

Semantic memory processing in left temporal lobe epilepsy using functional Magnetic Resonance Imaging

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Introduction: The surgical planning in left temporal lobe epilepsy is usually associated with language functions, and sometimes by memory functions (Detre et al, 1998). Functional MRI of semantic memory network was carried out in left temporal lobe epilepsy patients.

Methods: After obtaining the institute ethics approval, 7 patients (2M/5F, mean age \pm SD: 26.14 \pm 6.91 years) with left temporal lobe epilepsy (MRI reported LMTS, left mesial temporal sclerosis) and 5 healthy controls (4M/1F, mean age \pm SD, 31.40 \pm 3.51 years) were recruited in this study. Standard diagnostic and exclusion criteria were followed. Auditory cue of a standardized story in Hindi, using Super Lab presentation software was provided to the subjects using MR compatible auditory interface system (NordicNeuroLab, Norway). After the story, patients were instructed to speak the answers in this story based questions during fMRI scan. The fMRI sessions were carried out using 1.5T MR scanner (Avanto, Siemens, Germany) using 12-channel head coil. The stimuli were presented using a MR compatible audio visual stimulus system with binocular LCD goggles (Nordic Neuro Lab, Norway). Single-shot echo planar imaging (EPI) sequence was used for the BOLD studies (number of slices: 29, slice thickness 4.5 mm; TR: 2000 ms, TE: 24 ms, FOV: 100 mm, resolution: 64x64 and total number of measurements: 72).

Results: During semantic memory task (Table 1, Figure 1) in left TLE group with respect to control group, BOLD activation was observed in bilateral fusiform gyrus (BA37), right supramarginal gyrus (BA40), left post central gyrus (BA2) and right posterior cingulate gyrus (BA30). With respect to controls, deactivation was seen in left insula (BA13).

Discussion: Deactivation of left insular cortex in LTLE group with respect to control group suggests that cognitive processing is affected in LTLE patients. BOLD activation in bilateral fusiform gyrus suggests LTLE patient group require more effort for decision making processing than controls during the semantic memory task. Insula may be involved in cognition, switching conscious awareness between networks (Chang et al, 2012). The damage to left insula due to lesion was associated with poorer performance on verbal memory tasks suggesting that the insula was part of a functional network that mediates verbal memory (Manes et al, 1999). Medial temporal structural abnormality may affect semantic memory networks in LTLE subjects.

References:

1. Detre JA, Maccotta L, et al., Neurology, 1998, 50, 926-3.
2. Chang LJ, Yarkoni T, Khaw MW, Sanfey AG, et al, Cereb. Cortex 2012, PMID 22437053, ePub ahead of print.
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Table 1. Bold activation due to semantic memory in LTLE subjects and healthy controls with respect to each other

Area of activation	BA	LTLE Vs Control		Control Vs LTLE	
		Left	Right	Left	Right
Insula	13	-	-	10	-
Fusiform gyrus	37	46	27	-	-
Supramarginal gyrus	40	-	100	-	-
Post central gyrus	2	21	-	-	-
Posterior cingulate	30	-	17	-	-

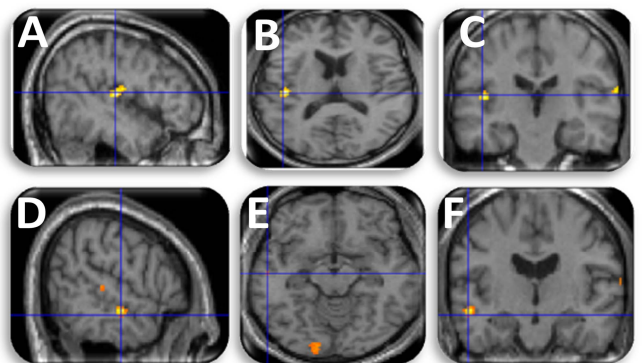


Figure 1. BOLD activation during verbal memory task in LTLE subjects group (A,B,C) and healthy control (D,E,F) in the sagittal (A,D), coronal (B,E) and axial (C,F) sections.