Supplementary 1a: Persyst 14 interictal epileptic discharge (IED) detection

In Persyst P14, the IED morphology is decomposed into six half-wave segments based on inflection points and curvature extrema, with the first two describing the preceding activity and the middle two the deflection of the IED. A hierarchy of feedforward neural network rules is implemented in order to ascertain the probability of events being IEDs [1]. We included IEDs of an IED type with high similarity above a similarity threshold of 0.5 [2]. The detected IED types were visually reviewed and all of them were in concordance with the visual analysis for presurgical diagnostics. The two most frequent IED types per patient were selected for analysis.

Supplementary 1b: Details electric source imaging

Based on the patients' individual T1-weighted MRI of the head we created a 3-compartment boundary element head model with the conductivities skin: 0.33 S/m, skull: 0.0165 S/m, brain: 0.33 S/m; ratio: 1/20. EEG electrodes were coregistered based on three landmarks (preauricular points right and left and nasion) together with label-matching for EEG electrode positions. For ESI, the source volume was restricted to the cortical segmentation, which was created based on the patients' individual MRI within the software Curry 9.

For source reconstruction, we used two independent inverse methods in each patient, which are commonly used in clinical practice: One method was the minimum norm inverse solution (*standardized low-resolution brain electromagnetic tomography* (sLORETA), which yields an F-statistic for each source location [3] and one was the scanning method *multiple signal classification* (MUSIC). In brief, sLORETA consists of calculating the standardized current source density in grey matter at each of the cortical voxels. This estimation is based on a linear weighted sum of scalp potentials, with the end result being a non-parametric approach that has no localization biases in the presence of biological or measurement noise [3,4]. MUSIC is a parametric approach that delineates dipole location and orientation by source space scanning and maximizing dipole scan metric [5]. For each averaged IED type, sources were obtained within a time window of 1000 ms with time point zero corresponding to the main IED peak). All evaluated IED types fulfilled the definitions of IEDs [6].

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