

Ictogenesis: A result of hyposynchrony?

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Position: No

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1. Seizure

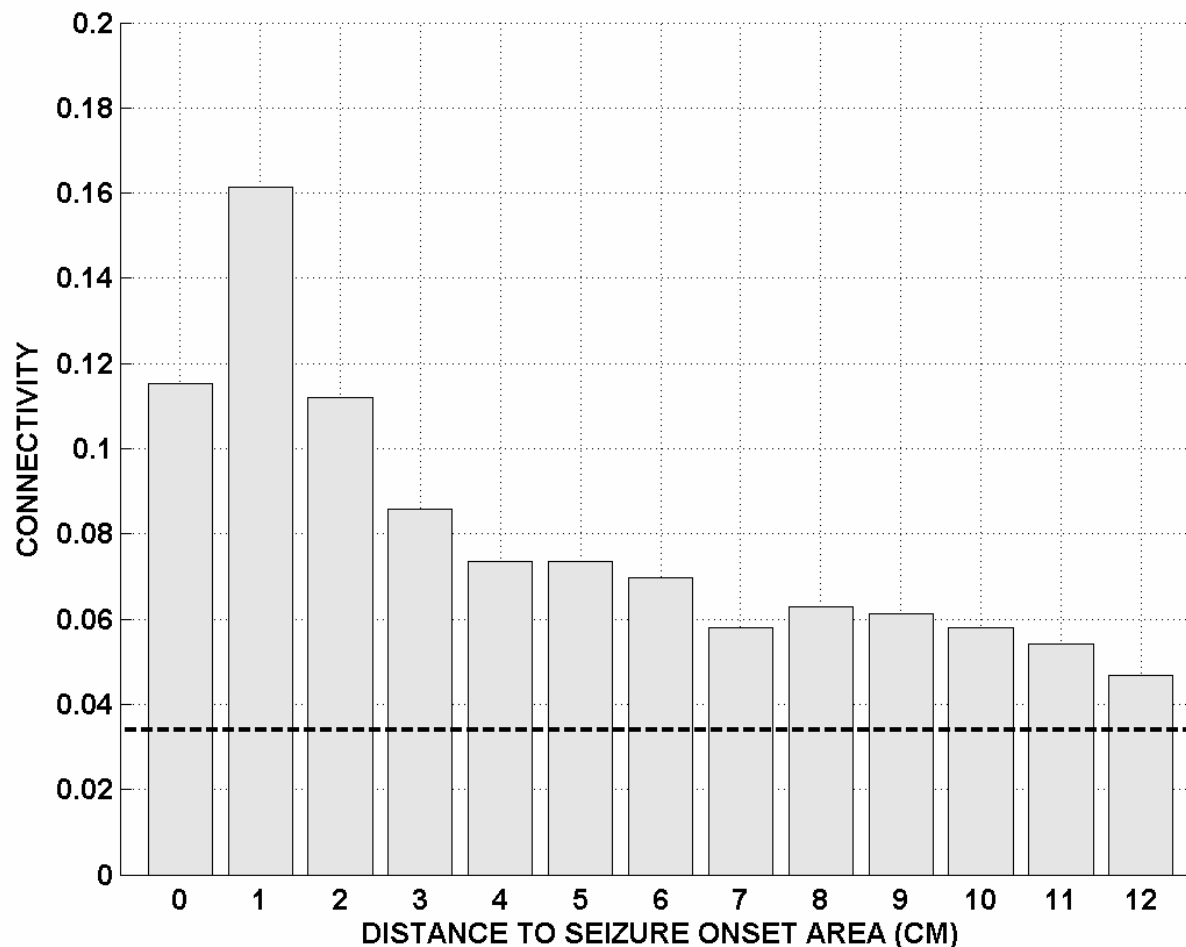
- A seizure is a paroxysmal event due to abnormal, excessive, hypersynchronous discharges from an aggregate of CNS neurons.
- Hypersynchronous activity is a *sine qua non* for seizure; it is essential for seizure

2. Background icEEGs*

- 1 hr epochs of background icEEG from n=6 successive (unselected) patients, 3 MTLE and 3 neocortical
- Estimate MSC for every 30 sec, and then average over 1 hr
- Estimate functional connectivity for each electrode contact. Functional connectivity of an electrode contact is defined as the average MSC of that contact with all other contacts in the ipsilateral hemisphere
- Display functional connectivity measures with respect to distance from the seizure onset area

