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Seizures in Adults

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* Drug doses are a guide only, always check second source and follow local practice guidelines

Take Home Points:

- Most seizures stop spontaneously - but those patients seizing for more than 5 minutes are unlikely to stop.
- The initial priority when a patient is actively seizing is to protect them from physical harm and stop the seizure.
- Benzodiazepines, through any route available, are first line in treatment, followed by a repeat dose and then a stepwise progression to second and third line drugs with endotracheal intubation as necessary.
- Unless the seizure is typical in a patient with known seizure disorder, serious diagnoses, such as poisoning, brain tumor, and meningitis, must be considered and worked-up as appropriate.
- In many cases, diagnoses other than seizure must be entertained - notably a cardiac event such as syncope.
- New onset seizures in patients who are pregnant and with HIV/AIDS may represent a variety of challenging and serious diagnoses - early consultation is advised.

Introduction

Seizures frighten everybody. They can be distressing not only for patients but also for their families, public bystanders and even emergency providers. Because the convulsions associated with seizures can be so dramatic, we tend to lose our ability to think in a logical manner when a patient is actively seizing. In this episode of C3, we cover the initial approach to the seizing patient, how to manage status epilepticus and how to disposition these patients from the emergency department.

Background

- Some important definitions:
 - **Seizure** - abnormal neurologic function caused by inappropriate electrical discharges in the brain
 - **Convulsion** - motor activity from seizure
 - **Epilepsy** - condition of recurrent seizures, not due to a specific structural (e.g. brain tumor) or metabolic (e.g. hypoglycemia) cause
- Key Types of Seizures:
 - **Tonic-clonic**
 - This is what most people think of when they think of seizure
 - Alternating stiffening (tonic) and rhythmic jerking (clonic)
 - 3 typical phases:
 - **Tonic** - abrupt onset of LOC, rigidity, with apnea and cyanosis, usually urinate and sometimes vomit
 - **Clonic** - symmetric, rhythmic jerking
 - **Post-ictal** - somnolence, fatigue, may last hours
 - **Absence**
 - Classically in school-aged children
 - Usually resolve as the child grows up
 - Can have up to 100 per day
 - Brief (seconds sometimes), **LOC but no loss of postural tone**
 - Patients appear **confused, detached, withdrawn**
 - Stops abruptly with **no post-ictal phase**
 - **Partial**
 - **Simple** partial/focal seizures do not involve LOC
 - **Complex** partial seizures are the fascinating ones
 - They can appear to cause personality changes, hallucinations
 - Generally present differently than the typical "seizure" patient, more likely altered mental status

Key History and Physical Examination

- **Was it a seizure?**
 - Does this patient have a history of seizures?
 - Seizure mimics:
 - Syncope - or syncope with hypoxic seizure - **most common mimic**
 - Psychogenic non-epileptic seizures (formerly known as pseudoseizures)
 - Movement disorders (dystonia, myoclonic jerks, tremors)
 - Narcolepsy
 - Differentiating seizures from syncope:
 - Seizure 5x more likely if confused thereafter (postictal confusion is the most **sensitive** finding for true seizure (94% sens, 70% spec)
 - Seizure 3x more likely if pt aged <45 years
 - Tongue biting (highly specific), aura, rhythmic shaking and dystonic posturing suggest seizure
 - Head turning to one side during the seizure is also highly specific, but you need a witness to have seen this!
 - Incontinence actually not that helpful to distinguish
- **Was it different than previous seizures?**
 - Any fever, new type of headache, preceding illness, meningeal signs, toxidrome?
 - Change in nature and pattern of seizures
 - Antiepileptic drug (AED) and general medication history
 - Any recent changes in meds?
 - Many medications can lower the seizure threshold
 - Consider key BAD causes:
 - Cardiac arrhythmia (VTach)
 - Is there a history of CHF or other heart disease?
 - Tumor (brain mets)
 - Is there a history of cancer?
 - Infection (meningitis, brain abscess)
 - Is there a fever, new onset headache, infectious symptoms?
 - Electrolyte abnormalities (Na, Ca, Mg and Glucose)
 - Is there reason to suspect abnormal electrolytes?
 - Cerebrovascular (stroke, TIA)
 - Is there a history or findings of focal neuro deficits?
 - Trauma (subdural hematoma, brain contusion)
 - Is the patient vulnerable to unrecognized trauma/abuse?
 - Overdose or withdrawal related
 - Are there signs of alcohol or drug use?
 - Environmental (heat stroke, envenomation)
 - Check core temperature

- **Are there neurologic findings?**
 - Typically the neurological examination is normal without focal abnormalities
 - Todd's paralysis is a focal neuro deficit in the post-ictal phase
 - Must consider stroke, spinal injury, or other nerve damage first
 - Todd's usually resolves in 30 minutes → you have to re-check the deficit
- **Is there significant trauma?**
 - A complete examination for trauma is necessary
 - Pay special attention to head and neck, MSK exams
 - Posterior shoulder dislocation is associated with seizure

