Downward Dog: Now What?
A Multidisciplinary Approach to the "Down Dog"
From Transient Ataxia to Collapse

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A number of cardiac and neurologic conditions can cause a dog to collapse. Any significant cardiac disease will drain a patient's energy just like any serious neurologic problem affecting the brain, spinal cord or neuromuscular system. But most cardiac or neurologic diseases are fairly easy to characterize, because most have distinct abnormalities on the physical or neurologic examination. However, one of the most challenging problems is where the animal has a transient loss of consciousness (T-LOC) or sometimes a transient loss of balance. Potential causes include fainting (i.e syncope), a disorder of balance (i.e. a cerebellovestibular disorder) or some type of atypical seizure (given that most of us would recognize a typical seizure for what it is). When these events are transient, they are frequently a significant diagnostic challenge. Even in people, the characterization of an event presents a dilemma, see this brief excerpt from a human neurology article: "Note that not all patients are able to answer the question 'Were you unconscious?' with a simple 'yes' or 'no'. In fact, it is better to ask patients whether they remember every part of the entire attack, or whether there was amnesia for at least part of the events. Likewise, eyewitnesses may be asked whether the patient was unresponsive during part of the attack, and how this was established."[1] No wonder we often find it a challenge in our patients, especially when we then also have to first rely on the owner's assessment of what happened and then we have to interpret what the owner means!

However, even when a specific etiology cannot be identified, it is often possible to narrow down the list of differential diagnoses so that a reasonably accurate prognosis and treatment strategy can be reached. For challenging cases, and in the absence of an EEG (which is only available at UC Davis to the best of our knowledge), it can come down to cycling through a Holter monitor or even an Event monitor and then an MRI or even an anticonvulsant trial to see if the events respond. But capturing a syncopal event or establishing whether or not there is a response to anticonvulsants can depend on the frequency of the events, with occasional events being much harder to pin down than events that occur frequently. It is however important to keep in mind that Holter data inclusive of heart rate variability analysis are likely to provide valuable diagnostic information even if the patient does not experience an event during the monitoring period.

Transient Loss of Consciousness (T-LOC) is a commonly used term, purposely meant to encompass all disorders characterized by self-limited loss of consciousness (LOC), irrespective of mechanism. Syncope is a particular form of T-LOC caused by transient global cerebral hypoperfusion characterized by rapid onset, short duration, and spontaneous complete recovery. An epileptic seizure is a transient occurrence of clinical signs due to abnormal excessive or synchronous neuronal activity in the brain but where cerebral perfusion is within normal limits[2]. The classic seizure has 1.the pre-ictal phase. 2. the seizure itself, which should involve a disturbance of consciousness, abnormal motor activity and often associated autonomic signs, such as salivation or urination. 3. the post-ictal period, which may last for hours and can vary from blindness, aggression, stupor or panic. Seizures in any given patient are generally stereotypic, meaning that if there was a video of the previous event, it would be essentially identical to the current event (other than perhaps varying a little in intensity), which would in turn be identical to the next event.

There can be, however, a degree of overlap in presentation between syncope, epileptic seizures and other causes of transient loss of posture/consciousness. For instance, although LOC often occurs without warning, in some forms of syncope there may also be a prodromal period in which various symptoms (which in people are described as lightheadedness, nausea, sweating, weakness, and visual disturbances) warn that syncope is imminent. In rare cases, if the period of hypoperfusion during a syncopal event is severe then it can even precipitate a seizure. It is also not uncommon for neurologists to see animals referred for a seizure when they have actually had an acute vestibular event and especially a cerebellar infarct, which often causes them to go rigid and to become very disoriented (presumably because their world is spinning rapidly). Trying to ask that animal if it was unconscious during the event is often rather unrewarding!

