



## **How Do We Evaluate, Treat, and Disposition New Onset Seizure Patients?**

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A 25-year old female presents to the ED after having had a witnessed tonic clonic seizure 30 minutes prior to presentation. She was sitting on a couch when the event occurred and she was incontinent of urine. She recalls feeling “strange” seconds prior to the event which lasted 3 minutes. She denies head trauma, alcohol or other drug use, similar past events, or preceding infections. On physical exam her vital signs are blood pressure 120/80, pulse 68, respiratory rate 14, temperature 98, pulse oximetry 98% saturated. She is alert, oriented to person, place, and time; she can recite the months of the year forward and backwards, has 3 object recall after 5 minutes. Cranial nerves II, III, IV, and VI are intact including a normal appearing fundus with venous pulsations. There is no facial asymmetry, speech is fluent, swallowing is normal. She has no upper or lower extremity weakness and her gait is normal. Her deep tendon reflexes are +4 symmetrically in both the upper and lower extremities; her extensor planter reflexes (Babinski’s) are upgoing bilaterally.

## **Key Clinical Questions**

What are the key components of the history and physical in a patient with a first time seizure?

What laboratory tests are indicated in this patient in the ED?

Does this patient need a neuroimaging study in the ED?

Which patients with new onset seizures should be started on AEDs in the ED?

Which patients with new onset seizures need to be admitted to the hospital?

What are the key components to the history and physical in a patient with a new onset seizure?

## **Key Learning Points:**

- Patients with a first time seizure with no co-morbidities should have a serum glucose, electrolytes; women of child bearing age should have a pregnancy test. Patients with co-morbidities should be considered for more extensive metabolic profiling. (Class II and Class III evidence)
- Patients with a first time seizure should have a noncontrast head CT in the emergency department. (Class II evidence; no outcome data to support recommendation)
- Patients with a first time seizure with HIV should have a lumbar puncture either in the ED or after admission to the hospital. (Class II data)
- Patients with a first time seizure who have a normal head CT, glucose and electrolytes, and normal neurologic examination can be safely discharged from the ED on no AED therapy. (Class III data)
- AED therapy has potential complications and risk of recurrence is multifactorial; initiation of AED therapy is best reserved for the physician who will assume primary care of the patient. (Class III data)

## **Introduction**

The history begins with a careful description of the event and its surrounding circumstances with documentation of the preliminary symptoms, progression of the clinical pattern, duration of the event including the post-ictal period, presence of incontinence or biting of the tongue. Every effort must be made to obtain a clear description of the event(s) from witnesses. Seizures may be exacerbated by a number of stressors, such as fatigue, pregnancy, or systemic infection. Identification of the stressors may explain an event and become the focus of management.

An accurate set of vital signs including a rectal temperature and pulse oximetry should be obtained. Assess the mental status, skin color, pupil position and reactivity. If the patient is actively convulsing, describe the motor activity. Look for "automatisms" which are repetitive actions such as lip smacking, swallowing, chewing, or fumbling. Automatisms are frequently seen in complex partial seizures and may be the only indicator that there is ongoing seizure activity.

Seizures resulting from drug overdose may be suggested by the presence of a toxidrome as seen in anticholinergic, sympathomimetic, or tricyclic ingestions. Hypertension with bradycardia may indicate an intracranial catastrophe, while fever may be the manifestation of a CNS infection (though seizures may independently result in elevated temperatures from muscular hyperactivity or central deregulation). Irregular heart rate or carotid bruits may indicate a stroke, which is a common cause of new onset seizures in the elderly.

Perform a complete neurological examination identifying focal deficits which may represent an old lesion, new intracranial pathology, or reversible postictal neurologic compromise (Todd's paralysis). In cases of a new Todd's paralysis, the physician must rule out a new structural lesion. Other physical findings suggestive that a patient has had a seizure include hyperreflexia and extensor plantar responses both of which should resolve during the immediate post-ictal period. Document the patient's mental status recruiting the assistance of persons familiar with the patient. Post-ictal confusion usually resolves over several hours and failure for gradual improvement must prompt a search for other causes.