* Zaveri, et al, Neuroreport, 2009

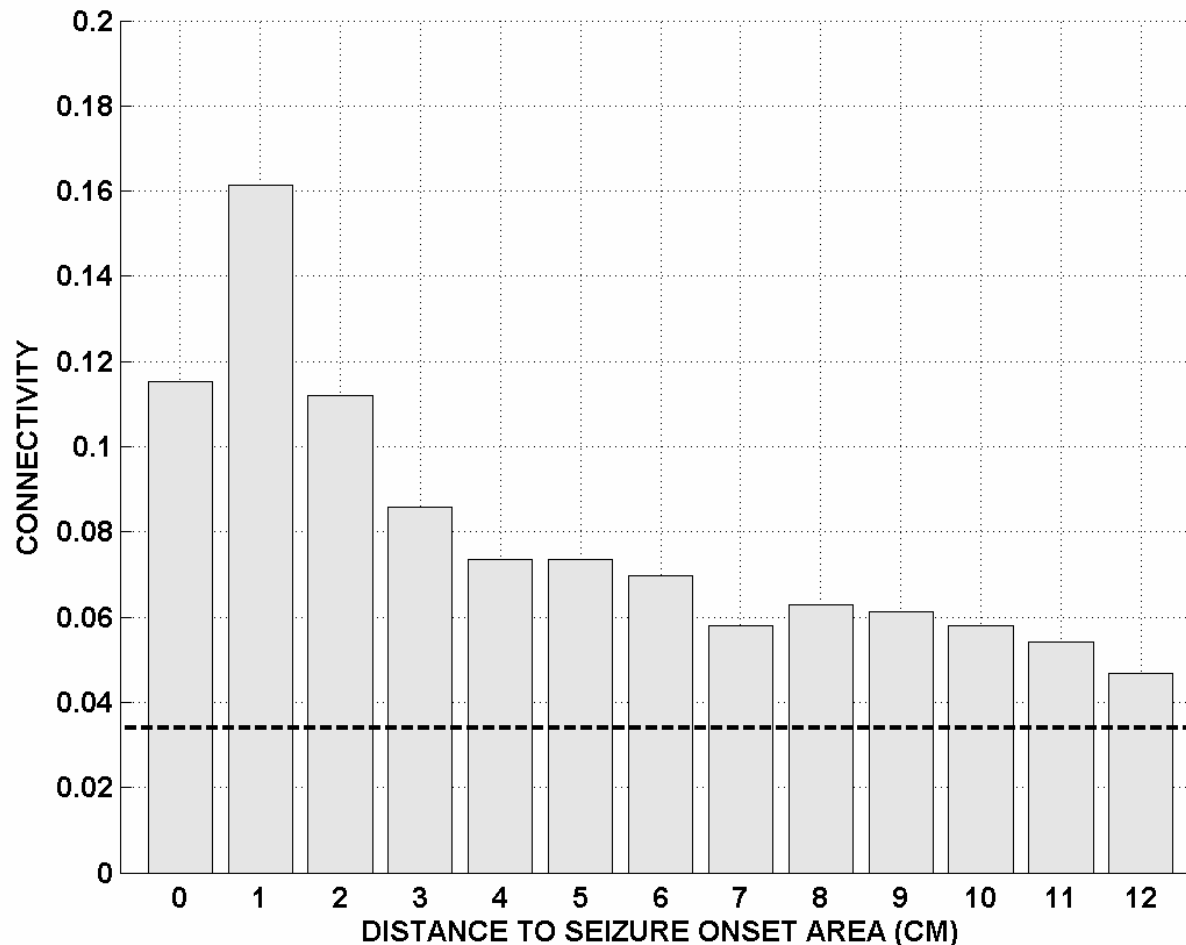
Average beta band functional connectivity as a function of distance to seizure onset area



- Connectivity is significantly non-zero
- Connectivity is a function of distance

- Linear measure
- Inter-contact distance
- Nonstationarity
- Estimator statistics

