Seizures in Dogs - Part 1

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1. Introduction.

Seizures are the one of the most common problem in dogs. Up to 5.7% of all dogs experience seizure during their lifetime. The clinical manifestation may be very dramatic and violent and very stressful for the pet owner. For an accurate management it is very important to identify and treat, whenever possible, the underlying cause. Most of the time the affected pets have to be treated with antiseizure medications for the rest of their life; however, with proper treatment, pets affected by seizures can usually maintain a good quality of life.

2. Definition

A seizure event is the clinical manifestation of an abnormal hypersynchronos electrical activity of the cerebral cortex, the clinical manifestation of this abnormal electrical activity is a transitory and involuntary change of the normal neurological status, and it is usually self-limiting.

3. Pathophysiology

Brain neurons communicate each other by electrical discharge (called depolarization). If one area of the brain or the entire brain at once starts firing excessively and without voluntary control, create a prolonged electrical activity called paroxysmal depolarization shift (PDS). The area of the brain where this abnormal electrical activity originates is called *seizure focus.* (Fig. 1)

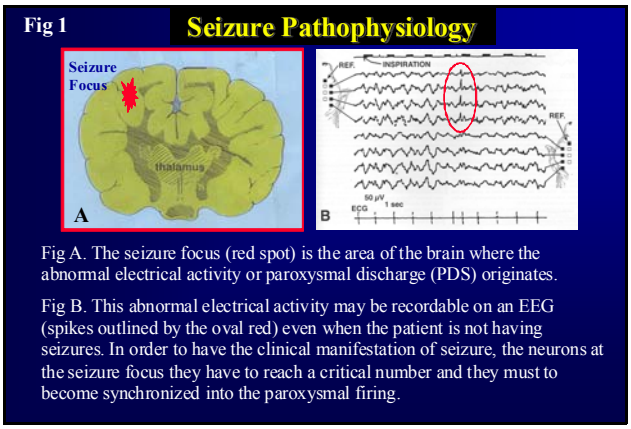
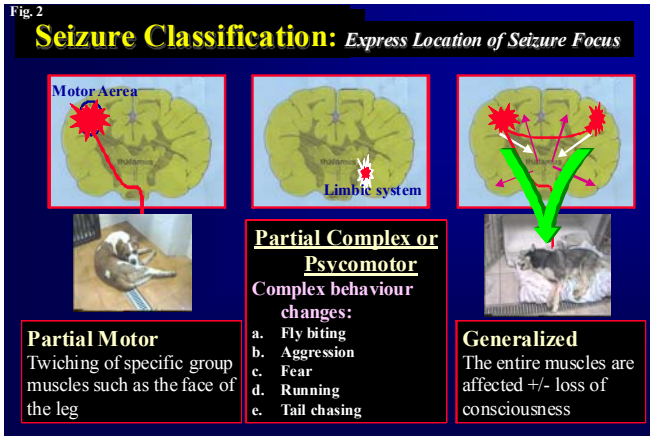


Fig A. The seizure focus (red spot) is the area of the brain where the abnormal electrical activity or paroxysmal discharge (PDS) originates.

Fig B. This abnormal electrical activity may be recordable on an EEG (spikes outlined by the oval red) even when the patient is not having seizures. In order to have the clinical manifestation of seizure, the neurons at the seizure focus they have to reach a critical number and they must to become synchronized into the paroxysmal firing.

At the seizure focus an imbalance exists between excitatory and inhibitory mechanism that favor the sudden onset of excitation. Increase excitability and the consequent PDS may result from:

The clinical manifestation of the seizure will correspond to the area of the brain where the seizure focus originates. For example, if the seizure focus originates in the area of the brain responsible for the movement on of one leg or to one side of the face, the initial clinical manifestation will be a twitching of the leg or the one side of the face; this is called focal motor seizure or partial motor seizure. If the seizure focus spread to the entire brain, the entire body will be affected and consciousness may be lost: this is called focal seizure with secondary generalization (or Jacksonian seizure). If the seizure focus originates from the area responsible for behavior or from the limbic system or the temporal lobe we may have behavioral change such as aggression, hiding, running away for no apparent reason, or biting at imaginary objects (fly biting); this is called complex focal seizures or psychomotor seizure. (Fig. 2)



