

EEG AN UNEXCEPTED TOOL FOR DIAGNOSTIC PRECISION IN CARDIOGENIC SYNCOPE

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Introduction:

Transient loss of consciousness (TLOC) accounts for approximately 1.2% to 3% of all Emergency Department (ED) visits and 12% of all neurological evaluations. Ninety percent of TLOC cases are attributable to three clinical conditions: syncope, epileptic seizures, or psychogenic non-epileptic seizures (PNES). Despite the fact that differences in semiology and diagnostic pathways have been widely standardized, a misdiagnosis rate of around 10% to 20% still exists. EEG is recommended in all cases of suspected epileptic seizures to identify any findings that may support the diagnostic hypothesis. In cases of syncope, two characteristic EEG patterns can be observed: "Slow" and "Slow-Flat-Slow". The last one is indicative of more severe cerebral hypoperfusion, prolonged RR interval, asystole, and a longer duration of loss of consciousness.

Methods:

CASE 1: A 26-year-old woman presented to the Emergency Department following two closely spaced episodes of transient loss of consciousness (TLOC), occurring without prodromes, and characterized by staring, jaw clenching, and flexion posturing of the upper limbs. Witnesses denied any pallor, sweating, cyanosis, and/or sphincter release. The episodes lasted 20–30 seconds, followed by slight psychomotor slowing but no significant mental confusion. Triggering factors included nausea and abdominal pain in the preceding hours. Family history was unremarkable. Personal medical history included previous episodes that had been investigated from both a neurological and cardiological standpoint, with no significant findings.

CASE 2 An 11-year-old boy presented to the emergency department due to a sudden loss of awareness, upward deviation of the eyeballs, and rigidity, occurring while watching scenes with intermittent light stimuli. The episode lasted 20–30 seconds. Personal and family medical history was unremarkable. In both cases, during the EEG recording—requested due to suspected epileptic seizures—a transient loss of consciousness (TLOC) occurs, characterized by a "slow-flat-slow" pattern associated with prolonged asystole, exceeding 20 seconds in the case of the young woman. The ECG recording (+video) shows that the cardiac pause precedes the EEG changes.

Results:

There are only few studies in the literature that have analyzed EEG alterations during syncope, and they typically describe nonspecific patterns such as generalized slowing and/or voltage attenuation, which are considered consequences of hypoperfusion. In contrast, the described "slow-flat-slow" pattern is specific to severe hypoperfusion and is more frequently associated with cardiogenic syncope (cardioinhibitory mechanism) and with convulsive semiology or symptoms potentially suggestive of epileptic seizures.

Furthermore, there is a correlation between the semiology observed during syncope (e.g., loss of consciousness, fixed gaze, rigidity, orobuccal automatisms) and the different phases of the EEG pattern

Conclusions:

The cases described highlight the need to identify, among patients with transient loss of consciousness (TLOC) of unclear etiology, specific subgroups who may benefit from combined cardio-neurological monitoring.

The signs and symptoms occurring during syncope have an EEG correlate, allowing classification into four groups:

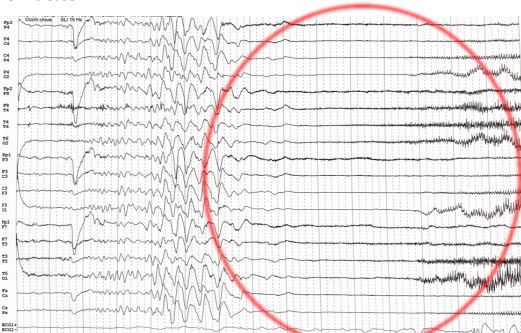
Group 1: Loss of consciousness, fixed gaze, and muscle rigidity during the initial "slow" phase, persist through the "flat" phase, and resolve in the second "slow" phase.

Group 2: Oro-buccal clonic movements appear during the "slow" phase but not during the "flat" phase, suggesting dependence on cortical activity.

Group 3: Eye movements, vocalizations/noises, and stertorous breathing occur only during the "flat" phase.

Group 4: Mouth opening and snoring may occur in both the "flat" and "slow" phases.

Clinic Case 1



EEG signal flattening occurs when cerebral blood flow is less than 0.16-0.17 ml/g/min

Clinic Case 2



The "slow-flat-slow" pattern is most frequently associated with asystole



The increase in amplitude and duration of the waves in the "Slow" phase is an expression of a progressive impairment of neuronal synaptic connectivity.

Bibliography:

J. Gert van Dijk, et al., *The semiology of tilt-induced reflex syncope in relation to electroencephalographic changes* Brain, Volume 137, Issue 2, February 2014, Pages 576–585.



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