Voxel-Based Morphometry and Time Frequency Analysis of Epilepsy for Detection of Ictal Impaired Consciousness

Mahatsente, Rhyana (School: Northridge High School)

Epilepsy is a neural seizure disorder caused by an abnormal synchronized firing of neurons. Many etiologies of symptoms remain an enigma to neuroscientists today. The impairment of consciousness in seizures results in unprocessed sensory information and leaves physicians blind to ictal events. This impairment has a potential correlation to neuronal degeneration, hinting at effects towards gray (GMV) and white matter volumes (WMV). In this study, a epileptic dataset was acquired, containing 35 healthy and 31 epileptic patients. GMV and WMV were obtained via voxel-based morphometry (VBM) and placed under a consciousness mask for both groups. Both faced GMV degeneration in the Right Temporal Lobe and Left Hippocampus, however, the epileptic group experienced an accelerated rate. The epileptic group faced GMV decay in Left and Right Cerebrum, as well as in Right Superior Temporal Gyrus, while the healthy group experienced GMV deterioration in the Left Hippocampus. WMV was reduced in both groups, however, this occurred rapidly in the epileptic group, serving as a biomarker for impairment. A pediatric epileptic intracranial electroencephalography (iEEG) of a visuospatial working memory task was obtained and underwent time frequency analysis, providing Event Related Spectral Perturbation (ERSP) or power changes due to the task. Although the subject showed a decrease of 20 dB ERSP in delta waves in the A2 electrode, an increase in ERSP of delta waves by 5% of the baseline and a 20 dB decrease in ERSP of beta waves were observed, serving as biomarkers for working memory network disruption, contributing to impairment.

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