## **What laboratory tests are indicated in a patient with a first time seizure?**

The laboratory tests indicated in the ED for patients presenting after having had a first time seizure who are alert, oriented, and have no clinical findings include a serum glucose level, electrolytes, and women of child bearing age require a pregnancy test. A drug of abuse screen should be considered. All other tests are of very low yield in this group of patients and there are no prospective studies at this time in adults or children to support more in depth testing in the ED such as phosphate, calcium, or magnesium levels. However, patients who are on dialysis, malnourished, taking diuretics, or who have underlying significant medical disorders need comprehensive testing including CBC, blood urea nitrogen (BUN), creatinine, calcium, phosphate, magnesium, and an urinalysis. Rhabdomyolysis, which is a rare consequence of a

seizure, may be diagnosed if the urine tests positive for blood in the absence of red blood cells on the microscopic exam. A serum creatinine phosphokinase (CPK) level is indicated in these cases. Serum CPK levels have not been found useful in differentiating seizures from other causes of loss of consciousness. Cardiac monitoring for dysrhythmias is an important part of every resuscitation for patients who have had a seizure of undermined etiology. An ECG may reveal evidence of drug toxicity.

Lumbar puncture: A lumbar puncture is considered in those patients with an unresolving post-ictal state, fever, headache, meningeal signs, a positive HIV history or who are otherwise immunocompromised. There are no prospective studies that support performing a lumbar puncture as part of the diagnostic evaluation in the ED on patients who are alert, oriented, asymptomatic, and not immunocompromised even if the seizure was a first time event.

### **Which ED patients with a first time seizure need a neuroimaging study in the ED?**

Three per cent to 41% of patients with a first time seizure have an abnormal head CT. In one retrospective review, 22% of patients with a first time seizure who had a normal neurologic exam had an abnormal head CT. The question remains whether identifying the abnormality in patients with nonfocal neurologic examinations who are evaluated in the ED has an impact on outcome. This, of course, depends on the outcome measure used; clearly, identifying a lesion may direct disposition and possibly argues in favor of ED neuroimaging. A head CT should be strongly considered in the ED whenever an acute intracranial process is suspected, in patients with a history of acute head trauma, history of malignancy, immunocompromise, fever, persistent headache, history of anticoagulation, or a new focal neurologic examination.

### **Which patients with a first time seizure need to be started on an AED and / or admitted to the hospital?**

The decision to initiate anticonvulsant therapy in the ED should be made in conjunction with the patient's primary care provider or neurologist. The decision for therapy is based on the underlying cause of the seizure, the results of a neuroimaging study, and an EEG. All of these data are rarely available prior to ED discharge, consequently the decision to initiate therapy must be based on the predicted risk for seizure recurrence. The chances of a patient having a recurrent event after one unprovoked seizure varies depending on the patient's age and the seizure's underlying etiology. Seizure etiology combined with EEG findings are the best predictors of recurrence; when no etiology is identified and the EEG is normal the recurrence rate is 24% at two years . Patients who have structural lesions on CT or patients with focal seizures that secondarily generalize have a risk of recurrence of up to 65% and are the group of patients that probably benefit from initiating anticonvulsant therapy in the ED.

There is limited literature to help the clinician decide which patient with a new onset seizure needs to be admitted to the hospital. Clearly, those patients with new focal neurologic deficits, new CNS lesions on neuroimaging, or underlying medical problems need to be admitted. More problematic is the patient with no underlying medical problems and a normal examination. Fundamental to this decision is the risk of a seizure recurrence. There is only one study that specifically investigated the incidence of seizure recurrence within 24 hours of ED presentation. The study suffers from its retrospective design and it is unclear to what extent selection bias impacts its findings. The authors reported a 19% seizure recurrence rate within 24 hours of presentation, decreasing to 9% if those patients with alcohol related events or focal lesions on CT were excluded. Unfortunately, those patients with recurrent seizures are not well described and it is not possible to assess from the data provided if a recurrence could have been predicted based on vital signs and co-morbid factors.

**Areas in need of future research:**

- A well designed prospective study of patients with new onset seizures and results of laboratory testing and patient outcome.
- A well designed prospective study of patients with new onset seizures and the impact of neuroimaging on clinical decision making in the emergency department.
- Outcome data of seizure recurrence rate within 72 hours of patients with new onset seizure and no etiology identified in the the emergency department.
- Impact of emergent neuroimaging and EEG on clinical decision making in the emergency department.

**Recommendations:**

**Class A:**

None specified.

**Class B:**

1. Perform a lumbar puncture either in the emergency department or after admission in patients with a first time seizure with HIV disease following a head CT.
2. Determine a serum glucose and electrolytes on patients with first time seizure with no co-morbidities who have returned to their baseline.
3. Obtain a pregnancy test if a woman is of child bearing age.
4. Perform a Neuroimaging of the brain in the emergency department on patients with a first time seizure. If Neuroimaging of the brain is not available in the emergency department, discuss the risk of recurrence with the patient and the patient's primary physician and either admit the patient to the hospital or make arrangement for an outpatient evaluation.

