SYNCOPE IN ATHLETES
IS IT THE HEART?

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CASE EXAMPLES
CASE 1

• Hx: 14 yr old female, previously healthy, feeling well. Doing sprints in gym class. Coach reports watching her run and in mid-stride she looses consciousness, summer-saults on the floor and lays motionless on her back. No immediate evidence of trauma. No seizure like movements. Coach sends for the AED but before it arrives the she regains consciousness. She only feels tired afterward for 30 min then is back to normal. She remembers running then waking up on the floor. Family history of a great aunt with a pacemaker. No medications. Active in sports without issue.

• Physical exam is normal
CASE 2

Hx: 16 yr old male playing football with friends. Previously healthy, feeling well. In the middle of a play, passes out on the field. His friends felt he was out for 3 to 5 minutes. He awakes feeling tired but ok. Family history is significant for grandfather and uncle with a “thick heart”. No other known family history. He hasn’t been seen in your office since he was 10 but family reports no issues. He doesn’t do much physical activity except with friends, and that is only occasional. No known medication or drug usage.

Physical exam is normal
QUESTIONS

• Which case is most concerning?
  • Case 1
  • Case 2
  • Both
  • Neither
QUESTIONS

• What would you do next?

A. History and exam – if normal both may play sports without restriction
B. EKG – if normal may play
C. EKG and echo – if normal may play
D. Refer to Cardiology
E. Restrict from all sports permanently
DEFINITION

- Abrupt, transient and temporary loss of consciousness and postural tone that reverses without intervention

- Reversible impairment of cerebral function
  - brief, lasting seconds (rarely minutes)
  - followed by complete recovery without residual neurological sequelae

- Syncopal presentations may be dramatic

- Exercise related syncope – during or immediately after exercise
INCIDENCE

• 15 – 25% of pediatric age will have at least one syncopal episode by young adulthood
• Incidence peaks between the ages of 15-19 years
• Median age for male = 12 years, for females = 17 years
• Overall there is a modest female predominance

• Up to one in five children experience an episode of syncope before age 15

• During exercise – 3 to 20% of cases
HEMODYNAMIC HOMEOSTASIS

- With **passive upright posture** there is gravitational displacement of up to 25% of the body’s total blood volume to dependent regions
- Decreased venous return and mean arterial pressure
- Increases sympathetic outflow
- Increased heart rate (10-15 BPM), and increased diastolic BP (~10 mm)
- Active movement helps move blood back to the heart
ABNORMAL NEURO RESPONSES

• Initial responses to position change/stressors are normal
• However, inadequate venous return and a decrease in BP triggers increased cardiac contractility and heart rate
• Mechanoreceptors stimulated simulating systemic hypertension
• This triggers a central reflex resulting in further hypotension, vasodilation and bradycardia
• Syncope can occur
ABNORMAL RESPONSES

• Three types of responses
  • hypotension (12-35%)
  • bradycardia (5-15%)
  • mixed response (50-80%)
• Decrease in BP may be 40-80 mmHg
• Decrease in heart rate of ~40 BPM
• brief asystole may last 3-40 sec
CAUSES OF SYNCOPE

- Common Causes
  - Cardiac
    - Structural
    - Dysrhythmia
  - Non-cardiac
- Neurocardigenic
NEUROCARDIOGENIC SYNCOPE

• Aka: vasovagal syncope
  • by far the most common type of syncope in childhood (50% or more of cases)
• Predominate age at presentation is 9–14 years
• Increase in vagal tone
• Inciting events include
  • standing
  • stress (emotional or physical, pain)
  • reflex precipitants (swallowing, hair grooming)
• Often preceded by prodrome
• May play sports
NON-CARDIAC CAUSES

• Orthostatic hypotension
  • Failure of compensatory mechanisms which maintain normal cardiac output when assuming upright position
  • Prodromal Symptoms include dizziness, lightheadedness, blurred vision, weakness
  • More frequent in the morning, after meal or exercise
  • May play sports
NON-CARDIAC CAUSES

- Hyperventilation
  - Highly emotional circumstances
  - Dyspnea, shortness of breath, chest discomfort
  - Frequently associated with unrecognized anxiety
- Mechanism:
  - Hypocapnia and cerebral vasoconstriction resulting in transient ischemia
- May play sports
CARDIAC CAUSES

• Life threatening
• Result from an abrupt decrease in cardiac output related to cardiac pathology
• Two major groups
  • **Arrhythmias**: structurally normal vs abnormal hearts
    • Exogenous factors (toxins)
    • Inherited conditions
  • **Structural**
    • Congenital defect (pre or post surgery)
    • Infection (myocarditis)
STRUCTURAL HEART DISEASE

