Gray matter abnormalities in patients with mesial temporal lobe epilepsy: A quantitative assessment.

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Perspective

The goal of this study was to use statistical models to assess Grey Matter (GM) changes in patients with Mesial Temporal Lobe Epilepsy (MTLE).

Temporal Lobe Epilepsy (TLE) is a type of focal epilepsy that affects the temporal lobe. According to their anatomical substrates, TLE is now widely accepted to be divided into two electro-clinical entities: Mesial TLE (MTLE) and Lateral TLE (LTLE). Although most MTLE patients have hippocampal sclerosis, people with diagnosed lesions usually have a good surgical prognosis. Despite recent advances in imaging technology, 30 percent of TLE patients fail to recognise appropriate imaging indicators. As a result, these patients' surgery outcomes are typically dismal.

For example, epileptogenic zones outside the temporal lobe, such as the temporo-parieto-occipital junction, fronto-basal and orbito-frontal cortex, suprasylvian operculum, and insula, are rarely detected in individuals with temporal plus epilepsy, which may be a risk factor for surgery failures. In addition, a higher number of thalamic connections to regions in the ipsilateral and contralateral hemispheres was linked to postoperative seizure recurrence. MRI is a non-invasive method that has had a considerable impact on morphological evaluations of the brain in recent decades. Data from multi-modal MR imaging has been useful in determining the precise location of epileptogenic foci.

Advanced algorithms for quantitative morphological measures have recently been utilised, which can improve the sensitivity of diagnosing brain morphological anomalies. Clinical factors such as onset age, epilepsy duration, seizure frequency, and Antiepileptic Medication (AED) use, however, have a significant impact on the parameters derived from these morphological analyses. As a result, these confounding effects must be eliminated. To address these issues, we used corrected Voxel Based Morphometry (VBM) and Surfaced Based Morphometry (SBM) studies to look at the morphological changes in the cerebral GM of MTLE patients. We also used General Linear Models (GLMs) to examine the quantitative value of ROIs identified by the corrected VBM and SBM analyses.

64 adult MTLE patients and 100 healthy volunteers provided high-resolution MRI data. The modifications of cerebral GM of MTLE were detected by Voxel Based Morphometry (VBM) and Surfaced Based Morphometry (SBM) analysis. We also used the corrected VBM and SBM analyses to create General Linear Models (GLM) for quantitatively analysing areas of interest (ROIs).

From 2015 to 2019, a total of 64 MTLE patients between the ages of 15 and 44 were recruited to take part in this study. Every single one of the patients was right-handed. Left MTLE was detected in 35 of the patients, while right MTLE was diagnosed in 29. The diagnosis was made according to the International League Against Epilepsy (ILAE) criteria. This criterion was developed after a thorough analysis that includes seizure semiology, inter-ictal/ictal EEG, video-telemetry recordings, and an examination of MR scans for structural abnormalities in the mesial temporal lobe.

As a control group, a total of 100 healthy adult volunteers (50 males and 50 females) between the ages of 18 and 40 were recruited. All of the subjects were right-handed and had no history of neurological or mental illness, as well as chronic conditions including hypertension, diabetes, or coronary arteriosclerotic cardiopathy. The participants had the Wechsler Intelligence Test, EEG tests, and brain MRI scans. All of the tests yielded normal results.

In the left and right MTLE groups, the corrected VBM and SBM analyses found discriminable GM alterations in the ipsilateral hippocampus, the perisylvian cortex in the left MTLE group, and the bilateral orbitofrontal cortex in the right MTLE group. Both unilateral MTLE groups had their ipsilateral hippocampus volume GLM removed. An increased number of AEDs and a history of febrile convulsions were identified as risk factors for ipsilateral hippocampal atrophy in unilateral MTLE. Early onset age was also linked to left hippocampal atrophy in patients with left MTLE.

The current study used corrected morphological assessment to identify GM abnormalities in MTLE patients. The findings most likely reflected MTLE's structural network degradation. The decrease in ipsilateral hippocampus volume was established as a morphological biomarker of MTLE among the GM alterations. However, morphological examination utilising uncorrected hippocampus volume data was ineffective. Furthermore, the ipsilateral hippocampus volume GLM may help with unilateral MTLE assessment efficiency. In addition, risk factors for hippocampus volume loss in MTLE were discovered. In conclusion, we developed a quantitative technique to assess morphological changes in the GM of MTLE patients in order to help guide treatment decisions.

The current work created a quantitative assessment of unilateral MTLE based only on GM changes, with no demographic risk factors influencing the results. We discovered that locations both inside and outside of the temporal lobes may be connected with the MTLE epileptic network utilising our GM-based methodology.

There are two key flaws in this study that should be explored. For the GM morphological analysis, we solely employed 3D T1-weighted MPRAGE pictures. As a result, there was no evidence of changed structure networks from WM morphological analyses. We will need to include multimodal imaging data in

future study due to this constraint. The ipsilateral hippocampus volume GLM in unilateral MTLE morphological evaluations did not have high sensitivity or specific values, which must be raised to produce more robust and reliable protocols, which is the second main limitation of the current work. These low values could be owing to the limited sample sizes employed in this study, which would necessitate the recruitment of more patients in order to obtain more precise results.

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