

# Emergent Epilepsy & Status Epilepticus

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Canine patient in the immediate postictal phase demonstrating altered mentation and ptialism

## Seizures Defined

Seizures, characterized by an acute increase in aberrant electric activity in the brain, may lead to excessive and abnormal neuronal transmission that often results in uncontrolled muscular activity. There are 3 seizure phases:

1. **The Preictal Phase:** Although it is uncommonly recognized in companion animals, this pre-seizure phase most often consists of subtle behavioral changes.
2. **The Ictal Phase:** During the ictal phase of a grand mal seizure, the patient may exhibit varying levels of consciousness, may not respond to verbal and other sensory stimuli, may be recumbent with tonic or clonic limb movement, and/or may urinate or defecate. Focal (motor, sensory, and autonomic) seizures can be more difficult to recognize, can vary in presentation, and may include contractions of a single limb, altered consciousness, aggression, or fly biting.
3. **The Postictal Phase:** This phase lasts minutes to hours after the seizure, during which the patient acts abnormally, commonly demonstrating lethargy, ataxia, obtunded mental status (**Figure 1**), and atypical behavior.

You have asked...

What is an emergency specialist's approach to acute management of epilepsy and status epilepticus?

The expert says...

Seizures, a common presenting complaint to emergency clinicians (see **Seizures Defined**), occur for many reasons: toxin ingestion or medication overdose, severe metabolic disorders, neurologic and neuromuscular disorders, and primary epilepsy (see **Causes of Seizures & Tremors**, page 31). Emergency clinicians must be familiar with the differentials that can cause seizures in order to identify and treat underlying conditions. To differentiate seizures from tremors, syncope, or other neuromuscular disorders, thorough history taking and physical and neurologic examinations are necessary. Epilepsy can be diagnosed once other diseases are ruled out.

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## Diagnostics

Initial diagnostics typically consist of emergency blood analysis (ie, glucose, electrolytes, blood gases, urea concentration, PCV/TS), but a more complete blood analysis (ie, CBC, chemistry panel, thyroid profile), urinalysis, additional screening tests (eg, thoracic radiography, ECG, abdominal radiography or ultrasonography), and blood pressure monitoring are often recommended. Other pertinent tests (eg, blood ammonia or bile acids, coagulation profile, insulin level, toxicologic and infectious disease diagnostics) depend on the suspected underlying disease and should be considered before pursuing advanced imaging (eg, MRI; **Figure 2**) and cerebrospinal fluid analysis.

## Indications for Seizure Treatment

Except with head trauma, a single seizure is seldom cause for starting antiepileptic drugs (AEDs). Patients should be started on AEDs if they have status epilepticus or cluster seizures (ie, >1 seizure q24h) or if long-term control is necessary (ie, >1 seizure q4–6wk). AEDs are best started early in the disease course, acknowledging that each seizure may propagate further seizure activity, a phenomenon known as *kindling*. Recent evidence also shows that dogs undergoing surgery for PSS may be treated prophylactically with levetiracetam at 20 mg/kg PO q8h for 24 hours before surgery.<sup>1</sup>

## Stabilization & Immediate Management

As in any emergency, airway, breathing, and circulatory disturbances should be treated first. The first-line drug for seizures is typically a benzodiazepine (eg, diazepam, midazolam) administered IV or as double dose PR; although midazolam can be administered IM, the route is not rapid onset. These medica-

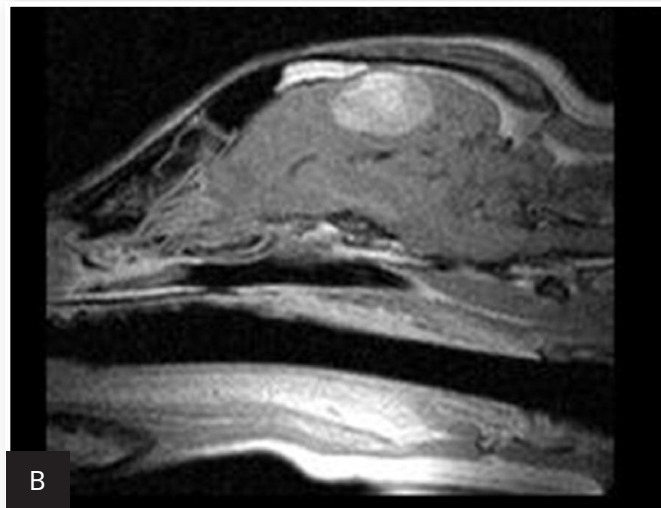
## Check Your A, B, Cs...

