VIDEO EEG MONITORING FOR THE ANALYSIS OF SPELLS IN ADULTS

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Introduction

The video EEG monitoring unit (V-EMU)is considered the gold standard for diagnosis of seizure- like events. In addition to EEG data, V-EMU allows for concurrent video, along with real- time clinical assessments, including vital signs, blood work and coincidental medications.

There are multiple indications for V-EMU. The most common indication is for spell classification, in particular distinguishing epileptic and nonepileptic events. V-EMU is very successful in this regards; the yield of diagnosis for paroxysmal spells during admission is up to 80%. Diagnosis is dependent upon capturing a typical event or definite interictal epileptiform activity. On average, 30% of spells are diagnosed as nonepileptic behavioral events. V-EMU can also allow for the diagnosis of physiologic nonepileptic events, including ischemic events, syncope, sleep disorders and encephalopathy. In general, a V-EMU admission results in a change in the diagnosis in 40- 60% of patients and approximately 20% of patients admitted for intractable epilepsy are ultimately found to have nonepileptic events.

V-EMU plays an important role with known epilepsy. Recording typical seizures can allow for seizure classification, in particular when focal versus generalized epilepsy cannot be well- distinguished based upon the outpatient work up. In patients with intractable epilepsy undergoing presurgical evaluation, V-EMU is crucial to record typical seizures for the purpose of localization. This setting also allows for additional localizing tests, such as ictal SPECT. Admission for the purposes of seizure quantification can be of benefit in patients with cognitive decline when there is a question of subclinical seizures. Medications adjustments can also be made during V-EMU, as the controlled setting allows for clinical and EEG monitoring during these changes.

Seizure Semiology
The temporal lobe is the most common site for focal onset seizures. Overall, there is a slight female predominance to temporal lobe seizures. Simple partials seizures typically last a few second, while complex partial seizures are longer than one minute. Patients may describe a variety of auras. Sensory auras from the temporal lobe include olfactory or gustatory hallucinations or epigastric rising. Auditory hallucinations suggest lateral temporal onset. Experiential auras may consist of a psychic feeling, déjà vu, depersonalization, fear or panic. Temporal lobe seizures may have autonomic features including flushing, nausea or pallor. Aphasia is suggestive of dominant lateral temporal onset. Temporal lobe seizures are typically followed by postictal confusion and fatigue with gradual recovery.

Frontal lobe seizures have a slight male predominance. Patients will often have clusters of nocturnal seizures, which are brief in duration, but can quickly secondarily generalize. As a result, frontal lobe seizures should be considered in patients with intractable generalized epilepsy. Patients may describe a somatosensory aura, following the homunculus in a “Jacksonian march”. Seizures may also be characterized by early posturing or clonic activity, with maintained awareness, or “bicycling” movements of the legs. There may also be odd, hypermotor features with large amplitude, irregular, complex movements. Autonomic features can occur as a result of insular involvement. The postictal phase is typically very brief. It is important to keep in mind that orbitofrontal seizures can mimic temporal lobe seizures.

Parietal and occipital lobe seizures are less common. Parietal lobe auras are typically sensory with a tingling or electric feeling. There may also be negative sensory feelings such as numbness or asomatognosia. Patients may feel the urge to move or have formed visual hallucinations. Occipital lobe seizures are characterized by elemental visual symptoms or distorted vision.

Primarily generalized tonic- clonic seizures have no aura, but may be preceded by a prodrome. The prodrome may begin up to two days prior to the seizure, and may be characterized by changes in mood, cognition or perception. Patients may also notice an increase in absence or myoclonic seizures immediately prior to a generalized tonic- clonic seizure. Seizures will often being with an ictal cry, with an immediate generalized tonic phase. In general, there is no consistent lateralized head deviation nor posturing.

Absence, or petit mal, seizures, have no warning. Patients lose awareness and are unresponsive typically less than 3 seconds. Eye blinking or oral automatisms may be described. There is rapid recovery. Rarely, is there de novo onset in adults, though absence status epilepticus can occur in elderly patients. In this situation, patients typically have a predisposition to generalized seizures (i.e. family history) and may occur in the setting of benzodiazepine or alcohol withdrawal.

Myoclonic seizures consist of single, brief jerks of the torso or extremities, and often cluster. Myoclonic seizures typically occur along with other generalized seizures. Tonic and atonic seizures most typically occur in the setting of symptomatic generalized epilepsy and rarely have onset in otherwise neurologically normal adults. With tonic seizures, patients may fall backwards, whereas atonic seizures are often associated with head drop and fall forward.

Nonepileptic Causes for Spells

Nonepileptic behavioral events are a common cause for spells which are refractory to medical therapy, and are the ultimate diagnosis in approximately 30% of the patients admitted for spell classification. There are multiple features to consider. Features suggestive of nonepileptic behavioral event include long duration, variable onset, waxing and waning motor activity, maintained awareness with generalized convulsions, opisthotonic posturing, side to side head movements and non-physiologic progression. Ictal eye closure and high frequency of events are also suggestive of a psychogenic etiology. Diagnosis requires capturing multiple typical events with V-EMU.

Management of nonepileptic behavioral events is important for control of events of quality of life. Legitimization of confirmation of the diagnosis can increase the likelihood of acceptance. Early discontinuation of antiepileptic drugs has been associated with better outcomes, and while selective serotonin reuptake inhibitors may treat underlying co-morbidities of depression and anxiety, use will not fully treat the event. Cognitive behavioral therapy is the only intervention that has been proven effective.

