Relation of automatically detected High Frequency Oscillations (HFOs) with the SOZ and clinical outcome.

Sergey Burnos[1,2], Tommaso Fedele[1], Niklaus Krayenbühl[1], Peter Hilfiker[3], Kristina König[3], Thomas Grunwald[3], Johannes Sarnthein[1]

[1] Neurosurgery Department, University Hospital Zurich, Zurich, Switzerland

[2] Institute of Neuroinformatics, ETH Zurich, Zurich, Switzerland

[3] Swiss Epilepsy Centre, Zurich, Switzerland

Rational:

While HFOs are gaining acceptance as biomarkers of the epileptogenic zone, their standardized detection is still debated.

Methods:

Preoperative invasive recordings were collected during sleep in 10 epilepsy patients, 6 implanted with medial temporal depth electrodes and 4 with neocortical electrodes. Recordings were analyzed with two automatic detectors, based on instantaneous spectral estimation. Both detectors have previously been validated independently on two different visually marked datasets. Analyses were conducted separately for ripple (80-250Hz) and fast ripple (FR, 250-500Hz) frequency ranges. Areas with the highest HFO rates were related to the seizure onset zone (SOZ) as determined by invasive ictal recordings and clinical outcome.

Results:

In patients with depth electrodes, we observed both ripples and FRs, while FRs were detected less frequently in cortical signals. With respect to the SOZ, FRs were more specific than ripples and correctly identified the SOZ in 5 patients, with a partial overlay in 2 more patients. In patients with good outcome (4 patients), we observed a high specificity of FRs. Ripples were more sparsely distributed, and we observed possibly physiological ripples outside the SOZ. In patients with poor outcome (4 patients), ripples and FRs occurred in contacts showing epileptiform potentials and were present also in non-resected non-SOZ areas.

Discussion:

The time-frequency based automatic ripple and FR detection provides a rapid assessment of the potential contribution of HFOs. Fast ripples were more specific than ripples in identification of the epileptogenic tissue. The clinical relevance of HFOs was evaluated with fully automatic detectors, which standardize the definition of an HFO.