**For any emergency patient, Airway, Breathing, and Circulatory disturbances should be treated first.**

tions are metabolized quickly and only inhibit seizures briefly; they may also be administered by constant-rate infusion (CRI). For patients already on AEDs, the dose may need to be increased. These medications should not be administered as first-line agents if a portosystemic shunt (PSS) is suspected, as doing so may induce a coma. If ethylene glycol (EG) intoxication is suspected, blood samples should be collected before medications are administered (if possible); propylene glycol (in injectable diazepam), sorbitol (in many activated charcoal products), and mannitol may cause false-positive results on routine in-hospital EG testing.

Status epilepticus requires rapidly increasing blood levels or *loading* the patient with a long-term AED by injection to rapidly reach therapeutic blood levels; phenobarbital is often the first choice. Rapid increases in blood levels with phenobarbital or bromide can lead to severe sedation, making close neurologic monitoring essential. Owners should be counseled that although adverse effects, particularly sedation and ataxia, may last for several weeks, their presence is not a reason to discontinue therapy.

Propofol, a rapid-acting GABA-agonist IV anesthetic that decreases seizure activity in the brain, is given to patients that fail to respond to benzodiazepines or as a first-line agent to arrest status epilepticus in patients with a PSS. A single



A

B

2

Postgadolinium T1 axial (A) and sagittal (B) MRIs of a dog with a brain tumor

AED = antiepileptic drug, CRI = constant-rate infusion, GABA = gamma-aminobutyric acid, EG = ethylene glycol, PR = per rectum, PSS = portosystemic shunt

## Causes of Seizures & Tremors

- Hypoglycemia
- Derangements of calcium, sodium, magnesium, phosphorus
- Primary epilepsy
- Encephalitis
- Neoplasia
- Hepatic encephalopathy
- Renal disease
- Liver disease
- Head trauma
- Cardiac disease
- Neurologic disease
  - Degenerative brain disease
  - Vascular events
  - Malformations (eg, hydrocephalus)

## Common Toxicities

- Permethrin or pyrethroids (cats)
- Antiarrhythmic medications
- Baclofen
- Methylxanthines (eg, chocolate)
- Strychnine
- Bromethalin
- Ethylene glycol
- Mold or moldy food
- Antihypertensive medications
- Antidepressants or antipsychotics
- Stimulants
- Marijuana
- Organophosphates
- Metaldehyde (snail bait)
- Xylitol
- Lead
- Ivermectin
- Naphthalene (moth balls)
- Fluorouracil

induction dose is typically insufficient to arrest status epilepticus, and CRI is often necessary; this may be administered with or without concurrent CRI of a benzodiazepine and/or during long-term AED administration. While some controversy exists regarding the antiseizure effects of propofol, it has been reported as successful treatment in humans with refractory status.<sup>2-7</sup> Patients on propofol infusions usually require intubation to protect the airway and may require oxygen supplementation and/or assisted ventilation to avoid risk for apnea.

Patients unresponsive to these medications may be anesthetized with isoflurane for 1 to 6 hours while long-term AED therapy is initiated.

Several other AEDs are available for injection: Levetiracetam (**Figure 3**) is immediately effective with few adverse effects and has become more widely used in veterinary medicine. Bromides (eg, PO or PR potassium bromide, injectable sodium bromide) may also be administered as long-term AEDs in dogs only. Although they are not widely used in veterinary medicine, phenytoin and pentobarbital may be alternative agents for seizure prophylaxis or treatment of status epilepticus.<sup>8-10</sup>

## Consequences of Status Epilepticus

Seizures are not benign and may warrant investigation or additional treatment. Excessive muscular movement may result in severe hyperthermia that can lead to hypocoagulation, severe GI signs, and multiple organ failure; seizures can also result in



Levetiracetam injection has become more available in recent years and has few adverse effects; it may help control status epilepticus and can be used as a long-term AED.

noncardiogenic pulmonary edema and self-induced trauma. Cerebral edema secondary to hyperthermia and/or prolonged seizures may be treated with mannitol and furosemide and/or hypertonic saline. Steroids may be used when there is structural intracranial disease and inflammation. Some patients may show temporary postictal neurologic deficits, including cortical blindness. ■ **cb**

See **Aids & Resources**, back page, for references & suggested reading.

For More



See the algorithm on **Status Epilepticus: Emergency Management** on page 33 of this issue.