By Steven Karceski, MD

How to Identify the Signs and Symptoms of Partial Seizures

The clinical presentation can at first seem to indicate a number of diagnoses. Here's how to narrow the choices.

Localization related epilepsy (LRE) is also called partial epilepsy. A person who has a single kind of LRE may experience any combination of partial seizures: *simple partial*, *complex partial* and *secondarily generalized*. There are many causes of partial seizures, including head injuries, tumors, infection, and stroke (Table 1). Many people with partial seizures recall having a "warning" or "aura" just prior to losing consciousness. The aura is the simple partial portion of the seizure. As the seizure propagates, and involves a larger volume of cerebral cortex, consciousness can no longer be preserved (i.e., the person loses awareness). It is at this point that it becomes a complex partial seizure. In some cases, simple partial and complex partial seizures will spread to both hemispheres. When this occurs, the resulting tonic-clonic seizure is referred to as a secondarily generalized.[1]

A detailed history and physical exam may provide clues to the origin of the seizures. The description of the seizure, called the seizure *semiology*, is critical in this process. To get the clearest description of the event, the physician must combine the patient's recollection with the observations of friends, family or other witnesses. Of course, some brain regions are "silent." That is, a seizure may start in one area but produce no obvious outward signs or symptomatic complaints. When the seizure spreads to "symptomatic" cortex, localizing information becomes available.[2]

Localization of seizure onsets is important for several reasons. First, identification of partial seizures may direct specific treatments. For instance, if a person's partial seizures are refractory to medical management, epilepsy surgery may be considered. In order for surgery to be successful, accurate identification of the region of seizure onset is needed. This localization begins with a description of the seizure semiology. In combination with medical testing, this information is a critical step in the presurgical evaluation of persons with focal seizures.

Galen first used the term "aura" to refer to the "breath of air" that occurred just before the seizure started. The use of this term has continued to modern times. The aura is the portion of the seizure that the person can recall, and is the simple partial portion of the seizure. If the seizure spreads, consciousness is lost (or altered), and the person will not remember anything but the aura. At this point, the accounts of witnesses may provide clues to the location of the seizure onset.

Sensory Symptoms

Up to 60 percent of auras include some type of sensory component. Most sensory symptoms are described as "pins and needles". The symptoms are usually unilateral, and most commonly involving the face, arm, and hand. In most people, the symptoms indicate that the seizure started in the contralateral cerebral hemisphere. However, as with all "rules", there are always exceptions, and there have been instances where the sensory symptoms were ipsilateral to the region of seizure onset.

When carefully examined, sensory symptoms that "march" from one body region to an adjacent region have the most specific localizing value, indicating that the seizure involves the contralateral parietal lobe. More specifically, the pins-and-needles sensation indicates that the seizure involves the somatosensory region (i.e., the postcentral gyrus). However, this is not the only area from which sensory symptoms may arise. Contralateral mesial frontal structures can also produce sensory symptoms. In some instances, the superior temporal gyrus has been shown to cause *bilateral* sensory symptoms.

Pain is an uncommon aura. When it occurs, it often means the seizure involves the contralateral parietal lobe. However, the mechanism that produces the pain is not well understood, and there are cases of pain that is ipsilateral to the region of seizure onset. In these cases, involvement of the thalamus may be responsible for the ipsilateral nature of the symptoms.

Motor Symptoms

Unilateral clonic movements are one of the most frequently encountered lateralizing signs. Just as with sensory symptoms, the face, arm, and hand are most often involved. The mechanism in most cases is through direct involvement of the primary motor strip (*i.e.*, the prefrontal gyrus). Less often clonic movements can be produced by the contralateral frontal lobe.

Unilateral tonic or dystonic movements may help with seizure localization. Seizures that cause these movements are either frontal or temporal lobe in origin. Up to 89 percent of patients with frontal lobe epilepsy had contralateral limb dystonic posturing. In persons with temporal lobe epilepsy, dystonic posturing predicts onset in the contralateral hemisphere nearly 100 percent of the time.

Asymmetric dystonic posturing can also be helpful. Usually, one arm is rigidly

Definitions of Seizure Types

Simple Partial Seizure: consciousness is unimpaired. The symptoms or signs of a simple partial seizure are determined by the region of brain in which the seizure occurs. The seizure occupies a limited volume of cerebral cortex.