Labs, Imaging And Other Tests

- **Labs**
 - In patients with known seizure disorder on AEDs, the only labs usually necessary are levels of the drug that they are taking
 - Levels are commonly available on an emergent turnaround basis for the following drugs:
 - Phenytoin
 - Carbamazepine
 - Phenobarbital
 - Valproic acid
 - Levels for many of the newer AEDs are either not available or take days to result
 - In patients where the cause of the seizure is unknown, more extensive blood tests are indicated, including:
 - Serum chemistry (including calcium and magnesium)
 - Pregnancy test
 - Urine/serum toxicology
 - **Lactic acid**, if obtained soon after a tonic-clonic seizure, will usually be markedly elevated
 - **Prolactin** is also typically elevated in the postictal phase - this is sometimes used to help confirm that a seizure occurred [Chen]
 - Both of these markers will usually return to baseline within an hour
- **Imaging**
 - CT head indicated if:
 - First time seizure
 - Suspicion for structural lesion or bleed
 - Significant head trauma (e.g. large hematoma/skull fracture, failure to return to baseline mental status), either preceding or secondary to the seizure
 - If negative, may need outpatient MRI to further evaluate

- **Other tests:**

- **ECG** is indicated in first time seizures or when there is a question of an arrhythmia-induced event
- **Lumbar puncture (LP)** is indicated following CT if the patient is febrile or immunocompromised
- **Electroencephalography (EEG)** is indicated if there is a question that the patient still might be seizing

Managing The Actively Seizing Patient And Status Epilepticus

- **Treatment of the patient who is actively seizing**

- Protect the **patient** from injury (e.g. don't let them fall off the bed!)
- Protect the **airway**, roll on them on their side, apply oxygen (passive oxygenation), and suction secretions as possible
- Have airway equipment and intubation meds ready
- Check blood glucose
- Can't do that much else until you stop the seizure!!!

- What is status epilepticus?

- Most seizures stop on their own in 1-2 minutes
- Sometimes the endogenous processes in your brain fail and the seizure continues
- The longer it lasts the less likely it is to stop as the seizure becomes self-sustaining
- Continuous or intermittent seizures for more than 5 minutes without recovery of consciousness is known as status epilepticus
- **Thus, from an emergency medicine point of view, any patient who continues to seize in the ED is essentially in status**

- **Stopping the seizure**

- Start with **benzodiazepines**
 - Lorazepam 2 mg IV q 5 min OR
 - Diazepam 10 mg q 5min IV
 - both are equally effective - diazepam works faster (by about 3-5 mins) but lorazepam lasts longer
 - If no IV, midazolam 10 mg IM (can also give lorazepam IM but midazolam IM works faster)
 - IO (intraosseous) and IN (intranasal) route may also be used
- If seizures persist despite a couple of doses of benzodiazepines, the **next options** include:
 - Phenytoin
 - Can load with 15-20 mg/kg IV
 - Given at a rate no faster than 50 mg/min on cardiac monitor
 - Fosphenytoin
 - Can load with 15-20 mg/kg IV (dosed as phenytoin equivalents)

- Given at a rate no faster than 150 mg/min on cardiac monitor

- Can also give fosphenytoin IM

- Levetiracetam

- 1g IV over 15 minutes

- Valproate

- 20-40 mg/kg IV over 10 minutes

- The **next** agents induce coma:

- These can profoundly lower blood pressure and eliminate the patient's airway reflexes, necessitating intubation and intensive monitoring

- Phenobarbital

- 10-20 mg/kg IV bolus at a rate of 50-100 mg/minute

- Propofol IV drip

- Midazolam IV drip

- Use of paralytic agents for intubation

- Succinylcholine

- If patient has been seizing for a long time, rhabdomyolysis and associated hyperkalemia are possible, making succinylcholine more dangerous

- Rocuronium

- Although using a non-depolarizing agent like rocuronium eliminates the worry about hyperkalemia, the duration of paralysis is much longer, so EEG monitoring to ensure that the patient is still not seizing (or reversal with sugammadex) is necessary

- Beware of subtle subclinical status epilepticus (SSSE)

- Sometimes it seems as though a tonic-clonic seizure has stopped but it really hasn't

- Unless the patient returns to their normal state of consciousness we need to be careful not to miss subtle signs ongoing seizure

- These include:

- Rhythmic movements of the distal extremities

- Fixed gaze deviation (looking only to one side)

- Ongoing vital sign abnormalities (e.g. tachycardia)

Seizures In Patients With Epilepsy

- In patients with established seizure disorder, the key is to determine whether there is anything new or concerning about the most recent seizure

- If not, a medication level (if available) may be the only test necessary

- A loading dose of phenytoin can be given IV or PO in the ED

- Most AEDs do not require a loading dose

- Adjustments in AED or dosing may be made in conjunction with the patient's neurologist or primary provider in anticipation for discharge