**Class C:**

1. Patients with a first time seizure who have a normal neuroimaging of the brain, normal serum glucose and sodium, and normal neurologic examination can be discharged from the ED with outpatient follow-up.
2. Patients with a first time seizure who have a normal neurologic exam, normal neuroimaging of the brain, normal serum glucose and sodium, and no co-morbidities do not need to be started on an antiepileptic drug (AED) in the ED.

## **Annotated Bibliography**

**1. DeLorenzo R, Hauser W, Towne A, et al. A prospective, population-based epidemiologic study of status epilepticus in Richmond, Virginia. *Neurology* 1996; 46:1029-1035.**

This is an important prospective study that used a strict definition of status epilepticus involving 204 events. The authors report a projected annual incidence of status epilepticus of 50 per 100,000 population, with an overall mortality of 22%; 3% for children and 26% for adults. According to the study, over one half of patients presenting to the ED in status epilepticus had no prior seizure history. Mortality in patients with status epilepticus is linked to the duration of the seizures and the underlying etiology

**2. American College of Emergency Physicians. Clinical policy for the initial approach to patients presenting with a chief complaint of seizure who are not in status epilepticus. *Ann Emerg Med* 1997; 29:706-724.**

This clinical policy is currently under revision. In essence, it is a formal consensus document that provides general guidelines for approaching the patient who has had a seizure. The policy recommends that patients with a first time seizure have, at a minimum, a set of electrolytes, a glucose level, and a pregnancy test if a female of child-bearing age. Therapeutics are not addressed.

**3. Turnbull T, Hoek T, Howes D, Eisner D. Utility of laboratory studies in the emergency department patient with a new onset seizure. *Ann Emerg Med* 1990; 19:373-377.**

This is a prospective study of 136 patients with new onset seizures seen over a four-year period; it is not clear if these were consecutive patients (though doubtful thus introducing selection bias into the study). All patients had an evaluation of electrolytes, BUN, Cr, CBC, glucose, calcium, and magnesium. 11 cases of laboratory abnormalities were discovered, only two of which (patients with hypoglycemia) were not suspected. The authors conclude that, with the exception of serum glucose, serum analyses are of low yield in patients with new onset seizures who have normal physical exams and no co-morbidities.

**4. Pesola G, Westfal R. New onset generalized seizures in patients with AIDS presenting to an emergency department. *Acad Emerg Med*. 1998; 5:905-911.**

This is a retrospective review of 26 AIDS patients with new onset seizures which were compared to 120 non-HIV patients. Four of the HIV patients were found to have treatable lesions that were not suggested by clinical findings. This study supports the need for a CT and a LP in HIV patients with new onset seizures.

**5. Tardy B, Lafond P, Convers P. Adult first generalized seizure: etiology, biological tests, EEG, CT scan, in an ED. Amer J Emerg Med. 1995; 13:1-5.**

This is the only study that specifically looks at seizure recurrence within 24 hours of presentation. It suffers from its retrospective design with probable selection bias. Of 247 patients, alcohol and acute stroke were the most common etiologies identified. 5 patients were hypoglycemic, 4 were hyponatremic, 3 had calcium or sodium abnormalities. 85 patients had a focal lesion on head CT; 32% had an EEG with a focal abnormality. Seizure recurrence was 19% in the first 24 hours; when alcohol and focal lesions were excluded, the rate dropped to 9%. Unfortunately, a complete data set is not provided to allow for an predictors that might enable the clinician to risk stratify patients.

**6. Henneman P, DeRoos F, Lewis R. Determining the need for admission in patients with new-onset seizures. Ann Emerg Med 1994; 24:1108-1114.**

This is a retrospective review of 333 adult patients with new onset seizures. The authors conclude that patients needing admission can be predicted by a standardized medical evaluation in the ED though unfortunately the retrospective study design did not allow for a standardized evaluation to have been performed. A complete data set on patients is not provided making it difficult to support some of the conclusions made by the authors.

**7. American College of Emergency Physicians, American Academy of Neurology, American Association of Neurological Surgeons, American Society of Neuroradiology. Practice Parameter: Neuroimaging in the emergency patient presenting with seizure (Summary Statement). Ann Emerg Med 1996; 27:114-118.**

This is an important practice guideline that all emergency physicians should be familiar with. The guideline was a joint collaboration between ACEP and the AAN and the AANR. An evidence-based approach was taken to formulate recommendations. The three societies jointly recommended that a neuroimaging study could be obtained as an outpatient if the patient the neurologic exam was normal and no predisposing co-morbidities, eg malignancy, are identified.