

CLINICAL APPROACH TO SYNCOPE

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INTRODUCTION

Syncope is a sudden loss of consciousness associated with loss of postural tone (collapse) from which recovery is spontaneous. Pre-syncope is a term used to describe episodic rear-limb or generalized weakness, ataxia, or altered (but not complete loss) of consciousness. The common denominator leading to all forms of syncope is decreased or brief cessation of cerebral blood flow. Severe heart rhythm disturbances are probably the most common causes of syncope in dogs and cats.

SYNCOPE OR SEIZURE?

Distinguishing syncope from seizure can be difficult. Clues for differential diagnosis include situational triggers, prodromal signs, and behavior during the episode, and the events that follow (Table I). Collapse episodes that are precipitated by exercise, stress, cough, gag, emesis, micturition, defecation, and pain are most likely syncope rather than seizure. Disorientation after the event with slow recovery of normal consciousness is common with seizure. However, protracted cerebral hypoxia resulting from cardiac arrhythmia may also be followed by relatively slow recovery. Differentiating seizure from syncope can be confounded by the possibility of "hypoxic convulsive syncope" where prolonged cerebral hypoperfusion results from profound cardiac arrhythmia. Syncope without prodromal signs, without violent tonic-clonic activity, and quick recovery suggests a heart rhythm disturbance. Although usually associated with flaccid collapse, syncope due to arrhythmia can be associated with extensor rigidity and spontaneous urination or defecation. Hypersalivation is rarely associated with syncope due to heart rhythm disturbances. Other causes of transient loss of consciousness include syncope-like episodes caused by hypoxemia or hypoglycemia.

WHAT IS NEURALLY-MEDIATED SYNCOPE?

The definition of neurally mediated syncope (NMS) is: The development of arterial vasodilatation in the setting of relative or absolute bradycardia. Usually, bradycardia is expected with cardiogenic syncope. However, vasodepressor syncope (ie carotid-sinus hypersensitivity) is defined as a pure vasodepressor (vasodilation) reaction. Numerous terms have been used to identify neurally mediated syncope. These include neurocardiogenic syncope, vasodepressor syncope, vasovagal syncope, situational syncope, and reflex syncope. The terms neurocardiogenic and vasovagal syncope are considered synonymous by some but others consider them separately. The term neurocardiogenic syncope is sometimes used when reflex is triggered within the heart or pulmonary arteries. The precipitating event is an adrenergic surge. Vasovagal syncope is common in humans and is triggered in the brain in response to emotional shock, phobias (such as blood phobia and needle phobia), instrumentation and pain.

These mediated syndromes are the result of an incompletely understood autonomic reflex mechanism. Some theories proposed include Baroreflex dysfunction (paradoxical activation of the baroreceptors), Neurohormonal imbalances (renin, serotonin, vasopressin, epinephrine, and Cerebral blood flow abnormalities (impaired autoregulation).

In dogs, neurocardiogenic bradycardia is usually precipitated by fight, flight, fright or startle situations. . ***The common denominator of all neurally-mediated syncope is vagal input to the cardiovascular center of the brainstem with subsequent sympathetic withdrawal, often accompanied by vagal outflow.*** In the clinical setting in dogs, the most easily recognized hallmark is bradycardia. Lethargy persists in some patients after bradycardia has resolved and these patients may be hypotensive from vasodilation. Other cardiac conditions that may be associated with neurally mediated syncope include other causes of pulmonary hypertension, and left ventricular outflow tract obstruction.

A specific variant of NMS includes situational syncope, which is named for the specific situation that is associated with the syncopal episode. Coughing, emesis, micturition, defecation, and exertion are all possible triggers for syncope. In dogs very often the precipitating situations are exertion with excitement, abrupt change from inactivity to sudden "normal" activity, being startled, climbing stairs, physical restraint, bathing, grooming, or barking/jumping with excitement. An ECG or auscultation is required for documentation of bradycardia. A 24-to-48 hour ambulatory ECG (Holter) and even 5 to 7 day event recording are somewhat insensitive since the episodes are often infrequent.

DIAGNOSING THE CAUSE OF SYNCOPE: FIGURE I

The patient history, physical examination, situational activity, and the symptoms that occur during and after the event are crucial to establishing the cause of syncope. Another important diagnostic goal is to document the heart rhythm at the time of the event. In some cases, no underlying cause of syncope can be identified. If the description of the episode is strongly suggestive of syncope, then the cause is generally assumed to be neurally mediated.

