Electrographic seizure patterns

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Electrographic Seizure Pattern

- Rhythmic repetition of components that may or may not have an epileptiform morphology
- Lasting more than several seconds
- When this pattern produces clinical symptoms and/or signs, it is called a clinical electrographic seizure discharge
- When it does not produce clinical symptoms, it is called a subclinical electrographic seizure discharge
Electrographic Seizure Pattern

- Isomorphic Seizure Pattern
- Metamorphic Seizure pattern

Isomorphic Seizure Pattern

- Ends as it begins, without progressing through multiple phases into a postictal phase
- Ictal morphology is usually similar to interictal epileptiform patterns
- Differ only in having greater rhythmicity, duration, spatial extent and amplitude
- Almost exclusively seen in generalized seizures
- Prototype: 3/s spike-and-wave complexes

Generalized spike and wave, in a 22-year-old woman with a primary generalized tonic clonic seizure

Frequent repetitive myoclonic jerks, associated with generalized spike and wave, in a 22-year-old woman with juvenile myoclonic epilepsy
Myoclonic status epilepticus in a 65-year-old comatose man who suffered an anoxic event 48 hours ago.

**Metamorphic Seizure Pattern**
- Ends differently from its beginning, commonly progressing through 2 or more different ictal phases into a postictal state
- Ictal morphology can also be dissimilar to interictal epileptiform patterns
- Ictal morphology may consist of smooth sinusoidal rhythms and has no spike or sharp wave
- Seen both in generalized seizures and focal seizures

**Are IEDs “Inter-ictal” or Ictal?**
- Unsettled controversy
- Are IEDs fundamentally distinct from ictal discharges or in fact represent just very brief seizures?
- Answer to this question may vary with seizure and syndrome type

**Interictal is “Inter”-Ictal**
- EEG partial seizure patterns rarely resemble repetitive spikes or sharp waves
- Partial seizures typically show a complex evolution
- Sometimes beginning with repetitive activity in the alpha or beta band slowing to the theta delta range
- Discharge increases in amplitude and spreads topographically
- Seizures typically are followed, but not preceded, by an increase in IED frequency that lasts for hours to days

**Interictal Is Actually Ictal**
- Recent fMRI studies shown blood flow increases, analogous to those observed during seizures, to be associated with isolated IEDs
- Similar effects mimicking ictal discharges can be observed with respect to cardiac rhythm changes and increases in prolactin secretion
Is Repetitive IEDs Ictal?

- When continuous or nearly so without intervening background activity — electrographic seizures
- When more distinct interval is noted between IEDs, i.e. periodic may constitute transitional phase between interictal and ictal events
- Transitional nature may be confirmed by clear evolution into electrographic seizures gradual resolution, usually over several days
- In cases in which associated epilepsy partialis continua is noted, or clinical deficits that resolve, along with periodic EEG pattern, shortly after administration of antiepileptic drugs, an ictal state can be assumed.

Generalized Epileptiform Patterns: Ictal or Interictal?

- Absence Seizures
  - Morphologies of ictal and interictal discharges are essentially identical
  - The only difference is one of duration
  - Studies show that for clinical absences to be detectable, the spike-wave burst must last at least 3-5 seconds
  - In experimental situations, however, a delay in reaction time can be observed in association with even one spike-wave complex
  - Clearly the ictal-interictal distinction is somewhat arbitrary in this instance

Generalized Epileptiform Patterns: Ictal or Interictal?

- Myoclonic Seizures
  - Seizures are extremely brief, lasting substantially less than 1 second
  - Typically correlate with isolated polyspikewave complexes
  - Similarity between ictal and interictal discharges in generalized epilepsies

Periodic patterns

Periodic pattern

- Used for generalized periodic patterns
- Regional and lateralized periodic patterns: PLED
- Indicate acute, subacute, severe diffuse encephalopathy
- Relatively characteristic depend on the origin of encephalopathy

Periodic pattern

- Periodic pattern with repetitive rate >1 discharge every two seconds frequently seen in CJD
- A repetitive rate of 1 discharge every 4 seconds or more frequently seen in SSPE
Triphasic waves

- High amplitude positive sharp transients preceded and followed by low amplitude negative waves
- The first negative wave has low amplitude than the negative afterwards
- Generalized distribution, largest deflection in bipolar fronto-occipital derivation
- Repetitive rate approximately 1-2 Hz

Triphasic waves in a 74-year-old man with renal failure
Periodic lateralized epileptiform discharges (PLEDs)

- Sharp transients such as sharp waves or spikes
- Repeat in periodical or semi-periodical pattern
- Regional or lateralized distribution
- May occur independently both cerebral hemispheres
- Usually having multiple phases and complex morphology
- Main component is negative wave

Periodic lateralized epileptiform discharges (PLEDs)

- Occur in Acute, subacute, severe regional destruction lesions — cerebral infarction, fast growing tumor or herpes encephalitis.
- Alternation of consciousness commonly occur
- Usually disappear after a few week particularly after a stroke
- Chronic regional epileptogenic lesions without underlying acute or subacute lesions

Left-sided PLEDs in a 74-year-old woman after evacuation of a left subdural hematoma 4 days earlier.

Left-sided ictal discharge in the same patient.

Bilateral independent PLEDs in a 72-year-old woman after anoxia.

Generalized PLEDs in a 33-year-old woman after anoxia.
Burst suppression

- Constitutes a form of the periodic pattern, in which cerebral activity less than 10 microvolt
- Seen in stuporous or comatose patients with severe anoxic or toxic encephalopathy
- Patterns may convert into electrocerebral inactivity when status of the patient worsens
- Pattern reversible if caused by toxic or drugs
- Can occur in a cerebral hemisphere indicate an acute severe brain lesion

Background suppression

- Activity less than 10 microvolt
- Generalized pattern usually correlates with clinical clouding of consciousness
- Postictal flattening of background can occur
- Generalized background suppression indicate severe, diffuse encephalopathy
- Rarely found in normal subject
- Regional background suppression indicate severe focal disturbance
Ictal pattern without spikes and sharp wave

- Has no spikes or sharp wave
- Usually begins and ends abruptly
- Often recognized by its association with clinical seizure manifestations
- Some of these patterns are local or generalized

Beginning and end of a brief (16-second) left-sided electrographic seizure in a 56-year-old comatose woman in partial NCSE with hepatic and renal failure.
Ictal pattern without spikes and sharp wave

- Local ictal slow waves
  - Rhythmical 4-6 Hz or 2-10 Hz in CPS or TLE
- Periodic or rhythmic slow waves in epilepsy partialis continua

- Generalized decrease of amplitude
  - Electrographic seizure begin with sudden reduction of high amplitude background activity in hypsarrhythmia
  - Electroencephalographic response in tonic seizure, infantile spasm

- Sudden loss of amplitude or low voltage fast activity in non-epileptic attack of deconditioning or in terminal stage of metabolic coma

- No change of background activity in simple partial seizure and in EPC

Ictal pattern without spikes and sharp wave

- Alpha wave usually in unilateral or focal in new born with unilateral, generalized seizure or status epilepticus
  - Also can be found in CPS

- Beta wave
  - Fast activity 14-20 Hz appear with maximum in temporal or fronto-temporal in CPS

Pseudoepileptiform patterns