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Spatiotemporal iEEG analysis of ictal events in temporal lobe epilepsy / Casadei Garofani, B., Capodiferro, A., Curia, G.. - (2026). [10.5281/zenodo.23372376]

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07/11/2026 01:58

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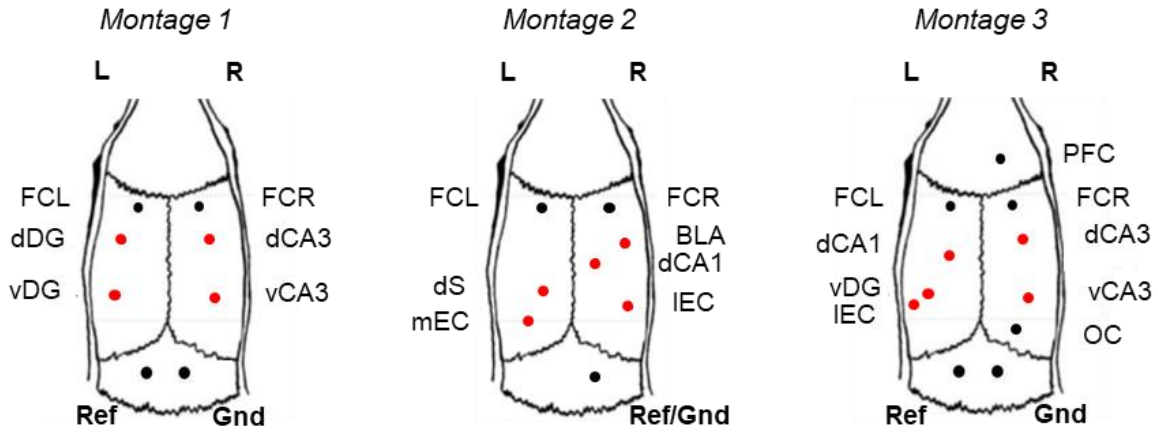
Spatiotemporal iEEG analysis of ictal events in temporal lobe epilepsy

doi: 10.5281/zenodo.23372376

GENERAL INFORMATION

The repository contains the experimental data representing the core *focus* of the research study presented in the paper "Spatiotemporal iEEG analysis reveals seizure type-specific dynamics in temporal lobe epilepsy". EEG traces were used to characterize seizure-type specificity and temporal dynamics of ictal events in the rat pilocarpine model of temporal lobe epilepsy (TLE).

- **Induction of TLE, electrode implantation and *montages*:** 1 week after the animals' arrival, rats were injected with pilocarpine to induce *status epilepticus*. After two weeks of recovery, rats underwent stereotaxic surgery for electrode implantation according to one of the 3 electrode *montages* depicted below.



BLA:	Basolateral Amigdala	**FCR**:	Right Frontal Cortex	**PFC**:	Prefrontal Cortex
dCA1:	Dorsal CA1	**Gnd**:	Ground	**R**:	Right
dCA3:	Dorsal CA3	**L**:	Left	**Ref**:	Reference
dDG:	Dorsal Dentate Gyrus	**lEC**:	Lateral Entorhinal Cortex	**vCA3**:	Ventral CA3
dS:	Dorsal *Subiculum*	**mEC**:	Medial Entorhinal Cortex	**vDG**:	Ventral Dentate Gyrus
FCL:	Left Frontal Cortex	**OC**:	Occipital Cortex		

Black dots indicate epidural monopolar electrodes, whereas red dots indicate intracranial depth bipolar electrodes. Electrode abbreviations with their corresponding full names are provided within the box.

- **Video EEG recordings:** Four to seven days after surgeries, rats were placed in recording cages with food and water *ad libitum* and video-EEG recordings, 24-hour long, at least three days per week, were performed up to 15 weeks post-*status epilepticus*. EEG traces were acquired with a low-pass filter at 1 kHz and a high-pass 0.3 Hz, at a sampling rate of 4 kHz, using one of the following acquisition systems: ***Neuralynx acquisition system*** - EEG traces were acquired using Digital Lynx 4SX (NeuraLynx FHC Company, USA) acquisition system and Cheetah (NeuraLynx FHC Company, USA) acquisition software.

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ADInstruments acquisition system - EEG traces were acquired using PowerLab 16/35 (ADInstruments, Bella Vista, AU) acquisition system and LabChart (ADInstruments, Bella Vista, AU) acquisition software.

- **EEG analysis:** EEG traces were manually reviewed for the identification of epileptic events after application of a 50 Hz notch filter using Persyst 14 (Persyst Development Corporation, USA) for data acquired using Neuralynx system, or LabChart (ADInstruments, Bella Vista, AU) for data acquired using ADInstruments system.
- **Seizure definition:** Electrographic seizures were defined according to the guidelines of the American Clinical Neurophysiology Society (ACNS)[1]. Overall, they were grouped in focal to bilateral tonic-clonic seizures (FBTCS) or non-generalized seizures (NGS).
- **Seizure severity:** The seizure severity was assessed scoring each behavioural manifestation according to a modified Racine scale[2] that has been optimized for the pilocarpine model (see table below). When the rat was not facing the camera and seizure severity could not be assessed reliably, the seizure was excluded from the analysis of behavioural manifestations.