Seizures Classification: it is based on their clinical manifestation

A. Generalized seizures

These are seizures in which the initial clinical signs reflect involvement of both cerebral hemispheres. The most common type of seizure is the generalized tonic-clonic seizure, mostly known as grand mal seizure. Other types of seizures included in this category are tonic, clinic, atonic, myoclonic and absence (or petit mal) seizures.

a. ***Generalized tonic-clonic or grand mal seizures***. The seizure typically starts with a tonic phase, which is a sustained contraction of all muscles. The dog may or may not lose consciousness and fall to its side with the neck in rigid extension or in dorsiflexion with the limbs extended. Breathing is often irregular and or absent at this time, and the dog may start salivating, urinating or defecating involuntary. This tonic phase, may last for approximately one minute. This phase is followed by the clonic phase, during which there is paddling or jerking of the limbs and chewing movements. This phase may last several minutes. This entire episode is called ictus, which is one phase of the seizure, it is usually self-limiting and it is generally followed by some other transient clinically abnormalities, called post-ictal phase, as consequences of the seizures itself. These may include disorientation, restlessness, gait incoordination, blindness and deafness, compulsive drinking, pacing, etc. Post-ictal abnormalities usually resolve after several hours, but can last for days, particularly if the seizure was prolonged.

b. ***Tonic seizures***: In this type of seizure, the abnormal motor activity consists only of generalized muscle rigidity without a clonic phase.

c. ***Clonic seizures***: These seizures manifest with paddling and jerking with no tonic component

d. ***Atonic seizures:*** these are infrequent type of seizures and manifest with a sudden brief loss of generalized

fraction of second.

e. ***Myoclonic seizures:*** brief, rhythmic contraction of specific muscle groups

f. ***Absence seizures.*** These are frequent in children and are characterized by an abrupt, brief loss of consciousness lasting approximately 5-10 seconds. These are also called Petit-mal seizures. This term is often used erroneously to refer to any sort of mild seizure or partial seizure. Absence seizures are rare in animals and are difficult to document.

Cluster seizures (serial seizures): cluster seizures are two or more seizures occurring over a brief period and with the dog regaining consciousness in between the episodes. The occurrence of more than three seizures in 24 hours period, should be considered an emergency situation because it may predispose to a life threading condition called status epilepticus.

Status Epilepticus: Status epilepticus is defined as a continuous seizure lasting at least 5 minutes or two or more generalized seizures without full recovery of consciousness between the episodes. Continuous seizure activity of 30 minutes or longer may cause other systemic dysfunction, such as severe brain hypooxigenation, hypo or hypertension, hyperthermia, etc, which can lead to temporary or permanent brain damages.

Epilepsy.
Epilepsy is a condition characterized by recurrent seizures over a long period of time. It is usually classified in idiopathic epilepsy, symptomatic epilepsy, and cryptogenic epilepsy. Idiopathic epilepsy is diagnosed when an underlying possible cause for seizures (other than hereditary factors) cannot be

The age of onset is usually 1-5 year of age. It is inherited in some breeds but it can occur in any breed of dogs. The most common manifestation is the generalized tonic-clonic seizure, but other type of generalized or focal seizures can occur. Seizures usually occur spontaneously at night or when the patient is at rest or sleeping. Initially, seizures are infrequent (every 1 or 2 months), and if not treated they tend to increase in frequency and intensity.

Symptomatic epilepsy is diagnosed when a known or identified disorder of the central nervous system is determined to cause the seizures. Causes of symptomatic epilepsy are usually classified in intracranial and extracranial causes.

a. Intracranial causes of seizures include primary lesions of the brain:
   i. Degenerative diseases (e.g., storage diseases)
   ii. Developmental diseases (e.g., hydrocephalus)
   iii. Neoplasia
   iv. Infectious/Inflammatory diseases (e.g., bacterial, viral, fungal, protozoal, autoimmune)
   v. Trauma
   vi. Vascular (e.g., brain infarct, brain hemorrhage)

b. Extracranial causes of seizures include a disorder outside the brain that affects the brain.
   i. Metabolic disorders (hepatic encephalopathy, hypoglycemia, electrolyte abnormalities (e.g, hypocalcemia)
   ii. Toxins (e.g., lead, organophosphate, ethylene glycol)

Cryptogenic epilepsy is diagnosed when seizures are suspected to be symptomatic, but an underlying cause cannot be determined.

TO BE CONTINUED - ISSUE 4 OF 2011