- General diagnostic tests
 - When history and physical examination suggest metabolic disorders, serum chemistry profiles should be evaluated for electrolyte abnormalities, renal function, and to rule out hypoglycemia. In addition, complete blood count is used to detect anemia/ polycythemia or white blood cell abnormalities. However, generally these are uncommon in diseases causing syncope.
- Imaging studies
 - Echocardiography should be performed in patients with a heart murmur and/or arrhythmias to assess cardiac structure and function.
 - If a seizure is suspected, brain imaging may be indicated.
- Testing for arrhythmias

The only certain way to confirm an arrhythmia as the cause of syncope is to document the rate and rhythm during an episode. A 24-hour Holter recording is the gold standard to document an intermittent arrhythmia such as supraventricular tachycardia, ventricular tachycardia, and bradyarrhythmias. For longer term monitoring an implantable loop recorder can be utilized. Real-time auscultation (by the owner or veterinarian) during the episode of collapse is some times useful because it documents the associated rate as fast, slow or normal. Caution is advised with real time auscultation because with very rapid arrhythmias an accurate assessment of heart rate can be difficult to ascertain, or the arrhythmia responsible may have already terminated by the time the animal becomes syncopal. Presumptive diagnosis is sometimes legitimate when faced with selected breeds, clinical disorders, precipitating situations, or if an arrhythmia (i.e. ventricular arrhythmias or bradycardia, etc.) is observed on an ECG recording when the patient is not showing clinical signs. Ventricular tachycardia can be presumed as the most likely cause of syncope in Dobermans and boxers, even when subsequent ECGs contain only frequent ventricular premature beats. However, there is a subset of Boxers that can collapse from bradyarrhythmias. If the arrhythmia is episodic then 24 to 48 hour Holter monitoring or 5 to 7 day event recording is useful.

TREATMENT

Treatment varies depending on the cause and is aimed at managing the underlying disorder. If an arrhythmic etiology is discovered, antiarrhythmic medication or pacemaker therapy is indicated. Treatment of neurocardiogenic bradycardia and syncope in Boxers and Doberman pinchers is problematic. Usually, the episodes are infrequent and treatment is not required. The administration of beta blockers can precipitate bradycardia-related syncope in cardiomyopathic Doberman pinchers. Boxers with ventricular tachyarrhythmias that are treated with sotalol and then experience new or more frequent syncopal episodes may be experiencing neurocardiogenic bradycardia. Pacemaker implantation may be required if a bradyarrhythmia is documented during the event. However, if hypotension occurs in conjunction with the bradyarrhythmia, pacemaker implantation may not solve the collapsing episodes. Unfortunately, it is difficult to predict which patients experience hypotension as a component of the syncopal event.

Neurally mediated syncope due to high-preload and pulmonary hypertension usually responds favorably to cardiac unloading therapy. Exertion/excitement-related syncope in elderly small-breed dogs with loud mitral murmurs may be a warning of impending congestive heart failure. Potentially beneficial treatment includes furosemide, pimobendan, ACE inhibitors, and perhaps spironolactone. The author uses furosemide and ACE inhibitors, even if pulmonary edema is not present on thoracic radiographs. After one to two weeks, amlodipine may be added to the treatment regiment to further reduce afterload. The addition of digoxin may decrease the numbers of syncopal episodes. Although the exact mechanism is unknown, digoxin modulates baroreceptor function and inhibits sympathetic nerve discharge (the trigger for this type of neurally-mediated syncope). The frequency of syncope can be further reduced by client education and the avoidance of instigating situations, to whatever extent is practical. Anti-cholinergic therapy can be attempted if behavior modification does not decrease the syncopal episodes. The response to this type of medical therapy is variable among patients.

Beta-blockade has been recommended for treatment of humans with neurocardiogenic syncope precipitated by sympathetic surge but the overall evidence in their favor is weak (POST trial). It is the author's experience that beta-blockade exacerbates neurally mediated syncope in dogs. This relates to the fact that, when documented, episodes are almost always associated with bradycardia.

Syncope in cats is usually the result of a heart rhythm disturbance. Neurally mediated bradycardias and sick sinus syndrome are rare. In old cats, intermittent and high grade 2nd or 3rd degree (complete) AV heart block is the most common arrhythmic cause of syncope and episodic weakness. Hyperthyroidism should be ruled out as a primary cause for these arrhythmias. Young to middle aged cats with cardiomyopathy may have rapid ventricular tachycardia causing syncope (or sudden death). Cats with hypertrophic cardiomyopathy and loud, apical systolic heart murmurs may also experience exertional syncope or presyncope as a result of left ventricular outflow tract obstruction. These patients usually respond favorably to beta-blocker treatment. Metabolic causes of apparent syncope in cats are uncommon. Occasionally, hypoglycemia can occur as a result of insulin treatment in diabetic cats. Profound anemia can result in exertional syncope or pre-syncope.