Score	Seizure behavioral manifestation
0	no reaction (subclinical)
1	akinetic/immobility; catalepsy; staring; motionless; rats crouch on all limbs and their ears cocked back; mouth and facial automatism (e.g. chewing/mouthing, teeth chattering, eye blinking, vibrissae twitching, yawning); facial clonus
2	head tremor; body automatism (e.g. head nodding; scratching); involuntary body movements (e.g. wet-dog shake)
3	forelimb clonus; myoclonic jerk in the forelimbs; limb clonus; body tremor; body clonus; spasm; jump
4	rearing (rats rise up on their hind limbs); clonic convulsion in the forelimbs; tonic-clonic convulsion without loss of posture; tonic seizure without loss of posture; body and/or tail stiffening (resembling Straub tail)
5	rearing and falling; tonic-clonic convulsion with loss of posture
6	• ≥stage 3 seizures occurring in series in such a way the rat spends seizing minimum 20% of 1 h without recovery of normal behavior (rat appears disoriented and agitated); • a generalized seizure lasting longer than 5 minutes followed by other seizures occurring in series without recovery of normal behavior (rat appears disoriented and agitated).

- **Circadian seizure occurrence** was determined based on the light–dark cycle, with the light phase defined as “lights on” (08:00-20:00) and the dark phase as “lights off” (20:00-08:00).
- **Seizure frequency** was expressed as the number of seizures in 24 hours.
- **Seizure duration** was determined on the EEG recordings and refers to the electrographic ictal event.
- For analysis of the **seizure onset zone** (**SOZ**), the onset region was defined based on the appearance of the first epileptiform spike. When a seizure initiated in the non-temporal neocortex (frontal, prefrontal, or occipital cortices), or when a simultaneous onset was observed across two or more recording channels (even if within limbic areas), the onset region could not be reliably determined and was classified as “Unknown” (U).
- For analysis of the **seizure onset pattern** (**SOP**), patterns observed in iEEG recordings at the seizure onset were analyzed and five iEEG SOPs were identified (see table below) resembling most of SOPs previously described in human epileptic patients[3,4,5,6].

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SOP	
SOP1	LVFA: initial spike followed by low amplitude (<0.3 mV) fast activity (>13 Hz) in initial amplitude
SOP2	Preictal spiking followed by fast activity: rhythmic spikes of low frequency (≤3 Hz), high amplitude (>0.5 mV), prolonged duration (>5 s), followed by fast activity (>13 Hz)
SOP3	Sharp theta/alpha activity: sinusoidal activity of low frequency (<LVFA), median initial amplitude (>LVFA), and progressive increasing amplitude
SOP4	Rhythmic spikes/spike-waves: low frequency (6-14 Hz) with increasing amplitude spikes
SOP5	Burst suppression: brief bursts of medium to high-Voltage repetitive spikes alternating with brief periods of Voltage attenuation

LVFA: Low Voltage Fast Activity.

- For analysis of the **seizure termination pattern** (**STP**), patterns observed in iEEG recordings at the seizure end were analyzed and five iEEG STPs were identified (see table below) resembling most of the STPs previously described in human epileptic patients[7,8].

STP	
STP1	sADA: ≥80% decrease in amplitude between 2-s-before and 2-s-after seizure end (4-s interval), synchronous in ≥75% of all recording channels or of channels ipsilateral to seizure onset
STP2	aADA: ≥80% decrease in amplitude between 2-s-before and 2-s-after seizure end (4-s interval), synchronous in <75% of all recording channels or of channels ipsilateral to seizure onset
STP3	sBS: burst suppression (within 1 s) synchronous across ≥75% of the channels at seizure end
STP4	aBS: burst suppression (within 1 s) synchronous in <75% of the channels at seizure end
STP5	Synchronous delta brush: high-frequency activity (20-30 Hz) superimposed on rhythmic delta activity (RDA; <4 Hz) within 2 s from seizure end

aADA: asynchronous ADA; aBS: Asynchronous burst and suppression activity; ADA: abrupt decrease in amplitude; RDA: Rhythmic Delta Activity; sADA: synchronous ADA; sBS: Synchronous burst and suppression activity.

- For analysis of the **postictal pattern** (**PP**), PPs classification was based on established electrophysiological criteria within 30 s of seizure cessation. We identified four iEEG PPs (see table below), largely recapitulating those previously described in human epilepsy[9,10]. Postictal duration was analyzed by grouping postictal periods according to seizure type and across predefined time intervals to assess potential changes in duration over time.

PP	
PP1	Postictal suppression: abnormal slow-wave activity or suppression, amplitudes <10 µV, within 30 s of seizure cessation
PP2	Postictal attenuation: period of lower voltage (≥ 10 µV) but < 50% of the higher voltage background, within 30 s of seizure cessation
PP3	Postictal discharge: a series of repetitive sharp complexes, within 30 s of seizure cessation
PP4	Postictal slowing: initial delta slowing (< 4 Hz) transitions to theta frequencies (4-7 Hz) before returning to baseline background activity, within 30 s of seizure cessation

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- **Temporal evolution analysis**: We investigated whether SOZ, SOP, STP, and PP evolved across three predefined time intervals (4-6, 7-9, and 10-15 weeks). To assess the progression of epileptogenic activity at the single subject/rat level, only rats with data available for at least two time-intervals were included in this analysis.

CODE FORMAT

Below summarized the file formats and the software with which they can be opened:

File format	Required software
.xlsx	Excel

FILES

- "Experimental data_by ictal event" file includes experimental data on EEG traces organized by ictal event;
- "Experimental data_by analysis" file includes experimental data on EEG traces organized by analysis/paper figure.

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Funded by European Union's Horizon 2020 FETPROACT-2018-2020 - **GA n. 824164**