

Hurricane Animal Hospital  
One Davis Court  
Hurricane, WV 25526  
(304) 562-3321  
www.hurricaneanimalhospital.com

## Seizures: What You Need to Know

### What is a seizure?

Seizures are caused by an electrical storm in the brain. Normal brain cells (neurons) use the electrical and chemical signals to communicate with each other. This communication can either be **excitatory**, tending to activate the next neuron, or **inhibitory**, tending to shut the next neuron off. A delicate balance of these excitatory and inhibitory influences on any given neuron determines whether it is going to become activated and pass information on to other neurons. If the balance within the brain shifts too far toward excitation, too many cells may become too excited and a seizure can result. Keep in mind, we are talking about excitation or inhibition of individual neurons in the brain, not whether your pet is excited to see you when you get home. In fact, seizures in dogs occur most commonly when the pet is relaxed or asleep, although they can occasionally be associated with exercise or emotional arousal.

We can see this excess excitation if we record the electrical activity of the brain through an electroencephalogram (EEG). On the EEG, the seizure will appear as a series of sharp spikes as waves of excitation overtake the brain. This electrical storm then causes changes in the behavior and movement of the animal which we recognize as a seizure. There are several different types of seizures depending upon the nature and location of the electrical storm.

### Types of Seizures

Seizures are broadly divided into two types: **generalized** and **focal** (or partial) seizures. In a generalized seizure, the electrical storm appears to arise everywhere at once. In a partial seizures, the abnormal activity arises in a small area of the brain. Since your veterinarian may not see one of the seizures, he or she will rely on your description of what your pet does during the seizure to help them classify it. The descriptions provided here will help you understand the types of seizures, but don't jump to conclusions. Describe for your veterinarian or the neurologist exactly what you observe.

### **Generalized, tonic-clonic (grand mal) seizures**

Generalized seizures are further divided into two sub-types: major motor seizures (grand mal) and absence seizures (petit mal). The major motor seizures is the classic seizure. It is also sometimes called a tonic-clonic seizure. A classic seizure can have three phases, the aura or prodrome, the seizure itself (sometimes called the ictus), and post-ictal (post seizure) behavior. Not all seizures have three phases, but commonly they will.

The most common time for a dog to have a seizure is when they are relaxed and

quiet. They may even occur from a sound sleep. Seizures can occur anytime, but if they occur only when an animal is excited or exercising, it may indicate a heart problem or low blood sugar.

Just as some dogs can sense when their epileptic owner is going to have a seizure, some owners can sense when their epileptic dog is going to have a seizure. The **aura or prodrome** is a recognizable change in the pet's behavior that alerts the owner to an impending seizure. Most commonly, the pet that has an aura will act upset and anxious. He may seek attention from his owner or withdraw and hide. This aura may represent a focal beginning of the seizure and thus indicate a focal seizure, but we commonly see it in generalized seizures as well.

The classic seizure itself is called a **tonic-clonic seizure**. It begins with a stiffening of the muscles (the tonic part). Usually the pet will fall to their side with the legs stretched out and the head back. Once the seizure has begun, the pet is no longer conscious even though his eyes will remain open. Sometimes they will vocalize or the face may twitch. The vocalizations are involuntary and do not indicate pain. Often he will drool excessively, or he may urinate, defecate, or empty his anal glands causing a foul smell. He has no control over these "accidents" and is completely unconscious during the seizure. This tonic phase is usually very brief (less than 30 seconds) and gives way to rhythmic movements (the clonic part). Typically this consists of chomping of the jaws and jerking or running movements of the limbs. Often he will not breathe well during a seizure and the tongue may turn blue. Even though the seizure may seem to go on forever, the average seizure lasts less than 2 minutes. If the seizure goes on much longer, we become concerned that the pet may go into a continuous seizure (an emergency situation).

