A NEW ALGORITHM FOR AUTOMATIC DETECTION OF HFOs USING MAXIMUM DISTRIBUTED PEAK POINT TO CALCULATE BASELINE

Ren, Guoping[1, 2]; Yan, Jiaqing[3]; Yu, Zhixin[1, 2]; Wang, Dan[1, 2]; Mei, Shanshan[4]; Li, Xiaoli[3]; Li, Yunlin[4]; Wang, Xiaofei[4, 5*]; Yang, Xiaofeng[1, 2*]

[1]. Neuroelectrophysiological Laboratory, Xuanwu Hospital, Capital Medical University, Beijing, China. [2]. Center of Epilepsy, Beijing Institute for Brain Disorders, Beijing, China. [3]. State Key Laboratory of Cognitive Neuroscience and Learning, IDG/McGovern Institute for Brain Research, Beijing Normal University, Beijing, China. [4]. Functional Neurology and Neurosurgery, Haidian Hospital , Beijing, China. [5]. Department of Neruology, Beijing Children's Hospital, Capital Medical University, Beijing, China.

Rationale: Interictal high frequency oscillations (HFOs) are a promising candidate biomarker for defining the epileptogenic zone. Most current automated HFOs detectors use a solid-state baseline, so they perform well in channels with rare HFOs but lose accuracy in active channels. We propose a new algorithm using the method of maximum distributed peak points to calculate dynamic baseline to improve the accuracy of HFO detection in both inactive and active channels.

Methods: Intracranial EEG data from 6 patients were processed with automated detectors. HFOs and baselines were identified by two experienced analysts. For automatic detection, the data were band-passed between 80-200 Hz (ripples) and 200-500 Hz (fast ripples). We plotted the amplitude for each peak point and found a linear association in the amplitude of the maximum distribution area. We extrapolated the linear graph to meet 100% on the x-axis and denoted this point on the y-axis A. We calculated the baseline by taking the mean amplitude below point A. A 5 second moving window was used to form a dynamic baseline. HFOs were defined as activity containing at least eight consecutive peaks $\geqslant$ 3 SD and two peaks $\geqslant$ 6 SD above the mean baseline amplitude . Final results from the automatic detector were compared with the manual analysis results.

Results: The sensitivity and specificity of our detector was 75.66% and 80.43% for ripples; 75.91% and 80.39% for fast ripples, respectively. The rank correlation between visualized and automated detection of HFOs was significant for all recordings ($r=0.9525$, $p<0.0001$).

Conclusions: Our new algorithm calculates a dynamic EEG baseline using the method of maximum distributed peak points. It can effectively and accurately detect HFOs in both inactive and active channels.