SYNCOPE AND COLLAPSE
When should I worry?
Robert Vogt-Lowell, MD, FAAP, FAAC, MAAC
Pediatric Cardiologist
Pediatrix Cardiology of Miami

DEFINITIONS
- Syncope is a transient loss of consciousness and muscle tone that results from inadequate cerebral perfusion and from which there is a prompt recovery.
- Presyncope is the feeling that one is about to pass out but remains conscious with a transient loss of postural tone.
- Neither of the above require intervention nor results in end-organ damage as would a cardiac arrest.
- Definitions are clear in the abstract but frequently the challenge is how to classify the event

INCIDENCE
- It is estimated that as many as 15% of children and adolescents will have a syncopal event between the ages of 8-18 years (unusual before 6 years of age).
- As many as 3% of pediatric ER visits in some areas are due to syncope.
- About 47% of college age students report having fainted.
- There is a peak incidence in adolescent girls.
- Female preponderance extends well into adult life.
**PHYSIOLOGY**

- Normal brain function depends on a constant supply of oxygen and glucose.
- The core physiology of any true syncope event is *abruptly ineffective cerebral blood flow*.
- This abrupt ineffective cerebral blood flow can result from ineffective cardiac output or ineffective reflex cardiovascular control.

**CAUSES OF SYNCOPE**

- The differential diagnosis of syncope is broad.
  - Non-cardiac causes (autonomic).
  - Neuropsychiatric conditions.
  - Metabolic disorders.
  - Cardiac conditions.

**NON-CARDIAC CAUSES**

- Orthostatic Intolerance
  - Vasovagal Syncope
  - Orthostatic Hypotension (Dysautonomia)
  - Postural Orthostatic Tachycardia Syndrome (POTS)
- Exercise Related Syncope
- Situational Syncope
  - Breath holding
  - Micturition, defecation and cough syncope
  - Excess vagal tone
ORTHOSTATIC INTOLERANCE
Vasovagal Syncope
Orthostatic Hypotension
Postural orthostatic tachycardia syndrome (POTS)

- Encompasses disorders of blood flow, heart rate and blood pressure regulation that are most easily demonstrable during orthostatic stress

VASOVAGAL SYNCOPE

- Also called simple faint, neurocardiogenic or neurally mediated syncope.
- Most common type of syncope in otherwise healthy children and adolescents.
- Uncommon before age 10-12 years.
- Quite prevalent in adolescent girls.

VASOVAGAL SYNCOPE

- Characterized by a few seconds to a minute prodrome that might include dizziness, nausea, pallor, diaphoresis, palpitations, blurred vision, headache or a “dream state”.
- Prodrome is followed by LOC and loss of muscle tone.
- LOC is usually less than one minute.
- Patient will gradually awaken and describe the feeling as “waking up from a nap”.
- Syncope might follow waking up in the AM; after a hot shower; after prolonged standing; fright or pain; in the heat.
**VASOVAGAL SYNCOPE: Physiology**

- Lower extremity venous pooling leads to a decrease in venous return to the heart.
- In susceptible individuals reduced ventricular filling produces a large increase in the ventricular force of contraction similar to that in acute hypertension.
- This increase in ventricular force leads to withdrawal of sympathetic activity and vagal activation (vasodilatation, bradycardia and hypotension).

**ORTHOSTATIC HYPOTENSION**

- Also referred to as dysautonomia.
- In these patients the normal adrenergic increase in HR and vasoconstriction of the arterioles and veins in the upright position is absent or inadequate.
- This results in hypotension without a reflex increase in HR.

**ORTHOSTATIC HYPOTENSION**

- Usually exacerbated in conditions that decrease the blood volume (bleeding, dehydration).
- Drugs that interfere with the sympathetic vasomotor response (CCB’s, vasodilators) and diuretics.
- Also in peripheral neuropathies (Guillain-Barre syndrome).
ORTHOSTATIC HYPOTENSION

- OH is defined as a persistent fall in systolic/diastolic pressure of ≥20/10mmHg within 3-minutes of standing and no increase in HR.