### **Post-ictal Behavior**

Following the seizure, the pet may lay motionless for a period of time. Eventually he gets back on his feet. He may bounce back and be perfectly normal afterwards, but more typically there is a period of post-ictal behavior. Often the pet appears blind and disoriented during this post-ictal phase. He may pace or run about the house, bumping into things as he goes. Sometimes they are excessively hungry and will devour any food available. Rarely, a dog may behave aggressively during this period, especially if they are restrained. While such aggressive behavior is rare, it is important to recognize the possibility, especially if the dog is large and there are children in the household. Usually this post-ictal behavior begins to resolve within a few hours after the seizure and the dog gets back to normal.

### **Variations on the Theme**

Not all generalized seizures follow this pattern. Some won't show any aura but strike out of the blue. Some pets bounce back immediately after the seizures as if nothing had happened, while others may be disoriented for days. Some may show only tonic rigidity during the seizure itself, while others may show only clonic jerking and paddling. More rarely still, the pet may simply drop limply to the ground and lay motionless. A "drop attack" like this is more typical of a fainting spell, but can occur with seizures.

### **Cluster Seizures and Status Epilepticus**

Most seizures are brief and isolated, but sometimes they can be more serious. The large-breed dogs tend to have clusters of seizures. In these cases, the dog will have one seizure and recover from it. Then a few hours later, they have another. They never completely recover before another seizure strikes. Then they have another seizure, then another seizure, then another, another, another ... Sometimes this culminates into a continuous seizure that doesn't stop, a condition called **status epilepticus**. Occasionally status epilepticus can arise out of the blue; the animal begins seizing and never stops. Either way, this is a true emergency requiring immediate veterinary care.

### **Effects of Seizures**

Most seizures are brief, and with proper treatment, the pet can lead a normal life. None-the-less, seizures are serious business and even short seizures can cause brain damage. That damage tends to be cumulative over time. If the seizures are short, the main effect is an increased chance of another seizure in the future. Thus, there is a tendency for epilepsy to get worse over time, especially if left untreated.

If a seizure goes on for more than 30 minutes, the pet is liable to suffer serious permanent brain damage. This can be manifested as a change in personality, or loss of memory for things such as house breaking. Occasionally the pet may be left in a coma from the seizures. The seizure also creates a tremendous amount of stress on the heart and other organs. The body temperature may get very high from all the muscle activity and the animal may not breathe adequately. Sometimes the stress is too much and the pet may have a heart attack and die. Fortunately, this is rare.

### **Absence (petit mal) Seizures**

The other type of generalized seizures in people is the absence or petit mal seizure, Petit mal seizures differ from other seizures in several important aspects. First there is little movement during a petit mal seizure. As the name "absence" implies, the dog simply loses contact with the world during the seizure. They stare blankly and may blink but do little else. Absence seizures are also different in that they probably represent a storm of excitation within the brain. This creates a unique EEG pattern. This means that very different drugs are used to treat petit mal seizures. We're not sure if petit mal seizures really occur in pets. Most of the seizures that are called petit mal seizures in pets are actually focal seizures.

### **Focal Seizures**

In focal or partial seizures, the electrical storm begins in an isolated area of the brain. If we are recording an EEG at the beginning of such a seizure, we can see the storm starting in one part of the brain. A focal seizure may stay localized, or it may spread and affect the whole brain causing a classic, generalized, tonic-clonic seizure. In some cases, the aura preceding a generalized seizure may actually be a focal seizure. The fact that the seizure starts in a local area suggests that localized damage has occurred. As a result, when we see focal seizures, we are more worried about diseases which will cause local damage, such as a brain tumor or infection. Focal seizures are further divided into

two subtypes (simple or complex) depending on where the storm originated and how it affects the pet.

### **Simple Focal Seizures**

Simple focal seizures (also sometimes called minor motor or focal motor seizures) originate in the area of the brain that controls movement. A localized storm in this area results in movement of the area of the body controlled by that part of the brain. Most commonly, the face is affected resulting in twitching or blinking. This is usually limited to one side of the face. If the seizure spreads a bit, other parts of the body on that side will be affected. For example, the front limb may then begin to twitch and buckle. During a simple focal seizure, the pet is usually alert and aware. They may attempt to seek out their owner, confused about what is happening. The seizure may stop there or it may generalize. If it generalizes, the pet loses consciousness and has a classic grand mal seizure.

