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Clinical Review

AN EMERGENCY MEDICINE–FOCUSED REVIEW OF SEIZURE MIMICS

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☐ **Abstract—Background: Seizures result in a change in motor, sensory, and behavioral symptoms caused by abnormal neurologic electrical activity. The symptoms share similar presentations of several other conditions, leading to difficulties in diagnosis and frequent improper management. Objective: This review evaluates adult patients with suspected seizure, signs and symptoms of seizure, mimics of seizure, and an approach to management of seizure mimics. Discussion: A seizure is caused by abnormal neurologic electrical activity resulting in altered motor, sensory, and behavioral symptoms. Other conditions may present similarly, causing a challenge in diagnosis. These conditions include syncope, psychogenic nonepileptic seizures, stroke or transient ischemic attack, sleep disorders, movement disorders, and migraines. Diagnosis of seizures in the emergency department (ED) is often clinical. Differentiation between seizures and other conditions can be difficult. Laboratories and imaging provide little benefit in definitive diagnosis in the emergency setting. For patients that have an apparent seizure, resuscitation and management is precedent while identifying any provoking factors and treatment of those factors. For adults recovering from suspected seizure, the combination of a focused history, physical examination, and additional studies can provide assistance in diagnosis. Conclusions: Patients with an apparent seizure should be resuscitated with identification of provoking factors. Many conditions can mimic seizures. A focused history, physical examination, and additional studies will assist in differentiating seizures from mimics. Published by Elsevier Inc.**

☐ **Keywords—seizure; epilepsy; status epilepticus; seizure-like; mimics; syncope**

INTRODUCTION

Epilepsy affects approximately 2 million people in the United States (US), and approximately 150,000 US adults present every year with an unprovoked first seizure (1,2). Furthermore, 100,000–150,000 patients present in status epilepticus per year, and account for up to 55,000 annual deaths (3). Diagnosis of seizures can prove to be difficult, with social and financial implications to the patient. Identification of patients that would benefit from antiepileptic therapy is imperative (1–5).

A seizure is caused by abnormal neurologic electrical activity resulting in altered motor, sensory, autonomic, or behavioral symptoms. A seizure can occur in both hemispheres (generalized) or within one hemisphere (focal), which can spread to the entire brain. Generalized seizures are more common and often have a genetic association. Tonic–clonic generalized seizures are the most frequent type of seizure that presents in an adult, consisting of a tonic phase with muscle stiffening, followed by a clonic phase with rhythmic muscle contractions (6,7). Focal seizures are more often due to an insult to the brain (7). The symptoms of the seizures depend on the location of the abnormal electrical activity in the cerebral cortex. Epilepsy occurs due to a predisposition to generate recurrent unprovoked seizures (6,8).

Seizures can occur due to an identifiable insult (provoked seizures), which can be isolated to the brain or due to systemic disorder or illness. An unprovoked

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seizure occurs in the absence of these factors, and recurrence is seen in approximately half of these patients. Status epilepticus is defined by seizure lasting > 5 min or no return to baseline between seizures (1–3).

DISCUSSION

What Is the Cause of Seizures?

Seizures are classified as provoked or unprovoked. Patients without a history of epilepsy presenting with seizure often have a provoking factor. Provoked seizures occur due to a variety of reasons, including systemic illness, brain trauma, central nervous system (CNS) infection (meningitis, encephalitis, brain abscess), anoxic injury, intracranial hemorrhage or surgery, metabolic disorders, illicit drugs or drug overdose (most commonly tricyclic antidepressants and isoniazid), or alcohol withdrawal, within 7 days of the trigger (9,10). Seizures with metabolic disorders are most commonly due to hypoglycemia or hyponatremia (9,10). These seizures might be dependent on how acutely the metabolic change occurs (11). Seizures associated with alcohol withdrawal, one of the most common causes, occur most often within 7–48 h of the last drink (9,12). Unprovoked seizures are those with no discernible cause or occurring > 7 days from a precipitating factor.

Most causes of epilepsy are idiopathic. Those with identifiable etiology include trauma, brain neoplasm, CNS infection, stroke, degenerative or vascular disease, and congenital brain malformations (6,13).

Special consideration should be made for pregnant patients with concern for eclampsia, children with febrile seizures, and patients presenting with head trauma.

Signs of Seizure

Acutely, seizures are often a clinical diagnosis. A clear history can be difficult to obtain from a patient directly, so obtaining information from a witness, if possible, is beneficial. Patients that have convulsions from tonic–clonic seizures, the most common presentation, often have a typical clinical sequence. First, there might be an aura, such as déjà vu, a rising sensation in the abdomen, abnormal taste or smell, or autonomic changes. The ictal period frequently occurs for seconds to minutes (most lasting < 1 min), with a tonic phase with muscle stiffness, followed by a clonic phase with rhythmic movements. The postictal period occurs for minutes to hours with confusion, disorientation, and drowsiness (9,13,14). Incontinence is common, but not specific to convulsive seizures. Tongue biting is suggestive of seizure activity, with a lateral location most common. Table 1 presents findings suggestive of seizure. Of note, urinary incontinence is not helpful for differentiating seizure vs. mimic. Seizures associated with alcohol withdrawal occur with other symptoms of withdrawal, such as tachycardia, tremors, and diaphoresis (9,13,14).

Focal seizures depend on the area of the cortex where the electrical activity occurs and can result in a variety of neurologically positive symptoms, such as limb movement, abnormal sensation, or hallucinations. Symptoms usually have an abrupt onset and can spread or march in accordance to progression of activity in the motor cortex. After the seizure occurs, focal neurologic deficits can occur (Todd's paralysis), which typically resolves within 30 min. Focal seizures can progress into generalized seizures (6,7,14).

Patients in status epilepticus have an extended period of seizure activity over 5 min, which is life-threatening. Status epilepticus can occur with generalized or focal seizures (3).

Seizures are a clinical diagnosis based on history and examination; however, laboratory data can contribute to diagnosing metabolic disturbance, as well as assessment of damage due to prolonged seizure activity. The most common metabolic abnormalities include hypoglycemia and hyponatremia (10). Lactate has been shown to help differentiate seizures from psychogenic nonepileptic seizures (PNES) and syncope (sensitivity of 88%, specificity 87%) (18). Creatine kinase level elevation demonstrates a specificity ranging from 85% to 100% when differentiating seizure vs. PNES, although sensitivity ranges from 15% to 88% (19). The definitive diagnosis can be made with an abnormal electroencephalogram (EEG) during seizure activity (13).

Table 1. Findings in Seizure

Sign/Symptom	Sensitivity, %	Specificity, %	Likelihood Ratio
Tongue biting (15)	33	96	8.167 (95% CI 2.969–22.461)
Urinary incontinence (16)*	38	57	0.879 (95% CI 0.705–1.095)
Observed head turning (17)	43	97	13.481 ($p < 0.001$)
Observed limb jerking (17)	69	88	5.566 ($p < 0.001$)
Postictal confusion (17)	94	69	3.031 ($p < 0.001$)

Data demonstrates typical signs often related to seizures in studies comparing seizures vs. syncope with sensitivity, specificity, and likelihood ratio. Urinary incontinence was statistically insignificant.
* Statistics based on seizure vs. nonepileptic seizures and syncope.