- OH may only be demonstrable in the presence of dehydration.

- OH is similar to vasovagal syncope but without the vagal component (nausea, pallor, diaphoresis and hyperventilation); prodrome might only consist of lightheadedness.

POTS

- Relatively "new" syndrome most often seen in young women; might be mistaken with chronic fatigue.

- Decreased venous return causes an increased sympathetic discharge and significant tachycardia.

- Increased Adrenomedullin (potent vasodilator with diuretic effects) is seen in some patients.

- POTS is defined as the development of orthostatic symptoms associated with at least a 30 bpm increase in HR within 6-10 min of standing.

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EXERCISE RELATED SYNCOPE
- Syncope that occurs usually during recovery after sustained vigorous exercise.
- Occurs because of a combination of venous pooling, cessation of muscle pump action and decreased HR when exercise ends suddenly.

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Situational Syncope
- Breath holding
  - begins in infancy and resolves by school age.
  - triggered by pain or anger.
  - brief cry and breath holding followed by cyanosis and LOC.
  - 4/- brief tonic or clonic seizure.
  - Iron deficiency anemia.
  - In 17% of pts propensity for vasovagal syncope.
Situational Syncope

- Breath holding
- Micturition
- Defecation
- Cough
- Excess Vagal tone

- Rare form of orthostatic hypotension.
- Rapid bladder decompression results in decreased total peripheral vascular resistance with splanchnic stasis and decreased venous return.

Valsalva involved in defecation will produce in susceptible individuals an exaggerated adrenergic inhibition with a decrease in HR and BP.

Paroxysmal coughing produces a marked increase in intra-pleural pressure with reduced venous return and CO.

In some well conditioned athletes excess vagal tone might predispose to LOC.

CAUSES OF SYNCOPE

- Non-cardiac causes (autonomic).

- Neuropsychiatric conditions.
- Metabolic disorders.
- Cardiac conditions.
Neuropsychiatric Conditions

- **Seizures**
  - Also LOC and loss of postural tone.
  - Longer and involve convulsive activity.
  - There is a post-ictal phase.
- **Migraine syndromes**
  - Similar to syncope but LOC is longer and nausea, headaches and aura are more prominent.
- **Hysteria/Conversion**
  - Common in the presence of an audience
  - Lacks hemodynamic changes or injury.
- **Hyperventilation**
  - Usually preceded by emotional stress
  - Patient experiences chest tightness, SOB and paresthesias.

CAUSES OF SYNCOPE

- Non-cardiac causes (autonomic).
- Neuropsychiatric conditions.
  - **Metabolic disorders**.
  - Cardiac conditions.

Metabolic Disorders

- Poor hydration or dehydration.
- Hypoglycemia.
- Electrolyte disorders.
- Anorexia nervosa.
- Drugs and toxins (anti seizure meds, sedatives, tranquilizers, anti hypertensives, etc.)
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CARDIAC CAUSES OF SYNCOPE

- Cardiac syncope is potentially fatal and always deserves careful evaluation and treatment.
- The mechanism of cardiac syncope also involves an abrupt decrease in cardiac output and consequently decreased cerebral perfusion.
- Cardiac causes of syncope include
  - Obstructive lesions
  - Myocardial dysfunction
  - Arrhythmias

OBSTRUCTIVE LESIONS

- Aortic stenosis (AS)
- Pulmonary stenosis (PS)
- HOCM
- Pulmonary hypertension (PHTN)
Peripheral vasodilatation associated with exercise is not accompanied by an adequate increase in CO because of the obstructive lesion which results in diminished perfusion to the brain.

Patients may also complain of chest pain, palpitations and dyspnea.

Exercise often precipitates syncope.