- Hypertrophic Cardiomyopathy
- Coronary artery anomalies
- Valvular Aortic Stenosis
- Acute Myocarditis
HYPOTROPHIC CARDIOMYOPATHY

- Autosomal dominant (1 in 500)
- Asymmetric hypertrophy of the left ventricle
- Patients may experience exertional syncope
- Most common cause of sudden death during exercise (50%)
HYPOTROPHIC CARDIOMYOPATHY

- Mechanisms that lead to inadequate cardiac output include:
  - Left ventricular outflow obstruction
  - Ischemia during exertion
  - Arrhythmia
- Family History
- Echocardiogram is diagnostic
- Disqualification from competitive sports
CORONARY ARTERY ANOMALIES

- Congenital abnormalities in the origin of the coronary arteries may present as syncope or sudden death.
- Syncope may be first presenting symptom
- Very rare
OTHER STRUCTURAL CONDITIONS

- Aortic stenosis
  - Decrease in cardiac output
- Acute myocarditis
  - Coxsakie A and B and adenovirus
  - Rarely present with an isolated syncopal event
LIFE THREATENING CAUSES

- Arrhythmias
  - Long QT Syndrome
  - Preexcitation Syndrome (WPW)
LONG QT SYNDROME

• Long QT syndrome (LQTS) is a disorder of myocardial repolarization characterized by prolongation of the QT interval on the electrocardiogram

• Associated with an increased risk of sudden death due to the potential to degenerate into polymorphic ventricular tachycardia

• Long QT syndrome may be acquired or congenital
Prolonged QT interval

The corrected QT interval (QTc) is calculated by dividing the QT interval (0.60 seconds) by the square root of the RR interval (0.84 seconds). In this case, the QTc is 0.65 seconds.
ACQUIRED LONG QT

- Usually results from drug therapy or electrolyte disturbances
  - Hypokalemia
  - Erythromycin
  - Tricyclic antidepressants
- Patients with eating disorders may have increased QT interval and EKG changes
  - Typically normalizes during nutritional rehabilitation
PREEXCITATION SYNDROME

- Wolf-Parkinson-White
- May be underlying cause of sudden death
- 1-3 per 1000
- Treatment is ablation
EVALUATION OF SYNCOPE

• History is the key!
• Circumstances prior to, during and recovery after episode
• Timing and frequency of events
• Warning signs:
  • Syncope during exercise
  • Family history
    • Sudden death
    • Cardiomyopathy (enlarged or thick heart)
  • Syncope in response to loud noise, fright or extreme stress
• Medications/drug use
HISTORY IS KEY!

- Benign - typical setting involves prolonged upright posture standing in church or other warm, crowded environment
- More common during illness
- Mild dehydration increases likelihood of syncope
- Females may have increased syncope during menses
- Situational syncope usually associated with stereotypical triggers
- More likely to occur after exercise
- Typically occurs in three stages: Prodrome, Syncope (5-20 sec), Recovery period (5-30 min).
PRODROME

- Prodrome lasts several seconds to minutes
- Common symptoms include:
  - Dizziness or lightheadedness
  - Nausea or abdominal pain
  - Warm or cold sensation
  - Diaphoresis
  - Clamminess
  - Headache
  - Anticipated loss of consciousness
EVALUATION OF SYNCOPE

• Physical Exam is often normal between episodes
• Murmur?
• Vital signs in supine and standing position
  • Orthostatics
    • Drop in systolic BP >20 mmHg
    • Drop in diastolic BP > 10 mmHg
    • Supine, sitting, standing and 2 min stand
EVALUATION OF SYNCOPE

- Labs: CBC, lytes, beta-HCG

- Detailed exam
  - Syncope with peak exertion
  - Recurrent
  - Chest pain with syncope
  - Syncope resulting in significant injury
  - Seizures
  - Abnormal exam, ECG
  - History of repaired congenital heart disease
  - Family history of sudden death
DETAILED EVALUATION OF SYNCOPE

- Recommend referral if history, labs and/or ECG is abnormal
- Echocardiogram and exercise test most important tests
- EEG may be done to exclude seizure disorder
- Holter or Event Monitor
- Cardiac MRI

- Sports participation should be put on pause until workup is complete
- Final determination depends on cause of syncope
SUMMARY

• Most syncope is due to benign cause.

• Life threatening syncope is rare and may be harbinger of sudden death.

• History is the most important clue when trying to identify risks for sudden death.

• Careful cardiac and neurologic exam should be performed in any patient presenting with syncope with more detailed testing if history suggests malignant cause.

• Detailed recommendations regarding sports participation should be reviewed with patient and family.
CASES

• 14 yr old female, syncope doing sprints in gym class …

• 16 yr old male, syncope while playing football …
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D. Refer to Cardiology
E. Restrict from all sports – yes but may not be permanent
THANK YOU
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