

Recognition of pathological hippocampal-ripples based on ripple-spindle correlation analysis

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Rational

HFOs have been described as biomarkers of epileptogenic tissue; however their pathological/physiological classification poses a challenge to their predictive power. The characterization of ripple groups, formed based on their co-occurrence with epileptic-spikes (pathological) or sleep-spindles (physiological), showed significant differences in the medians but overlaps in the overall values, suggesting a possible improvement in this classification approach.

Methods

A total of seven patients were analyzed. Patient specific spindle and ripple prototypes were generated to obtain a fixed lag used in the spindle-ripple correlation. Ripples with a positive contribution to the antiparallel correlation of ripple-peaks and spindle-troughs were classified as physiological and the rest as pathological. Two additional groups were formed for ripples inside/outside the SOZ and their correlations with the spindle prototype calculated. The generated groups were characterized using 9 features.

Results

Two patients with ripples in both SOZ and non-SOZ showed lower values for physiologic-classified ripples in all features but peaks-per-sample-length (Fig.1). Three patients with all ripples in SOZ showed almost identical feature-means across groups and two patients with all ripples outside the SOZ showed almost identical means for the frequency domain features across groups. Ripples in the SOZ had a lower correlation with sleep spindles than ripples outside the SOZ (SOZ = -0.097, non-SOZ = -0.232).

Discussion

In general, the SOZ criterion generated groups with more distinct features than the ripple-spindle correlation. Prospective studies considering post-surgical outcome are needed to measure the predictive value of HFOs classified as pathological.

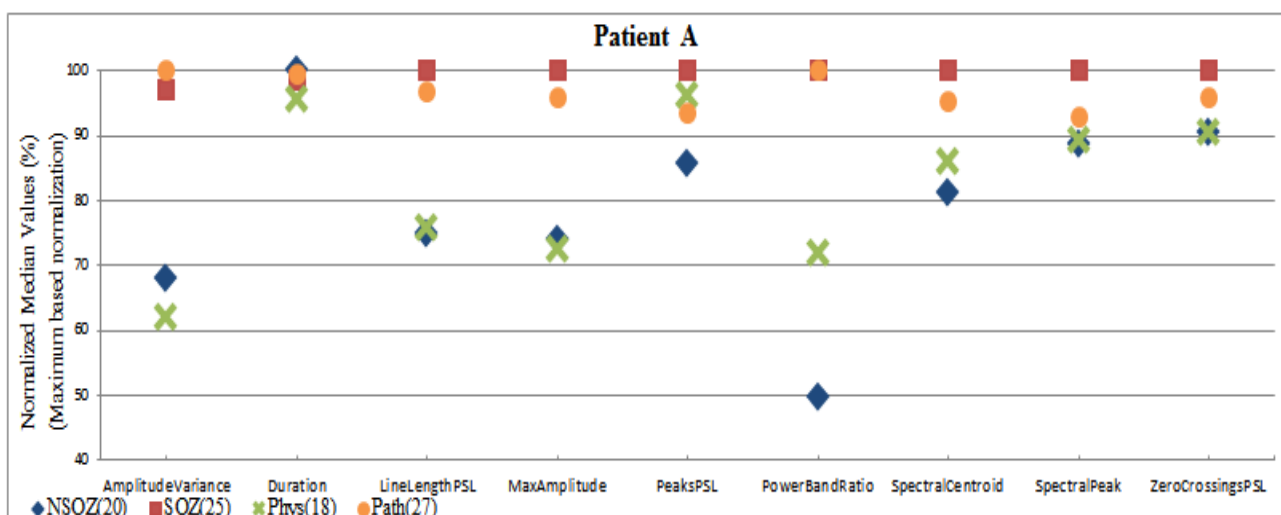


Figure 1: Patient A presented the most even distribution of ripples in and out of the SOZ, which explains the similarities between the physiological and non-SOZ groups as well as pathological and SOZ groups.