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Characterization of Grey Matter and White Matter Abnormalities in Epilepsy Using Voxel-Based Morphometry and Tensor-Based Morphometry

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White matter and grey matter changes in epilepsy detected by Voxel-based morphometry (VBM) and Tensor-based morphometry (TBM) shows notable similarities and differences to date. Therefore, a direct comparison of results using VBM and TBM is necessary to understand how different methods are sensitive in detecting structural brain changes in epilepsy. 45 patients with epilepsy and 46 healthy controls were scanned using a 3 Tesla MRI scanner. Sagittal, 3D, T1 weighted brain images were acquired from each subject. The data were analysed using Computational Anatomy Toolbox – CAT12. For VBM, voxel-wise grey matter volumes (VBM-GM), white matter volumes (VBM-WM) and Cerebrospinal fluid volumes (CSF-GM) were computed and smoothed (FWHM= 8 mm) for each participant. For TBM, voxel-wise Jacobian determinants were obtained and smoothed (FWHM= 8 mm). Finally, the group differences between patients and controls were detected using two-sample T-tests and results were interpreted without corrections for multiple comparison errors ($p< 0.001$, uncorrected). Univariate analysis showed widely spread morphological changes covering all lobes in the brains of epileptic patients. Volume reductions of GM were reported in the cerebellum, middle temporal gyrus, left occipital, right hippocampal, right para hippocampal, left superior frontal and left insula. WM volume reductions were mostly highlighted in the cerebellum. In addition, gross tissue volume reductions were detected in the cerebellum, middle occipital, middle temporal, left superior frontal, right inferior frontal, extra nuclear and frontal sub-gyral regions. Conjunction analysis of above results showed that although both methods detected widespread structural changes, there are similarities and differences in GM and WM findings. Therefore, we conclude that VBM and TBM are differently sensitive in detecting structural brain changes in epilepsy.

Keywords: *epilepsy, grey matter, white matter, gross volumes, structural MRI*