

Hey Clinical Problem Solvers! My name's T.J. La, a 6th year MD/JD/LLM student at Baylor College of Medicine and the University of Houston Law Center, and I am so excited to share with you more about generalized tonic-clonic seizures.

Before we dive right in, it's important to consider the **differential diagnosis of a generalized tonic-clonic seizure**. Many times the seizure is not witnessed, and reported by bystanders...so we must distinguish seizure vs. syncope vs. psychogenic nonepileptic seizure (which can be very hard to distinguish from an epileptic seizure but are not related to epileptic activity and may have a psychological cause such as severe mental stress or a traumatic event). Sometimes these can even be hard to tell apart for a seasoned clinician witnessing an event. GTCs are usually characterized by loss of consciousness and bilateral rhythmic jerking movements, post-ictal state (confusion/altered mental status after the event), and often associated with injury (e.g., tongue bite) and loss of sphincter control. However, you could imagine that if someone with a full bladder suffers syncope and hits their head, they could empty the bladder and the head strike could cause a concussion leading to AMS...and then there is convulsive syncope characterized by brief rhythmic jerks during syncope...so a careful history, exam, and evaluation are always necessary.

Looking at seizures specifically, we should classify them by the type of onset including **generalized** (when the onset of electrical activity involves both sides of the brain simultaneously) or **focal** (when the onset of electrical activity involves a focal region of the brain, and of note focal seizures can secondarily generalize).

Tonic-clonic seizures, formerly known as grand mal seizures, are the most common type of generalized-onset motor seizures.

- For those who have a tonic-clonic seizure for the first time, the risk of a second seizure depends on several factors including whether provoked or unprovoked and neuroimaging, and if unprovoked and no causative lesion is found on imaging, risk of future seizure is associated with abnormal exam and/or EEG.

Seizures are classified as provoked or unprovoked.

Provoked in this setting refers to being caused by an acute/reversible etiology (toxic/metabolic, drugs, infection, head trauma and hemorrhage).

- For toxins, drug or alcohol abuse or withdrawal can precipitate seizures, and also drugs like bupropion, antipsychotics like clozapine, TCAs, sedating antihistamines, and fluoroquinolones can lower the seizure threshold.
- For metabolic, low levels of sodium, calcium, or magnesium can lead to seizures, as well as hypo and hyperglycemia, uremia, and rarely hepatic encephalopathy.

- For infections, think of viral encephalitis, bacterial meningitis, brain abscess, neurocysticercosis, rabies, cerebral malaria, and toxoplasmosis.
- Other important causes include head trauma from blunt or penetrating injuries.

Unprovoked causes refer to seizures without a clear acute/reversible provoking factor, and are either due to structural lesions vs. genetic/ “idiopathic.”

- For structural, think of prior stroke and arteriovenous malformations for vascular causes, and a mass or brain tumor or congenital structural brain malformation for non-vascular causes.
- Idiopathic/genetic causes are epileptic syndromes due to a predisposition to epilepsy at the neuronal level.

For clinical manifestations, some patients have what we call an aura. A patient would describe having abnormal smells, a sense of fear, paresthesias, or déjà vu immediately before the seizure.

- As a side note: preceding aura, post-ictal state, incontinence, tongue bite/self-injury all suggests seizure but are not perfect signs (e.g., a person with a full bladder who syncopizes and hits his/her head could have concussive altered mental status, incontinence, and injury).

Next, a tonic-clonic seizure has two stages.

- The first is the tonic phase where loss of consciousness occurs, and the body’s muscles contract suddenly causing the person to fall. This phase tends to last for only a few seconds.
- The subsequent clonic phase is when the body’s muscles alternate from flexing and relaxing movements, some describing as jerking movements. These convulsions can last for minutes.
- After, there is the postictal state when the patient may experience confusion, disorientation, fatigue, headache, and muscle soreness that can last for hours.

On physical exam, look for focal neuro deficits which could represent the focal origin of seizures such as Todd’s paralysis in which a seizure is followed by a brief period of temporary paralysis contralateral to the cortical epileptogenic focus

- An elevated CK and lactic acidosis on labs can occur after a tonic-clonic seizure, so may be a clue in a patient who is simply ‘found unresponsive’ though this obviously nonspecific.
- Also, getting a CT is rapid and can assess for acute pathology (e.g., intracranial hemorrhage), and if negative and no etiology determined on labs then order an MRI for a more detailed look.
- If your index of suspicion is high for CNS inflammation or infection due to encephalitis or meningitis, get a LP.

- If you are suspicious a patient had a generalized tonic-clonic seizure, do an outpatient EEG if you were unable to pinpoint the provoking factor. If no acute etiology can be determined, an MRI and EEG can be done while the patient is under observation in the ED.

If a patient experiences multiple seizures, and a comprehensive evaluation does not reveal an acute reversible provoking factor or mimic, a diagnosis of **epilepsy** can be made, meaning the patient has recurrent unprovoked seizures.

- Epilepsy can also be diagnosed at the time of the first seizure if there is a high risk of recurrence based on imaging and/or EEG.

For management, treatment over diagnosis is the rule for emergent cases in which the patient is actively seizing. Secure the patient's airway, and assess their heart rate and blood pressure. Also check their glucose, and if the patient is seizing by the time you reach the patient treat them with a benzodiazepine immediately (even for status epilepticus). Status epilepticus is defined as seizures that last for more than 5 minutes or there is a recurrence of seizures without return to consciousness.

In summary, many people who have a tonic-clonic seizure never have another one and will not need treatment, but for someone who has recurrent unprovoked seizures—ie epilepsy—treatment with daily anti-seizure meds to control and prevent future seizures may be needed. If this is a new-onset seizure, get neuroimaging, lab testing (including blood tests for electrolytes, BUN, Cr, glucose, calcium, magnesium and phosphate levels, and LFTs), and an EEG. For known seizure disorders in patients on medications, check the anti-seizure med drug levels and look for acute provoking factors (e.g. systemic infection, metabolic disturbance, new medication).

We hoped you enjoyed this schema!