



## Seizures versus Syncope: How to Make the Call

Here's an approach to the common but challenging presentation of loss of consciousness.

One of the most difficult symptoms to evaluate, whether in the emergency department (ED) or the neurologist's office, is an episode of loss of consciousness. This complaint accounts for up to three percent of visits to the ED, and one percent of admissions to the hospital.<sup>1</sup> The differential is very long, and includes myriad cardiogenic, neurological and psychiatric illnesses (see Table 1).

One of the first steps in evaluating this presentation is a detailed history and exam. Serum testing is often requested to identify metabolic or toxic causes. Neuroimaging may be performed, especially if there is concern about an underlying CNS structural abnormality. Electrocardiography, prolonged cardiac monitoring and echocardiography may be needed if there is a history of heart disease, or if the initial testing more strongly supports a possible cardiac etiology. If neurocardiogenic syncope is suspected, heads-up tilt table testing may be helpful.

### Evaluating an Episode of Loss of Awareness

Which tests should be done first? Which are most helpful? Although some of these questions can be answered, it is clear that the evaluation of consciousness must be thorough and thoughtfully planned. Below is a proposed approach.

**The History.** The first step is always the medical history. A person who has experienced loss of awareness may remember only part of the event. Unfortunately, many people who experience loss of awareness are amnesic of the event: if no witness was present, details of the event will be lost.

Witnesses should be thoroughly questioned: was there evidence of focal neurological symptoms, suggesting an underlying focal CNS cause (head and eye deviation, unilateral dystonic posturing)? Was there confusion after the event, and how long did the confusion last? What were the circumstances of the event: had the person been sitting or standing for long periods of time? Table 2 suggests a list of questions that may help to narrow the differential in this first visit.<sup>2</sup>

A careful review of the person's past medical history may also shed some light as to the cause of loss of awareness. Is there a family history of either seizure or cardiac arrhythmias, suggesting a genetic disorder such as an idiopathic epilepsy syndrome or a hereditary channelopathy such as prolonged Q-T Syndrome? Are there risk factors (see Table 3) for the development of seizures? Is there a history of cardiac disease such as a prior heart attack or valvular insufficiency? Has there been a prior stroke, head injury or CNS tumor? A positive response may focus the scope of testing.

The history, however, can sometimes be misleading, especially in the instance of *convulsive syncope*. The observer reports "loss of awareness and shaking." Myoclonic "jerks," tonic spasms, and even versive eye movements (which could be misinterpreted as a sign of a focal seizure) have all been reported during syncope. The cause of these movements is unclear, but most believe that they are due to the transient (hypoxia-related) disinhibition of neurons in the medulla.

When this occurs, there is a brief increase in reticulospinal signals, activating

spinal motor neurons. One important clue in the history which would suggest this possibility is that in convulsive syncope, the movements are usually quite brief.<sup>3</sup> During a seizure, the movements are longer, and often follow a highly organized pattern. For instance, in a generalized tonic-clonic seizure, there is first a tonic phase (stiffening), followed by low amplitude, fast frequency clonic movements. As the clonic movements progress, they become higher in amplitude, and gradually slow in frequency before stopping.

**The Exam.** Once the history has been established, the next step is the physical examination. Emphasis should be placed on the neurological and cardiac examination. For instance, a seizure may cause focal weakness (a Todd's paralysis, also called a Todd's phenomenon). The presence of focal neurological deficits strongly suggests that the cause of the loss of awareness was neurological. Is there evidence of an arrhythmia? Both supraventricular (atrial) and ventricular arrhythmias can cause syncope (see Table 4).<sup>4</sup> The presence of a murmur might point to valvular abnormality, and therefore the cause of the event. Finally, blood pressure and heart rate recordings, while sitting and standing (orthostatics), are required.

**Blood Tests.** Serum testing is almost universally performed on anyone coming to the ED for complaints of loss of awareness. Though likely to be of low-yield,<sup>2</sup> there are several tests that should be completed. For instance, loss of awareness can occur as a result of elevated or low serum glucose. Electrolyte disturbances (hypercalcemia, hypernatremia, hyponatremia) can cause seizures. Anemia may cause cerebral

hypoxia. Kidney and liver disease can sometimes result in loss or alteration of awareness: serum tests aimed at grossly evaluating these are indicated. Fortunately, most of these tests are readily available in any ED.

There is one test which deserves special consideration: measurement of prolactin levels. For many years, prolactin levels, when elevated after an episode of loss of awareness, were thought to indicate the diagnosis of seizures. However, neurologists now realize that serum prolactin can be elevated after seizures or syncope. In other words, it is not helpful when used as a diagnostic test to distinguish between the two diagnoses. But if the question is whether the event was a seizure or non-epileptic psychogenic event, the presence of an elevated prolactin, when performed within 10-20 minutes after the event, can be useful.<sup>5</sup>

**ECG.** A 12-lead electrocardiogram is usually readily accessible. It can identify cardiac arrhythmias such as bundle branch block, A-V block, long Q-T syndrome, and ventricular hypertrophy. Often performed in the ED, it is a test that every patient with possible syncope should undergo. This seems an obvious statement; however, a recent study showed that only 59 percent of people who came to the ED with possible syncope actually had an ECG.<sup>2</sup> This may be due to the fact that a normal ECG does not *exclude* the possibility of an intermittent cardiac arrhythmia.

Holter monitoring, often performed for 24 hours, may not be much better: the sensitivity of this test is about 10 percent. Longer cardiac monitoring (48 to 72 hours) increases the sensitivity to 20 percent. External loop monitors, which can be worn for months, increase this to 25 percent. Implanted loop monitors, which can be worn for years, may highlight a diagnosis in up to 50 percent when used correctly.<sup>2</sup> In other words, if initial cardiac testing is negative, but the suspicion for a cardiac arrhythmia is high, more extensive testing may be needed.