The First Time Seizure

- In patients with a first apparent seizure, the emphasis must be on ruling out a serious underlying cause (see BAD or secondary causes above)
- Initial treatments for secondary causes include:

CAUSE	TREATMENT
○ Eclampsia	magnesium, benzos and BP control
○ Isoniazid	pyridoxine (B6)
○ Hypoglycemia	D50
○ Hypocalcemia	calcium gluconate or chloride
○ Hyponatremia	3% hypertonic saline
○ Aspirin, TCAs, or lithium	hemodialysis
○ Meningitis	antibiotics

- If nothing is found and patient appears well, workup can continue on an outpatient basis
- An AED does not have to be started after an initial seizure in the ED until the workup has progressed but may be started (preferably in consultation with the outpatient providers)
- A report to the Department of Motor Vehicles and advice not to drive until further evaluation is required in many jurisdictions

Seizure In Special Populations

- **HIV**
 - New onset seizures in a patient with HIV/AIDS requires a full-er evaluation
 - There are a number of unique brain tumors and pathogens that occur in AIDS that can present with seizures
 - Masses include toxoplasmosis, lymphoma
 - Pathogens include cryptococcus, cytomegalovirus, TB and neurosyphilis
 - CT Head followed by LP for CSF analysis is usual workup in the ED
 - Further consultation or admission for further evaluation may both be appropriate and necessary
- **Pregnancy**
 - New onset seizures in pregnancy or the post-partum period requires a fuller evaluation and early specialist consultation
 - Assume eclampsia until proven otherwise in patients from 20 weeks pregnant through to a full month after delivery
 - Initiate magnesium (6g IV followed by IV drip) empirically
 - If no access, administer 5 g and 5 g IM into the buttock.
 - May add benzodiazepines

- Other causes of seizure in pregnancy may require advanced imaging
 - Cerebral venous thrombosis
 - magnetic resonance venogram (MRV)
 - Stroke/related syndromes
 - CT/MR angiography

• Alcohol withdrawal

- Alcohol withdrawal seizures are often a very early manifestation of withdrawal - typically 6-48 hours after last drink
- Some patients may evolve into life-threatening withdrawal after seizing
 - a period of observation after treatment with benzodiazepines is thus appropriate

Pseudoseizures (Or PNES)

• PNES (Psychogenic Non-Epileptic Seizures)

- Many patients with seizure disorder also suffer from PNES (up to 40%)
 - Associated with depression, PTSD, and personality disorders
 - Clues for PNES
 - Preserved consciousness
 - Memory recall
 - Purposeful movements
 - Poorly coordinated thrashing
 - Back arching
 - Pelvic thrusting
 - Eyes held shut
 - Head rolling
 - Crying
 - Ability to protect themselves from noxious stimuli
 - No postictal period
 - No elevation of lactic acidosis or prolactinemia after event
- It can be difficult to make this diagnosis in the ED, maintain a non-judgmental approach and an open mind

Disposition

- Disposition varies widely depending on the scenario
- Patients with a known history of seizures who appear well are generally discharged for outpatient follow-up
- Patients with ongoing uncontrolled seizures or a possible serious secondary cause are generally admitted for further evaluation and management

References

Claassen J et al. Emergency Neurological Life Support: Status Epilepticus. *Neurocrit Care* (2015) 23:S136–S142. <https://www.ncbi.nlm.nih.gov/pubmed/26438462>

Falco-Walter JJ, Bleck T. Treatment of Established Status Epilepticus. *J Clin Med*. 2016 May; 5(5): 49. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4882478/>

Huff S et al. Clinical Policy: Critical Issues in the Evaluation and Management of Adult Patients Presenting to the Emergency Department With Seizures. From the American College of Emergency Physicians Clinical Policies Subcommittee. *Ann Emerg Med*. 2014;63:437-447. [http://www.annemergmed.com/article/S0196-0644\(14\)00080-8/fulltext](http://www.annemergmed.com/article/S0196-0644(14)00080-8/fulltext)
https://www.acep.org/MobileArticle.aspx?id=48428&coll_id=618&parentid=

Khoujah D, Abraham MK. Status Epilepticus: What's New? *Emerg Med Clin N Am* 34 (2016) 759–776. <https://www.ncbi.nlm.nih.gov/pubmed/27741987>

Krumholz A, et al. Evidence-based guideline: Management of an unprovoked first seizure in adults: Report of the Guideline Development Subcommittee of the American Academy of Neurology and the American Epilepsy Society. *Neurology*. 2015 Oct 27;85(17):1526-7. <https://www.ncbi.nlm.nih.gov/pubmed/26503589>

Webb J, et al. An Emergency Medicine-Focused Review of Seizure Mimics. *J Emerg Med* 2017; 52 (5):645-653. [http://www.jem-journal.com/article/S0736-4679\(16\)30990-8/fulltext](http://www.jem-journal.com/article/S0736-4679(16)30990-8/fulltext)