**OBSTRUCTIVE LESIONS**

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**MYOCARDIAL DYSFUNCTION**

- Congenital or acquired coronary artery disease.
  - Anomalous CXs, Kawasaki's
  - Myocardial ischemia or infarction
- Dilated cardiomyopathy
  - Self limited episodes of V-tach can lead to cardiac arrest
- Arrhythmogenic RV dysplasia (ARVD)
  - Adipose tissue or fibrosis replaces myocytes
  - V-tach commonly develops in these patients

**ARRHYTHMIAS**

- Extreme tachycardia or bradycardia can decrease CO and lower cerebral perfusion sufficiently to cause LOC.
- Simple bradycardia is well tolerated in children.

- Commonly encountered arrhythmias are:
  - Supraventricular tachycardia (SVT).
  - Ventricular tachycardia (VT).
  - Sick sinus syndrome (SSS)
  - Complete heart block (complete AVB).
**ARRHYTHMIAS**

- Arrhythmias may or may not be accompanied by structural heart defects.

- No identifiable structural defects:
  - Long QTc syndrome (torsade de pointes)
  - Short QTc
  - Wolff-Parkinson White (SVT)
  - ARVD (repeated episodes of VT)
  - Brugada syndrome (rare cause of VT, SE asian men; in 90% of cases LOC occurs at rest).

**ARRHYTHMIAS**

- Structural heart defects can be pre or post operated.

- Un-operated:
  - DCM, HCM, Ebstein’s, MS, MR, L-TGA or MVP

- Post-operative:
  - TOF, D-TGA, s/p Fontan (SSS, SVT, VT, complete AVB)

**EVALUATION**

- The goal is to identify high-risk patients with underlying heart disease.
  - ECG abnormalities (WPW, LQTs, Brugada)
  - Cardiomyopathy (HCM, DCM)
  - Structural heart disease

- Evaluation of pediatric patients might extend to other family members if a genetic condition is suspected.
EVALUATION: History

- Time of day
- Patient's position
- Relationship to exercise
- Associated symptoms
- Duration of syncope
- Patient's appearance
- History of cardiac, neurologic, endocrine or psychological disease.
- Medications
- Family history
- Social history

HISTORY

- Time of day
  - After waking up in the morning or after hot shower suggests vaso-vagal syncope or hypoglycemia (rare)
- Patient's position
  - Syncope while standing or upon standing suggests orthostatic intolerance.
  - Syncope while supine suggests arrhythmia or seizures
- Relationship to exercise
  - After sustained CV exercise suggests venous pooling
  - During active exercise suggests arrhythmia

HISTORY (cont.)

- Associated symptoms
  - Palpitations suggests arrhythmia
  - Chest pain suggests ischemia (obstructive lesions, CA)
  - SOR, tingling suggest hyperventilation
  - Nausea, HA, visual changes, diaphoresis suggest VVS
- Duration
  - < 1 min: VVS, post hypotension or hyperventilation
  - > 1 min: seizure, migraine or arrhythmias
- Patient's appearance
  - Pallor suggests hypotension
  - Abnormal movements, posturing, confusion suggest seizures
HISTORY (cont.)

- History of cardiac, endocrine, neurologic or psychological disorders may suggest a problem in that system.

- Medication history should include prescribed, OTC and recreational drugs.

- Family history should include CAD risk factors (MI< 30 yrs of age), arrhythmias, CHD, cardiomyopathies, LQTS, seizures or syncope (common in pts with VVS).

EVALUATION: Physical Exam

- Physical exam is usually normal after the fact.

- Should focus on cardiac and neurological status.

- If orthostatic intolerance is suspected, HR and BP’s in the supine, sitting position and after standing for several minutes (3-10) should be obtained.

- Careful auscultation for murmurs or abnormalities of S2 (pulm HTN).

- Neuro exam should include fundoscopic exam, test for Romberg sign, gait, deep tendons, etc.

CARDIAC LOC IS SUSPECTED WHEN

- there are few premonitory symptoms.

- it occurs during exercise.

- it occurs in the recumbent position.

- it is associated with chest pain or palpitations.

- there is a history of cardiac disease.

- there is family history of SCD or heart disease in the young.
THANK YOU