**Table 1. Differential Diagnosis of an Episode of Loss of Consciousness**

<b>Epileptic Seizures</b>	
Focal seizures	
Complex partial seizures	
Secondarily generalized tonic-clonic seizures	
Generalized seizures	
Generalized-from-onset tonic-clonic seizures	
Absence seizures	
Tonic seizures	
Clonic seizures	
Myoclonic seizures (if they occur in a flurry, may cause loss of awareness)	
<b>Non-epileptic, Physiologic</b>	
Syncope	
Cardiac	
Arrhythmias	
Cardiomyopathy	
Atrial myxoma	
Non-cardiac	
Vasovagal	
Orthostatic hypotension	
Medication-induced	
Cerebrovascular	
Transient ischemic attack	
Stroke	
Migraine	
Movement disorders (especially those which cause paroxysmal movements)	
Toxic-Metabolic	
Hypoglycemia	
Hyperglycemia	
Alcohol (or other drug) intoxication	
Sleep disorders	
Narcolepsy	
Parasomnias	
<b>Non-epileptic, Psychogenic</b>	
Psychiatric disease	
Anxiety/Panic	
Conversion disorder	

**EEG.** The same limitations apply to EEG. Routine EEG is very unlikely to capture a seizure, and may not record an epileptiform discharge, even when a technically good study is performed on a person with known epilepsy. In other words, not every EEG in a person with epilepsy is abnormal. Ajmone-Marsan and Zivin looked at the presence or absence of epileptiform abnormalities on serial EEGs.<sup>6</sup> The first recording showed epileptiform discharges in 56 percent. Repeated EEGs captured characteristic abnormalities in an additional 26 percent. Salinsky et. al found that four EEGs brought the yield for

epileptiform abnormalities to 90 percent.<sup>7</sup> When seizures are suspected, but the first EEG is "negative," additional EEGs may help to confirm the diagnosis. If there is still doubt, prolonged EEG, such as video-EEG monitoring, may be of benefit.

**Neuroimaging.** If you suspect a CNS cause, imaging is needed. MRI is superior to CT in identifying subtle abnormalities and may highlight a cause of focal (also called partial) seizures. Neuronal migrational disorders (cortical dysplasia), vascular malformations, tumors which appear "isodense" to brain parenchyma on a routine CT scan may be readily visualized on MRI.

**Table 2. A Proposed Scoring Scheme for Clinical Symptoms Pertaining to Loss of Consciousness**

Was it a seizure or syncope? If the added score is greater than or equal to 1, it was a seizure. If it is less than 1, it was syncope. The authors report 94 percent sensitivity and specificity using this bedside tool.

Symptom	Value
Awaken with bitten tongue	2
Déjà vu or jamais vu	1
Emotional stress associated with LOC	1
Head turning during the event	1
Unresponsive, unusual posture, limb movement, or amnesia of the event?	1
Confusion after an event	1
Lightheadedness	-2
Sweating before the event	-2
Event was associated with prolonged sitting or standing	-2

Loss of consciousness = LOC

Source: McKeon A, Vaughan C, Delanty C. Seizures versus syncope. *Lancet Neurology* 2006;5:171-180.

**Table 3. Risk Factors for Epilepsy**

- Febrile convulsion
- Perinatal insult
- CNS infection
- CNS mass lesion
- Family history of epilepsy
- Head injury (with loss of consciousness for > 30 minutes)
- Abnormal gestation or delivery
- Developmental delay
- Stroke (ischemic or hemorrhagic)

**Table 4. Causes of Syncope in 521 Outpatients Without Known Structural Heart Disease**

Etiology	Number of Patients	Percentage
Vasovagal syncope	247	47.4%
ANS Failure (orthostatic hypotension)	19	3.6%
Arrhythmias	13	2.2%
Paroxysmal atrial fibrillation	4	0.7%
Ventricular arrhythmia	5	0.9%
Sick sinus syndrome	3	0.5%
Aortic valve disease	1	0.1%
Psychogenic	15	2.9%
Hyperventilation	16	3.1%
Unknown	152	29.2%

ANS = Autonomic Nervous System

Source: Strano S, Colosimo C, Spatanga A, Mazzei A, Fattouch J, Giallonardo AT, Calcagnini G, Bagnato F. Multidisciplinary approach for diagnosing syncope: a retrospective study on 521 outpatients. *J Neurol Neurosurg Psychiatry* 2005;76:1597-1600.

The yield of these tests is highest when they are applied to patients who have experienced loss of awareness, and in whom there is a description of focal neurological deficits (either during the seizure, shortly afterwards, or at baseline). If the person has an idiopathic epilepsy syndrome, the MRI should be normal. In other words, the

results of the neuroimaging must be carefully interpreted in combination with the history, exam, and the results of other tests. As with these other tests, a negative MRI should not be interpreted as meaning “the person does not have epilepsy.”

**Tilt Table Testing.** An invaluable part of the evaluation of syncope is the tilt table test. When correctly performed, the test may reproduce the person’s symptoms, confirming the diagnosis of neurocardiogenic syncope. Often, low dose isoproterenol is used to increase the yield of the test (from 35 to 70 percent).<sup>2</sup>

## Conclusions

Transient loss of awareness is a common complaint, and presents a clinical challenge. However, the initial history and examination may suggest more likely causes in a given individual. Although many tests are available, each must be carefully interpreted in the context of the clinical situation. There is no one test that will “make the diagnosis.” Instead, as in most situations, it is the amalgam of testing, in combination with the physician’s good clinical judgment, that will resolve the dilemma: was it a seizure or syncope? **PN**

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