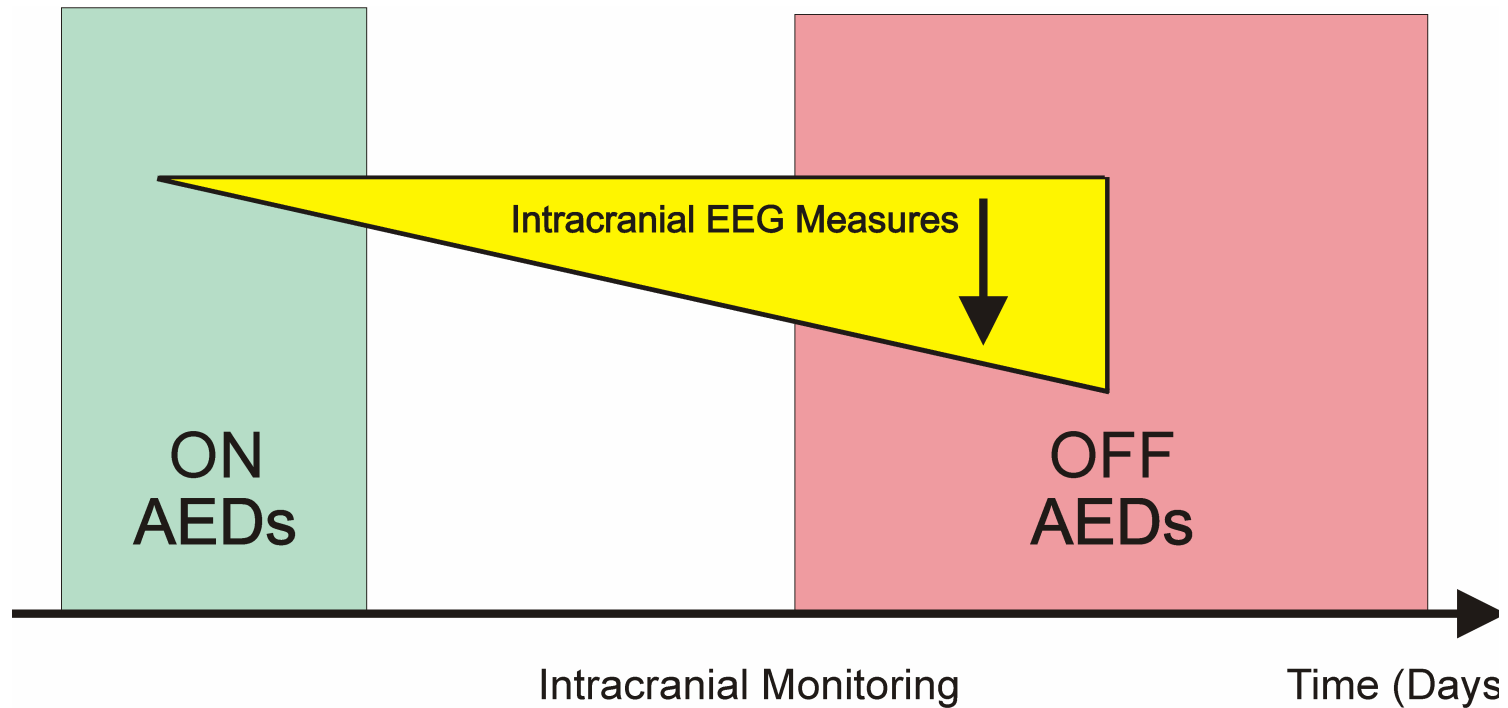
Average beta band functional connectivity as a function of distance to seizure onset area



- Schevon, Neuroimage, 2007
- Schindler, Chaos, 2008
- Staniek, Physical Review Letters, 2008
- Ortega, Epilepsia, 2008