### **Complex Focal Seizures**

Complex focal seizures originate in the areas of the brain that control emotions and behavior (the temporal lobes) and are sometimes called psychomotor seizures. When a seizure begins in one of these areas, the animal's consciousness is altered and they may behave bizarrely. They may run uncontrollably, engage in senseless, repetitive behavior, or rarely, fly into a rage. Other times, we see bodily functions affected and the pet may have diarrhea or vomit. Following a typical generalized seizure, usual behavior (post-ictal behavior) is common and may go on for hours. Complex focal seizures, like other types of seizures, are very brief.

Most often, an animal behaving aggressively or acting strangely has a behavioral problem or some other reason for the change in behavior. If, however, these changes occur as discrete episodes, and the pet also has a generalized seizure, we can be sure that this is a complex focal seizure and treat it accordingly. People with complex focal seizures may experience hallucinations. Some dogs have episodes of "fly snapping" where they appear to be biting at imaginary flies around their head. Some of these may be complex focal seizures although we cannot tell for sure.

### **What Causes Seizures?**

Many things can tip the balance between excitation and inhibition in the brain toward too much excitation. Keep in mind, we're talking about the excitatory influences on nerve cells in the brain, not the dog's emotional state. Once a certain threshold of excitation has passed, any animal may seize. Things that can push an animal past that threshold include toxins, metabolic diseases, and direct damage to the brain.

Some plants have evolved **toxins** which cause seizures as a defense against insects or other plant-eating animals. If your pet eats such plants, they could be similarly affected. We utilize some of these plant toxins and related chemicals as insecticides to protect our pets from fleas and our tomatoes from horn worms and these insecticides can cause seizures if used inappropriately. Other toxins, such as lead and some industrial chemicals, can also cause seizures. Thus your veterinarian will need to know about potential exposure to these compounds if your pet has a seizure.

The **metabolic state** of the pet will also influence the brain and can secondarily cause seizures. If the brain doesn't get an adequate supply of oxygen and nutrients to fill its needs, the excitability of the cells may increase and seizures result. Thus low blood sugar or heart disease may cause seizures. Electrolytes (different salts normally present in the body) play important roles in brain function. Alterations of these electrolytes (particularly sodium and calcium) can cause seizures. Low calcium levels can be a problem in a nursing mother. Toxic byproducts are constantly being produced in our body from normal activities of the organs. The liver and kidneys have the job of getting rid of these toxic byproducts. If either of these organs isn't able to do its job, these byproducts can accumulate and seizures may be one of the results. If your pet is having seizures, your veterinarian will recommend blood tests both to determine if one of these metabolic diseases is the cause and to provide a base line to watch for potential side effects of the antiepileptic drugs which may be used.

**Physical damage** to certain areas of the brain can produce an epileptic focus. This is a small area of the brain that initiates focal seizures which in turn can lead to generalized seizures. We don't know how local damage causes the electrical storm in that area, but we do know that many types of damage can have this effect. Thus head trauma, brain tumors, infections in the brain (encephalitis), strokes, just about anything that damages the brain can lead to seizures. If your veterinarian suspects such brain damage as the cause, they may refer you to a veterinary neurologist for brain scans, spinal taps, or other tests to be sure there isn't a brain tumor or other explanation for the seizures. We become especially worried about such acquired damage if the dog falls outside the age range where we typically see hereditary epilepsy, that is if they are less than one year or more than 3-5 years old. Sometimes, removing the cause of the damage cures the epilepsy. Other times, the damage has been done, and even if we can't remove the tumor or control the infection, the pet is often left with epilepsy. Even if we don't cure the epilepsy, the seizures will be easier to control without the continuing damage from an untreated tumor or infection. In addition, such a disease left untreated may well cause other, potentially even more serious problems.

For more information, see "Epilepsy" Handout and "Treatment of Epilepsy" Handout