus, left inferior frontal gyrus and right middle frontal gyrus in ETLE group with respect to LTLE and control group. During semantic decision task, BOLD activation was observed in left precentral gyrus, right insula in control group with respect to LTLE and ETLE group, whereas left cerebellum was active in ETLE group with respect to control and LTLE group.

During simple syntactic task, BOLD activation was observed only in left cerebellum in control group with respect to LTLE and ETLE group. During syntactic-semantic task, activation was involved in right post central and left precentral gyrus in control group with respect to other groups and in right cerebellum, right superior temporal gyrus, left middle temporal gyrus, right inferior parietal lobule and right middle frontal gyrus in LTLE group with respect to control and ETLE groups.

Discussion: During naming task, LTLE and ETLE groups exhibited deactivation in left hemisphere than control group, and activation in left cerebellum with increasing complexity of syntactic-semantic task, suggesting that motor speech programming and language are affected in both groups. During comprehension (jumbled sentences task), right post central gyrus and left precentral gyrus were recruited in control group than other groups. In the LTLE group, comprehension components of language were observed to be affected and compensated by right hemisphere in agreement with earlier literature^{3,4}.

References:

1. Lippincott, CE., Thesis: An Investigation of Extra-Temporal Deficits in Temporal Lobe Epilepsy, Drexel Univ., USA, 2010.
2. Saur D, Kreher W, et al, PNAS 2008, 105, 18035–18040.
3. Cousin E, Baciou M, et al, Neuropsychiatric Disease and Treatment 2008;4, 235–246.
4. Vigliocco G, et al, Current Biology 2000, 10, R78–R80.

Subject Group	Mean age years (±SD)	Gender	Handedness	Diagnosis
10 LTLE	24.20 ±6.46	6M/4F	R	LMTS
10 ETLE	24.50 ±6.87	4M/6F	R	FLE, PLE
10 Control	30.70 ±6.20	9M/1F	R	Normal

LMTS-Left mesial temporal sclerosis, FLE-Frontal lobe epilepsy, PLE-Parietal lobe epilepsy

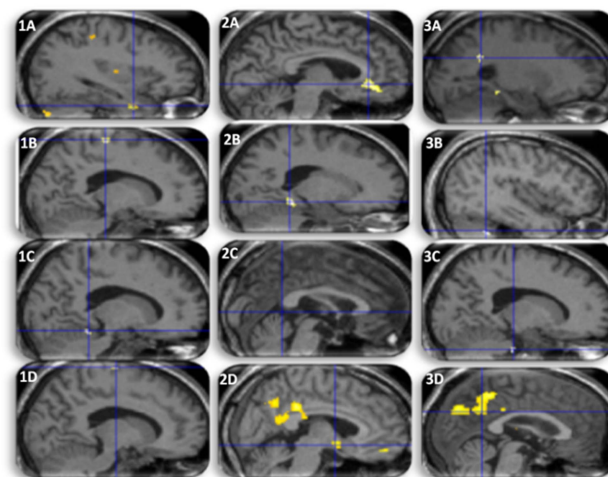


Figure 1: BOLD activation overlaid on sagittal sections during (A) Semantic noun naming Task, (B) Semantic Decision Task, (C) Syntax Task and (D) Jumbled Sentence Task in (1) Control group with respect to LTLE and ETLE group, (2) LTLE group with respect to control and ETLE group, (3) ETLE group with respect to control and LTLE group.