

Mapping the presurgical neuroanatomical correlates of postoperative outcome in temporal lobe epilepsy

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Target Audience

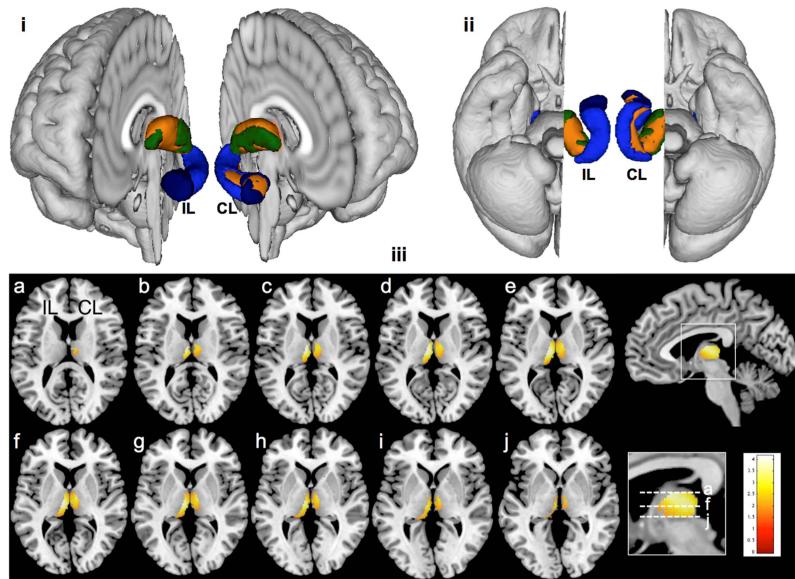
Epileptologists; MR Image Analysts; Neuroimaging Scientists; Neurologists; Neurosurgeons.

Purpose

Temporal lobe epilepsy (TLE) is the most common medically intractable epilepsy disorder, and neurosurgery to relieve refractory seizures is most commonly performed for patients with TLE. Surgery will render approximately 60-70% patients seizure free two years postoperatively. The reasons for why some patients continue to experience seizures after surgery are unknown. In the present study, we applied a series of automated mapping techniques to T1-weighted MR images in patients with TLE who underwent temporal lobe surgery to determine the presurgical imaging correlates of postoperative persistent seizures (PPS).

Methods

87 patients with unilateral TLE (55 left, 32 right) and ipsilateral hippocampal sclerosis (HS) were studied. All patients underwent comprehensive presurgical investigation, including MR imaging on a 3 T Siemens system, amygdalohippocampectomy, and standardised postoperative outcome classification. We compared MRI data between patients who were rendered seizure free (SF; ILAE classes I-II) and those with PPS (ILAE III-VI) using subcortical vertex-based surface analysis of subcortical structures (FSL 5), cortical thickness analysis (Freesurfer 5.2) and voxel-based morphometry (SPM8). Patients with right TLE were side-flipped, and changes in brain structure were treated as ipsilateral (IL) and contralateral (CL) to side of intended surgery. Results are reported corrected for multiple comparisons (FWE, $p < 0.05$).



Results

62% of patients were surgically rendered free from complex partial seizures (ILAE I-II). There were no significant differences between outcome groups with respect to clinical variables, the morphology of the IL mesial temporal lobe, or the cerebral cortex. However, patients with PPS showed evidence of shape, volume and concentration abnormalities of the hippocampus CL to the side of intended surgery relative to SF patients. Furthermore, there was convergent evidence indicating bilateral thalamic and striatal (predominantly putamen) atrophy in those with PPS. Figure 1 illustrates some of the main findings.

Figure 1. i/ii. Significant atrophy (orange) of the mesial temporal lobe (blue) CL to side of intended surgery and thalamus (green) bilaterally in patients with PPS using subcortical surface shape analysis. i/ii. Significant atrophy of the thalamus bilaterally in patients with PPS using VBM.

Conclusions

Morphological features of the to-be-resected mesial temporal lobe are unlikely to prospectively differentiate patients with TLE who will and will not be surgically rendered seizure free. Sophisticated neuroimaging approaches that have the potential to unlock prognostic markers of outcome in individual patients and prospectively identify those who are likely to experience PPS should focus assessment on a bihemispheric hippocampo-thalamo-striatal system.

Acknowledgement

This work was supported by a Medical Research Council grant awarded to SSK (Grant Number MR/K023152/1).