

Markers of epileptic activity in simultaneous scalp and intracranial EEG

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Objective In focal epilepsy, the activity of physiological brain networks is disrupted also during periods without any epileptic discharges visible in scalp EEG. Simultaneous recordings showed that only a minority of epileptic spikes detected by intracranial EEG (icEEG) also appear on the scalp.

Here the aim is to evaluate scalp EEG markers of cortical epileptic activity using simultaneous recordings that allow identification and validation of these markers.

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Methods We record high-density scalp EEG simultaneous intracranial EEG in patients who have undergone implantation of intracranial electrodes for epilepsy surgery evaluation.

We investigate scalp correlates of intracranial EEG activity. Notably, we measure and compare frequency power spectra, scalp voltage topography and connectivity during periods of interictal spikes vs baseline.

We use electric source imaging in atlas-based brain regions based on the individual MRI. We apply directed connectivity analysis (Partial Directed Coherence) on these sources and perform graph analysis.

Based on different features of the scalp EEG, we train a classifier with the aim of predicting periods with and without underlying epileptic activity.

In search of: potential multicentric data sharing with simultaneous scalp and intracranial EEG

State of IRB approval: approved

Time frame/current status: ongoing collection of data; optimization of analysis pipeline; presentation of first results at conferences.

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