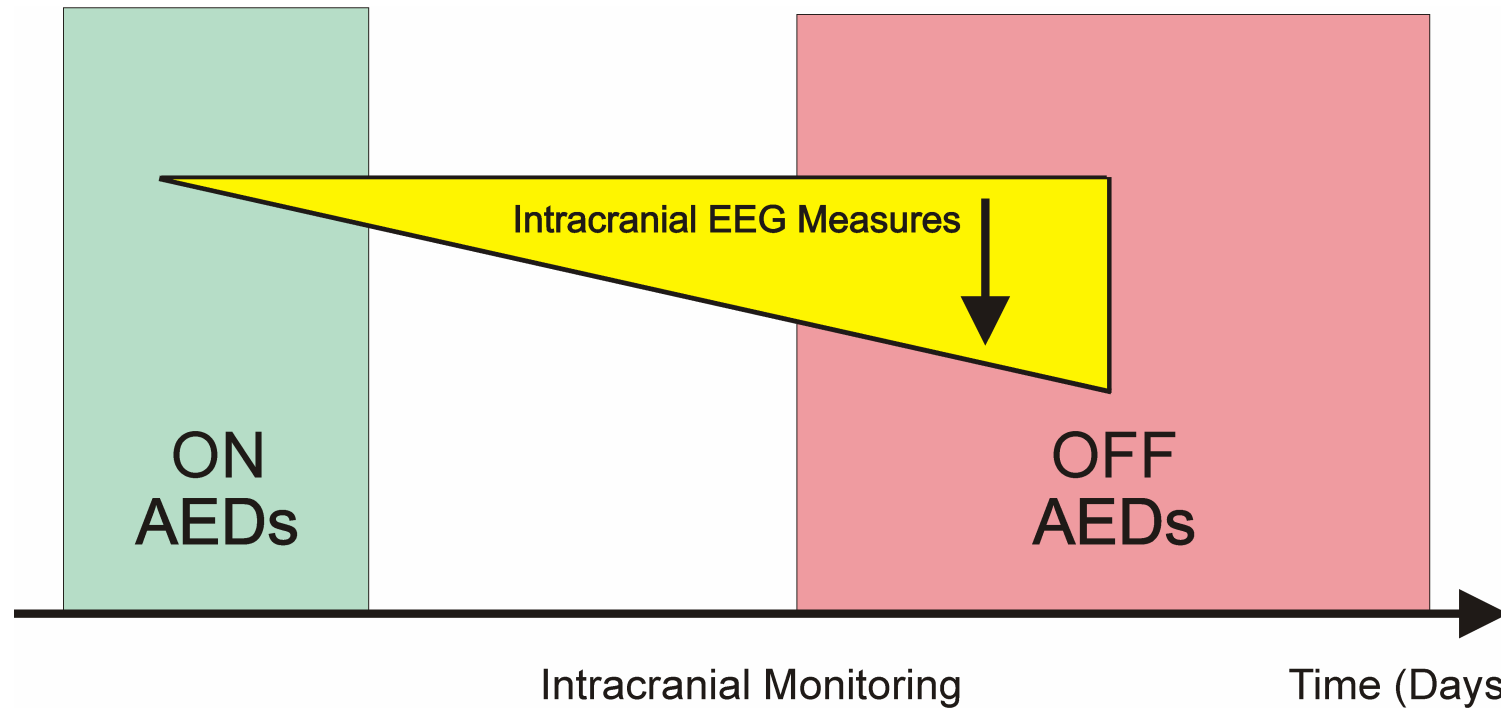
3. Pre-Seizure Change

- The transition from background to seizure is under investigation
- Emergent network topology at seizure onset in humans, M. Kramer, E. Kolaczyk, H. Kirsch, *Epilepsy Research*, 2008
 - Diffuse breakdown in global coupling and increased throughput in local, specific region
- Pre-ictal synchronicity in limbic networks of mesial temporal lobe epilepsy, F. Bartolomei, F. Wendling, J. Régis, M. Gavaret, M. Guye, P. Chauvel, *Epilepsy Research*, 2004



Comparison of on- and off-AEDs time-points:

1. Study: Compare on- and off-AEDs 1 hr background intracranial EEG samples, awake and matched by time of day, separated by several days.
2. Results: A decrease was observed in spike counts, Teager energy and spectral band measures from on- to off-AEDs.
3. This decrease is counter-intuitive.



Seizure generation in localization related epilepsy:

1. There is a considerable decrease of cortical tone and feedback to the thalamus.
2. This results in a switch in the thalamus from tonic to burst mode (burst mode is a very powerful mechanism to 'wake' cortex).
3. Thalamic burst activity results in greater cortical synchrony, which in turn results in seizure.