Syncope is a common cause for loss of awareness, and convulsive syncope can easily be confused with seizure. Features that suggest convulsive syncope include an aura of lightheadedness, dizziness and sweating, and then “white-ing” or “gray-ing” out of vision. Witnesses may describe pallor, and eye closure. Tonic or clonic activity will often be variable across different events and patients recover relatively quickly. Urinary incontinence does not reliably distinguish syncope from seizure. Triggers include positional change, physical exertion, Valsalva maneuvers, emotional situations, heat and dehydration. Cardiac tilt table testing during V-EMU may increase the yield of capturing events. The EEG during syncope will show generalized slowing due to decreased cerebral blood flow.

Parasomnias can be difficult to distinguish from nocturnal seizures. Parasomnias are characterized by vocalization, confusion and the patient may ambulate. These events typically last a few minutes, and will often involve complex tasks. Semiology is typically variable. Afterwards, the patient is typically amnestic to the event and may be confused.

Additional potential diagnoses for spells include cerebrovascular events and migraines. Cerebrovascular events typically progress over a few seconds to minutes. Symptoms are more likely to be negative: loss of sensation, weakness, or visual field deficits. Duration is minutes to hours, as opposed to less than two minutes with epileptic seizures. Ischemic events may be associated with focal slowing on the EEG. During a migraine, the EEG will most often be normal. Symptoms will last up to several hours.

Summary

The Video Epilepsy Monitoring Unity (V-EMU) is a crucial tool in the diagnosis of seizure- like spells. In addition to seizure localization, V-EMU can differential epileptic from non-epileptic causes for events, and is mandatory for the diagnosis of non-epileptic behavioral events. Careful attention to video, physical examination, EEG and parameters including EKG and vital signs can lead to definite diagnosis and appropriate treatment.

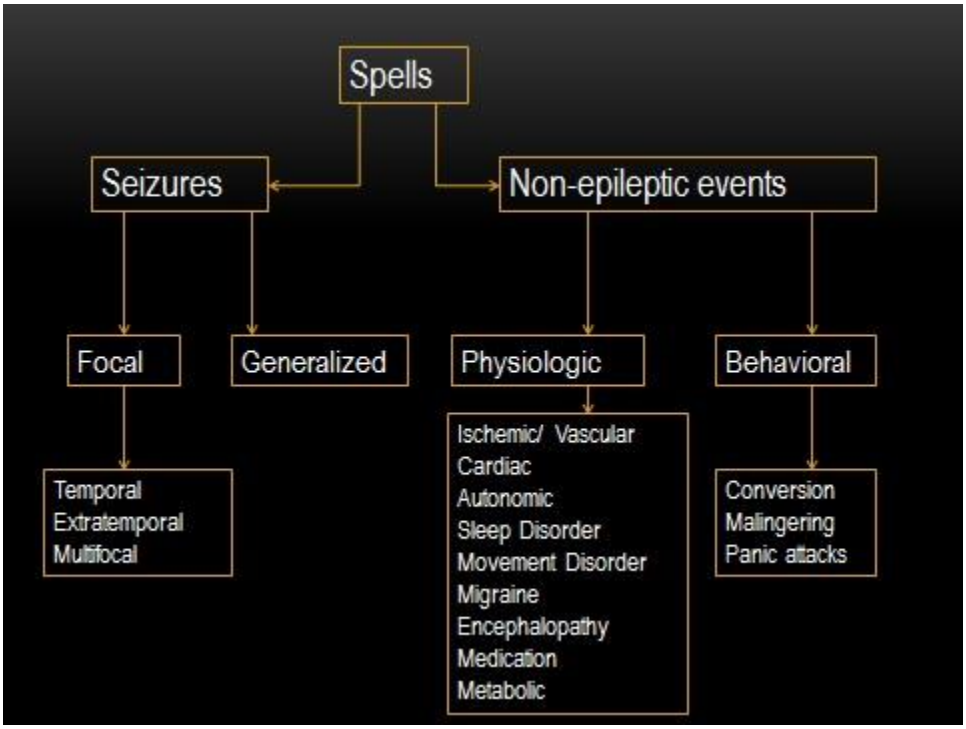
Table 1

Indications for Video EEG Monitoring
• Spell classification • Seizure classification (generalized versus focal) • Seizure localization (presurgical evaluation) • Seizure quantification • Medication adjustments under video EEG monitoring

Table 2

Distinguishing Epileptic Seizure from Nonepileptic Behavioral Events	
Features of Epileptic Seizures	Features of Nonepileptic Behavioral Events
• Brief duration (<2 minutes) • Stereotyped semiology • Classic aura (déjà vu, consistent motor/ sensory symptoms) • Postictal period • Typical abnormal posturing • Amnesia to event • Gradual recovery • Urinary incontinence • Events arising from sleep • Eyes open • Self- injury	• Gradual, variable onset • Waxing and waning course • Events out of “pseudo sleep” • Arm flailing • Multiple daily events despite antiepileptic drugs • Side to side head movements • Out of phase motor activity • Opisthotonic posturing • Postictal crying • Retained awareness with generalized motor activity • Persistent, forced eye closure • Pelvic thrusting • Stuttering • Very rapid recovery • Elevated somatization scales on neuropsychology testing

Figure 1- Spell classifications



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