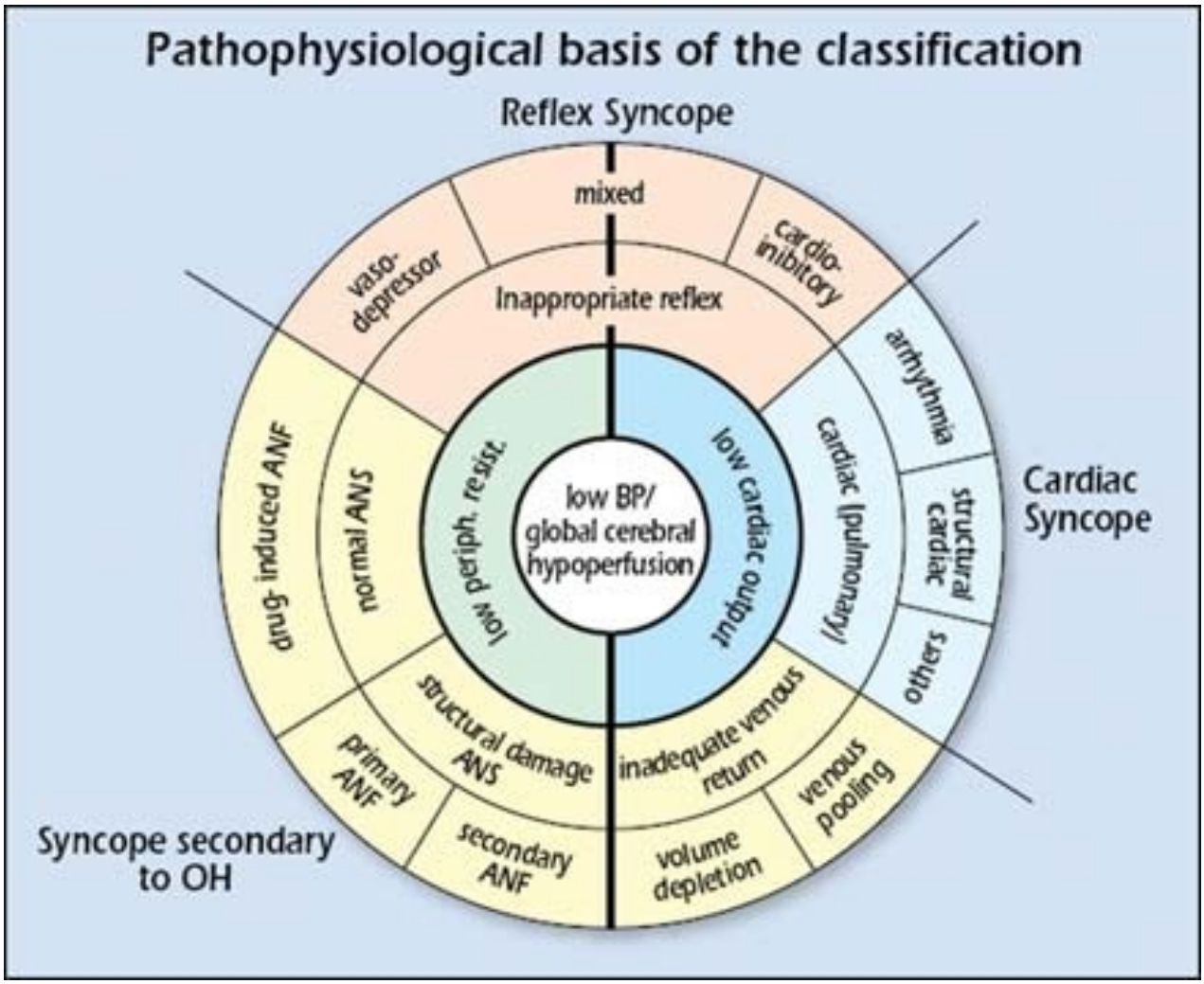
Typical syncope is brief. Complete LOC in reflex syncope lasts no longer than 20 seconds in duration. However, syncope may rarely be longer, even as much as several minutes. Recovery from syncope is usually accompanied by almost immediate restoration of appropriate behavior and orientation. Sometimes however the post-recovery period may be marked by fatigue. In such cases, the differential diagnosis between syncope and, for instance epileptic seizure, can be difficult. Note that a typical seizure is often of a similar duration to that of syncope; in most, though not all cases, the post-ictal period is not characterized by an immediate restoration of appropriate behavior and mentation!

Classification of the Types of Syncope:

Before we continue with some representative case studies it is important to quickly review the most recent classification of syncope based on the Guidelines of the European Society of Cardiology[3]:

Syncope (classification)

- Reflex (neurally mediated) syncope
- Vasovagal:
  - Mediated by emotional stress
  - Mediated by orthostatic stress
- Situational syncope
  - Cough, sneeze
  - GI stimulation (swallow, defecation, visceral stimulation)
  - Post-exercise
  - Post-prandial
- Carotid sinus syncope (cervical/neck stimulation)
- Atypical forms for trigger and/or presentation
- Syncope due to orthostatic hypotension
  - Primary autonomic failure
  - Secondary autonomic failure
  - Drug-induced orthostatic hypotension (beta-blockers, diuretics, vasodilator)
  - Volume depletion (hemorrhage, dehydration, etc)
- Cardiac syncope
  - Bradycardia
  - Tachycardia
  - Drug-induced arrhythmias
  - Structural heart disease: congenital or acquired, valvular or myocardial, cardiac tamponade, constrictive pericarditis, cardiac masses


Pathophysiological basis of the classification
Reflex Syncope
mixed
vaso-depressor
cardio-inhibitory
Inappropriate reflex
arrhythmia
structural cardiac
others
Cardiac Syncope
drug- induced ANF
normal ANS
low periph. resist.
low BP/ global cerebral hypoperfusion
low cardiac output
cardiac /pulmonary/
primary ANF
secondary ANF
structural damage ANS
inadequate venous return
volume depletion
venous pooling
Syncope secondary to OH

Classification of the types of Epilepsy:

Not my favorite topic by any means and something that is both controversial and dynamic in human medicine. Attempts have been made to adapt human classification schemes to veterinary medicine but obviously that is a bit tough if things are not settled for people. But this is a reasonably simple set of terms2 that refer to topics we all use from time to time:

- **Epileptic seizure:** A transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain.
- **Generalized seizure:** A seizure in which the first clinical changes indicate initial involvement of both cerebral hemispheres.
- **Generalized seizure:** A seizure that originates in and rapidly engages bilaterally distributed neuronal networks. Such networks may include cortical and subcortical structures.
- **Partial seizure:** A seizure in which, in general, the first clinical and electroencephalographic changes indicate initial activation of a system of neurons limited to part of one cerebral hemisphere.
- **Simple partial seizure:** A partial seizure without impairement of consciousness. May include motor, somatosensory, special-sensory, autonomic or rarely psychic symptoms (1981; no longer recommended).
- **Complex partial seizure:** A partial seizure with impairement of conscousness. May include symptoms listed under simple partial seizures, as well as abortions of behaviour (automatisms) (1981; no longer recommended).

References

1. Falls, fits, faints and funny turns. Thijs R., Bloem B., & van Dijk J. J. Neurol. (2009); 256: 155-167.
2. Mariani, C. Terminology and Classification of Seizures and Epilepsy in Veterinary Patients. Topics in Companion Animal Medicine (2013); 28: 34-41.
3. Brignole M, et al. Eur Heart J. 2013 Aug;34(29):2281-329.2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy: the Task Force on cardiac pacing and resynchronization therapy of the European Society of Cardiology (ESC). Developed in collaboration with the European Heart Rhythm Association (EHRA).