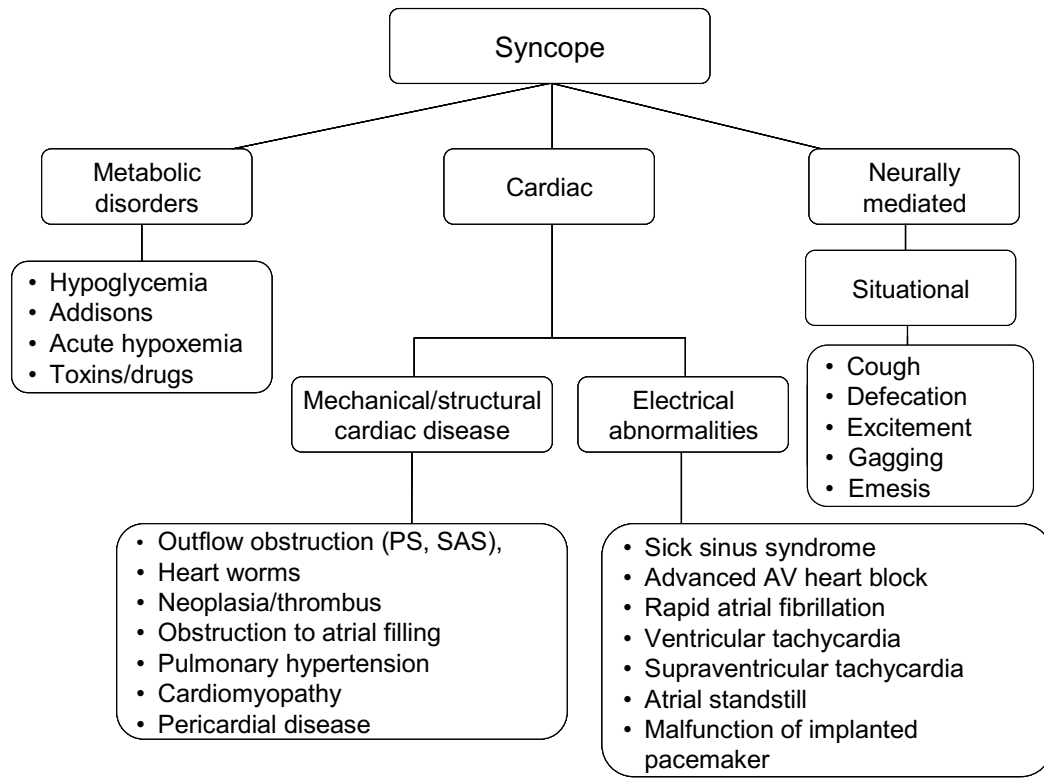
TABLE 1: DIFFERENTIAL DIAGNOSIS FOR SYNCOPÉ

Clinical Features	Syncope	Seizure	Neuromuscular*
Mentation	Normal	Maybe abnormal	Normal
Gait	Normal	Normal	Often abnormal
Alteration of consciousness	Yes	Frequently yes [§]	No
Precipitating events (excitement, stress, cough, gag, etc..)	Yes	Usually none	Variable depending on specific disease
Duration of episode	Short but can be longer	Seconds to minutes	varies
Abnormal mentation after the event	uncommon	Frequent	No
Urination/defecation during the event	uncommon	Frequent	No

* *Neurologic causes include: polymyositis, polyneuropathy, myasthenia gravis, narcolepsy, botulism, tick paralysis, hepatic encephalopathy, paraneoplastic syndromes, central nervous system lesions*

[§] *Some seizures (e.g., simple focal/partial seizures) are not associated with alteration of consciousness*

FIGURE 1. ALGORITHM FOR CAUSES OF SYNCOPE



PS= pulmonic stenosis, SAS= sub-aortic stenosis.

Table 2: **Classification of syncope:**

Category of syncope	Cause of syncope	examples
Cardiac syncope	Bradyarrhythmia	Sick sinus syndrome, AVB: high grade 2 nd or 3 rd , atrial standstill
	Tachyarrhythmia	Ventricular tachycardia, atrial tachycardia, AFib, OAVRT
	Structural heart disease	Aortic and pulmonic stenosis, pericardial effusion, pulmonary hypertension due pulmonary thrombosis/embolism, advanced degenerative AV valve disease, DCM, hypertrophic obstructive CMP
Reflex –mediated syncope	Vasovagal neurocardiogenic	Mediated by emotion: stress, fear, pain (not sure if present in veterinary patients)
	Situational	Intense activity, excitement, coughing, urination/defecation, gagging/ vomiting
	carotid sinus hypersensitivity	Primary dysfunction of baroreceptors in carotid arteries, neoplasia in neck area
Orthostatic syncope	Drug induced hypotension	Acepromazine, hydralazine, amlodipine, nitrates, beta blockers, diuretics
	Volume depletion	Dehydration, hemorrhage, redistribution

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