

Voxel Based Morphometric Analysis of Patients with Temporal Lobe Epilepsy and Correlation with Post-Surgical Outcomes

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Introduction

Epilepsy may arise from a vast number of causes including genetic, immune, and infectious, temporal lobe epilepsy (TLE) is among one of the most common types of this disease [1,2].The purpose of this study is to determine if there are changes in gray matter concentration using voxel based morphometry (VBM) between MTLE responders and non-responders to the surgical treatments including either an anterior temporal lobectomy (ATL) or Selective Laser Amygdalohippocampectomy (SLAH).

Methods

In this retrospective mono-center study, a total of 68 patients with TLE (18-74 age range and 42.9±12.90 mean±std) underwent either anterior temporal lobectomy (ATL) or Selective Laser Amygdalohippocampectomy (SLAH) and were scanned using DTI prior to surgery. On pre-operative MRI, 35 TLE patients were found to have mesial temporal sclerosis (MTS), and 33 had normal findings on MRI. Of MTS cases (MRI positive) 21 patients were responded to surgical treatments and 14 patients were still experienced seizure after surgery within 6 months follow up. In the patients with MRI findings negative 19 patients were responded to surgical treatments and 14 patients were still experienced seizure.

VBM was performed on T1 images using CAT12 and SPM12 toolboxes. Before estimating statistical model, data was smoothed using median filter to minimize the effects of noise and WM/GM interface (figure 1). Finally, first level statistical module was designed based on paired t-test. In the statistical model, total intracranial volume (TIV) was used as a confound variable to correct for different brain sizes.

Results

In TLE patients with MRI findings positive, significant differences in GM concentration have been shown between responders and non-responders in 5 different regions. These regions are included contralateral inferior temporal gyrus (50.63mm^3), ipsilateral middle temporal gyrus (27.00mm^3), contralateral postcentral gyrus (124.88mm^3), contralateral supramarginal gyrus (54.00mm^3) and ipsilateral superior parietal lobule (158.63mm^3). In TLE patients with MRI findings negative, ipsilateral fusiform gyrus (77.63mm^3) shows significant differences in GM concentration between two groups.

Conclusions

This type of analysis provides new insights for why some patients with TLE continue to experience postoperative seizures if pathological/clinical correlates are further confirmed.

References

[1] French, J. A., et al. "Characteristics of Medial Temporal Lobe Epilepsy: I. Results of History and Physical Examination." Annals of Neurology, vol. 34, no. 6, 1993, pp. 774–780.

[2] Pohlen, Michael S., et al. "Pharmacoresistance with Newer Anti-Epileptic Drugs in Mesial Temporal Lobe Epilepsy with Hippocampal Sclerosis." Epilepsy Research, vol. 137, 2017, pp. 56–60.

Learning Objectives

The results show significant changes in regions outside the temporal lobe, in the areas that are connected to the limbic system specifically hippocampus and parahippocampal regions suggesting different configurations of epileptogenic networks in these 2 groups.

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