Complex Partial Seizure: consciousness is impaired. The seizure occupies a larger volume of cerebral cortex such that normal thinking is impaired. Often, complex partial seizures cause automatisms (complex coordinated and involuntary movements). In some people, the automatism will be a perseveration of the activity they were performing at the time the seizure started. For others, the automatism may be primarily oral: repetitive chewing, swallowing, lip smacking or pursing of the lips. Other types of motor automatisms include repetitive picking of the clothes or semi-purposeful manipulation of objects in the environment.

Secondarily Generalized Seizure: The seizure starts as a simple partial or complex partial seizure, but propagates to both hemispheres, manifesting as a tonic-clonic seizure. A tonic-clonic seizure starts with a tonic phase (stiffening) followed by low amplitude, high frequency bilateral shaking. As the seizure progresses, the clonic movements increase in amplitude and slow in frequency.

Table 1. Common Causes of Seizures

Newborn, Infant, and Child	Adolescent and Adult
• Infection	• Infection
• Perinatal Injury (hypoxia; ischemia; intracranial hemorrhage; trauma)	• Drugs or drug withdrawal
• Structural (congenital malformations of the brain)	• Stroke (hemorrhagic; ischemic)
• Metabolic (hypoglycemia; hypocalcemia; hypomagnesemia; inborn errors of metabolism)	• Mass lesion (tumor, AVM)
• Other (familial; vitamin B6 deficiency; febrile convulsion)	• Metabolic (uremia; hepatic failure; hypoglycemia; electrolyte abnormalities)
	• Other (familial; mitochondrial diseases; neurodegenerative conditions; psychiatric)

extended at the elbow while the other is flexed at the elbow, giving a "figure 4" sign. The side of the extended elbow indicates that the seizure started contralaterally in the majority of cases. Seizures that include the "figure 4" sign as part of their semiology either arise from the opposite temporal lobe or the contralateral frontal (usually mesial) lobe.

Partial seizures can cause versive head and eye deviation. This finding is important in two stages of the partial seizure. If the head and eye deviation occurs while the person is alert (the simple partial seizure), it indicates contralateral motor involvement (as described above). Versive head and eye movements that occur *as the seizure is secondarily generalizing* indicate that the seizure started in the contralateral hemisphere. However, in this instance, the versive head movements do not have *localizing*, only *lateralizing* value.

After a seizure (the post-ictal period), a person may have weakness in one arm or leg, called *Todd's paresis* or *Todd's palsy*. When this occurs, it helps to at least lateralize the seizure onset. Todd's paresis indicates a contralateral seizure onset. Though not entirely clear, the weakness may be due to exhaustion of the affected neurons. After a seizure, there may be a regional increase in inhibitory neurotransmitters to prevent further seizures. It may be that the increased inhibition causes the contralateral weakness of a Todd's.

Auditory Symptoms

Auditory symptoms occur in less than one-fifth of partial seizures.[2] Often, the sounds are heard bilaterally; less often it is unilateral. Sometimes, instead of hearing a noise, the person will describe "muffled" hearing. In all cases, the seizure involved the superior temporal gyrus. Because this structure receives input from both ears, seizures that involve this region more often cause bilateral ringing, chirping, or buzzing noises in both ears.

Vomiting

Occurring rarely, ictal vomiting (or gagging) indicates that the seizure involves (usually) the nondominant insular cortex. Electrical stimulation testing in animals and humans causes vomiting. In addition, resection of this region of brain can cause decreased gut motility. Although helpful in localizing seizures, ictal vomiting may be misleading. Seizures that start ion the temporal lobe often spread to the ipsilateral insular cortex. In addition, temporal lobe seizures can quickly spread to the contralateral insular cortex. In other words, although ictal vomiting usually means that the nondominant insular cortex is involved, by itself, it may not indicate the hemisphere in which the seizure arose.

Conclusions

Two-thirds of people with seizures will stop having them when they take medications.[3] The remaining one-third may be candidates for resective epilepsy surgery. An accurate description of the seizure semiology is the first step in identifying the epileptogenic cortex. The physician combines this with high-resolution MRI, EEG, and video-EEG monitoring to narrow the list of possibilities. In some instances, functional studies such as SPECT, PET or MEG are needed to identify the epileptogenic zone. The success epilepsy surgery depends partly on the region of brain that must be removed; however, up to 85 percent of people with refractory epilepsy can become seizure-free following certain kinds of resective epilepsy surgery. **PN**

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