

Localization of physiological and pathological HFOs.

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ABSTRACT HFOs generated specifically during sensorimotor and cognitive tasks are likely to be physiological, whereas those generated early during habitual seizures are plausibly epileptic. HFOs are also spontaneously generated without tasks or seizures, and such spontaneous-HFOs can be either epileptic or physiological. Investigators have inferred that spontaneous-HFOs of epileptic nature, compared to physiological ones, are characterized by higher occurrence rate, higher spectral frequency band, more frequent co-occurrence with spikes, and larger variance in amplitude across events. In addition, our preliminary data suggest that spontaneous-HFOs of epileptic or physiological nature are both coupled with phase of slow waves. Specifically, we found that spontaneous-HFOs_{>150Hz} in the seizure-onset zone were more preferentially coupled with slow-wave_{3-4Hz} during slow-wave sleep, whereas those in the sensorimotor/visual cortex were more preferentially coupled with slow-wave_{0.5-1Hz} (Figure). Ultimately, consideration of multiple factors associated with given spontaneous-HFOs may improve localization of epileptogenic zone as well as eloquent areas.

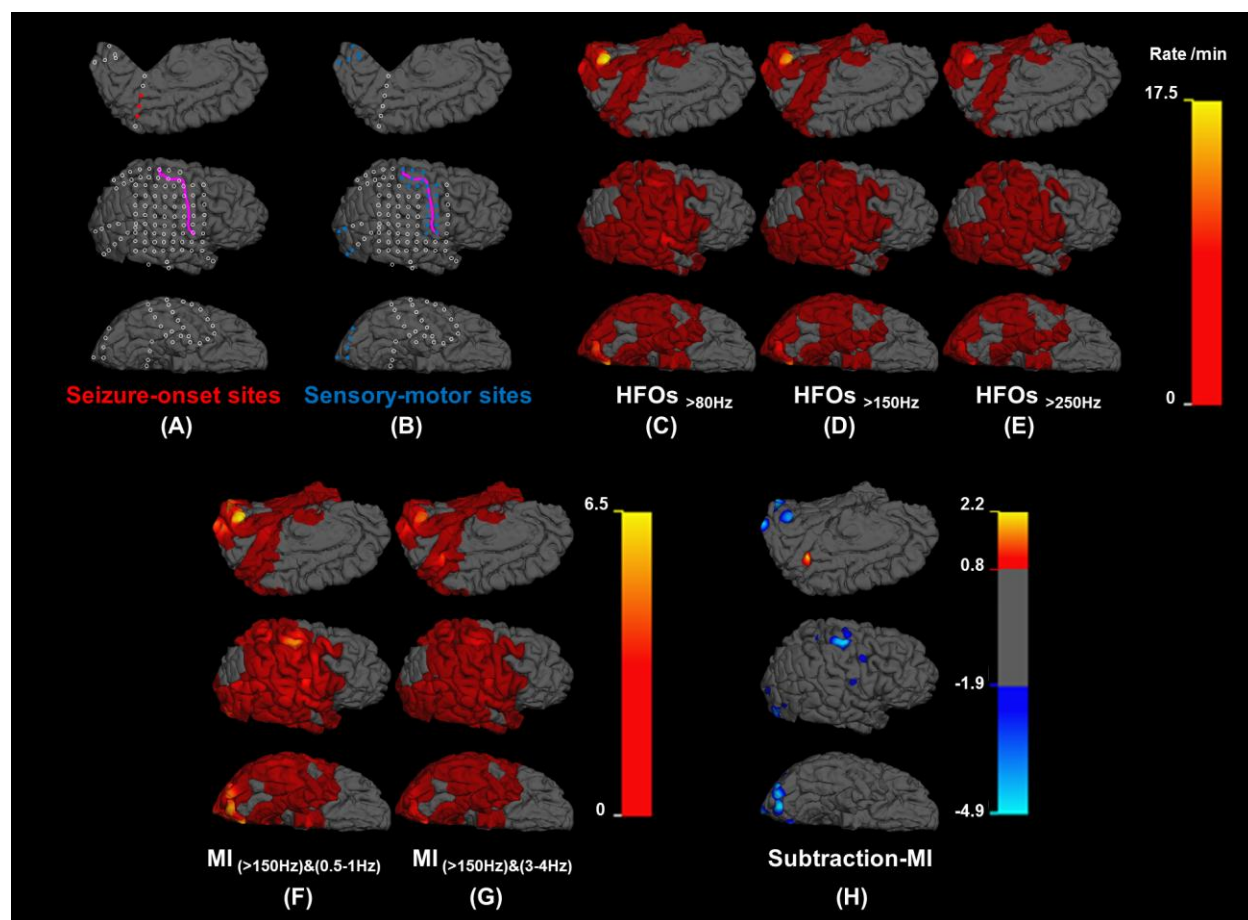


Figure. Spatial profiles of the rate of high-frequency oscillations (HFOs) and modulation index (MI), reflecting the amplitude of HFOs coupled with phase of slow-wave.

(A) Seizure-onset sites: red circles. (B) Somatosensorimotor-visual sites: blue circles. (C) Rate of HFOs_{>80Hz} (event/min). (D) Rate of HFOs_{>150Hz}. (E) Rate of HFOs_{>250Hz}. (F) MI_{(>150Hz)&(0.5-1Hz)}. (G) MI_{(>150Hz)&(3-4Hz)}. (H) Subtraction-MI co-registered to MRI (SMICOM). Subtraction-MI was defined as subtraction of MI_{(>150Hz)&(0.5-1Hz)} from MI_{(>150Hz)&(3-4Hz)}. The highest value was noted in the seizure onset site. Somatosensorimotor-visual sites were associated with negative values.