

# Status Epilepticus and Cluster Seizures

Edward (Ned) E. Patterson, DVM, PhD

## KEYWORDS

• Dog • Epilepsy • Seizures • Diazepam • Phenobarbital • Levetiracetam

## KEY POINTS

- First-line (emergent initial) therapy for dogs or cats with prolonged (>5 min) seizures or seizures without recovery between should be initiated as soon as possible with a benzodiazepine drug at home (dogs) or in the veterinary hospital.
- Following first-line therapy, urgent therapy with parenteral loading doses or miniloading doses of a long-acting antiepileptic drug such as phenobarbital, levetiracetam (LEV), or bromide (dogs only) should be given to rapidly attain therapeutic levels of a chronic therapy drug.
- The etiology of status epilepticus (SE) should be diagnosed and treated as soon as possible.
- For companion animal patients failing to respond to first line therapy, second-line therapy should be attempted with nonanesthetizing doses of intravenous phenobarbital and/or intravenous LEV and/or a constant rate infusion (CRI) of diazepam or midazolam.
- Companion animals in refractory SE because they have failed to respond to first- and second-line treatments should be anesthetized with a CRI of propofol or pentobarbital or other anesthetic as third-line therapy.

## DEFINITIONS

### *Status Epilepticus*

Status epilepticus (SE) in the current veterinary and human literature is most often defined as a single seizure lasting 5 minutes or longer, or 2 or more seizures without recovery between.<sup>1</sup> Previous definitions had often been seizure activity lasting for at least 30 minutes due to the clear-cut potential for permanent damage at that point. The rationale for a shorter duration for the definition has been the need for urgent and aggressive treatment early in the process well before the 30-minute mark.<sup>2</sup>

### *Generalized Seizure*

This type of seizure is one in which the first clinical changes indicate the initial involvement of both cerebral hemispheres.<sup>3</sup>

Department of Veterinary Clinical Sciences, College of Veterinary Medicine, University of Minnesota, 1352 Boyd Avenue, St Paul, MN 55108, USA

E-mail address: [patte037@umn.edu](mailto:patte037@umn.edu)

Vet Clin Small Anim ■ (2014) ■–■

<http://dx.doi.org/10.1016/j.cvs.2014.07.007>

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***Focal Seizure***

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A focal seizure is one that originates within neuronal networks limited to 1 hemisphere. Such networks may include cortical and subcortical structures.<sup>4</sup>

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***Convulsive Status Epilepticus***

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Convulsive SE (CSE) is SE with convulsions that are associated with rhythmic jerking of the extremities such as generalized tonic-clonic movements and/or mental status, impairment and/or neurologic deficits.<sup>5</sup>

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***Nonconvulsive SE***

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Nonconvulsive SE (NCSE) is defined as prolonged seizure activity seen on electroencephalography (EEG) without the clinical findings associated with CSE, with either a wandering and confused patient or a patient with severely impaired mental status.<sup>5</sup> Although NCSE could be common, it has rarely been recognized in veterinary patients to date; therefore this article will not address NCSE beyond this section. Continuous intensive care unit (ICU) EEG monitoring is routinely done for human SE patients. Similar monitoring for NCSE has been done in some canine and feline patients and proposed to be further investigated,<sup>6</sup> but it is not standard practice in veterinary ICUs at this time.

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***Acute Repetitive Seizures and Cluster Seizures***

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Acute repetitive seizures (ARS) in people have been variably defined, but an accepted definition is 3 or more seizures in the 5 to 12 hours prior to presentation.<sup>7–10</sup> In dogs, frequent seizures (ie, ARS) have usually been defined as cluster seizures (CS). Definitions of CS in dogs have been inconsistent between publications, but they generally have been defined as a bout of multiple seizures occurring over a short period of time that is different from the patient's typical seizure pattern. A useful clinical definition of CS is 2 or more seizures occurring within a 24-hour period, in which the patient regains consciousness between the seizures.<sup>11</sup>

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***Refractory SE***

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Refractory SE (RSE) in people is defined as continuation of either clinical or EEG-defined seizures after receiving adequate doses of initial benzodiazepines followed by a second acceptable antiepileptic drug (AED).<sup>5</sup> Patients with RSE usually require anesthetic agents at anesthetic doses as third-line treatment.

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***Super RSE (SRSE)***

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Super RSE (SRSE) is SE that goes on 24 hours or more after the onset of anesthesia<sup>12</sup>; because of financial constraints and other considerations, companion animals are often euthanized before SRSE occurs.

Recently, several definitions regarding seizures in companion animals have been proposed (**Box 1**).<sup>1</sup> These proposed definitions are based on, but not identical to current definitions for people.

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**INTRODUCTION**

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Most seizures in dogs and cats are self-limiting and last a couple of minutes or less. Seizures that last more than a few minutes or occur back-to-back without recovery between are emergencies and should be treated promptly, aggressively, and with a systematic plan. If 30 to 60 minutes of continuous seizure activity occur, irreversible neuronal damage begins, mainly because of excitotoxic cell injury related to excessive glutamate release.<sup>13</sup> Resulting autonomic and endocrine dysfunction can lead

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