Syncope:
To Head CT or Not, That is the Question

Eddie Needham, MD, FAAFP

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Eddie Needham, MD, FAAFP

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Dr. Needham has been a program director for 16 years. In 2017, he received the Gold Level Program Director Recognition Award from the Association of Family Medicine Residency Directors (AFMRD) for his years of leadership and experience. He has been a requested speaker at the AAFP’s annual Family Medicine Experience (FMX) for 10 years, as well as speaking for both the Georgia Academy of Family Physicians and the Florida Academy of Family Physicians for more than 15 years. Dr. Needham practices full-service family medicine, providing care from “conception to resurrection.” In October 2018, he received the AAFP’s Chair of the Year Award for his leadership of the Care of Cardiovascular Conditions Live Course. He was recognized as the Florida AFP’s 2013 Full-Time Florida Family Physician Educator, as well as the Georgia AFP’s 2007 Teacher of the Year. It is his joy and passion to teach students of medicine the wonders of the human body and spirit.
Learning Objectives

1. Evaluate patients who present with syncope to determine cardiac or non-cardiac causes.

2. Prepare diagnostic plans for patients who present with neurocardiogenic forms of syncope, which may include conducting a differential diagnosis of syncope.

3. Conduct appropriate tests, such as ECGs, exercise stress testing, tilt tests or blood screenings, to diagnose underlying conditions in patients whose ECGs and cardiac tests are normal.

4. Determine risk stratification of patients with suspected syncope for possible hospitalization and workup.

Audience Engagement System

Step 1

Step 2

Step 3
Syncope: Definition

• Transient loss of consciousness
• Brief with spontaneous recovery
• Due to global cerebral hypoperfusion
• “Inadequate cerebral nutrient flow”

Syncope: Classifications

• Reflex-mediated
  • Upwards of 50% in older adults
  • Vasovagal, micturition, defecation, swallowing, coughing
• Orthostatic
  • Dehydration, drug effects, autonomic dysfunction, aging
• Cardiac arrhythmias
• Structural cardiopulmonary disease
Syncope: Cardiac Causes

• Cardiac dysrhythmias
  • Bradycardia
    • AV block, sick sinus syndrome
  • Tachycardia
    • PSVT, V Tach (MI), A Fib, torsades de pointes, channelopathy

• Structural cardiopulmonary disease
  • Hypertrophic cardiomyopathy (HCM), dilated/restrictive cardiomyopathies
  • Valvular heart disease
  • Pulmonary HTN

Syncope: Diagnostic Evaluation

• History
• Physical Exam
• Labs only as indicated from the hx and PE
• Every patient should receive an EKG

Orthostatic vital signs

- Patient supine for 5 minutes.
  - BP and pulse recorded
- Patient sits/stands for 3 minutes
  - BP and pulse recorded
- The following changes are considered abnormal and may reflect hypovolemia or autonomic dysfunction:
  - Drop in systolic blood pressure of 20 mmHg or more.
  - Increase in heart rate of 20 beats per minute or more.

Syncope: Diagnostic Evaluation

Avoid computed tomography of the head in asymptomatic adult patients in the emergency department with syncope, insignificant trauma, and a normal neurologic evaluation.

In the evaluation of simple syncope and a normal neurologic evaluation, do not obtain brain imaging studies (computed tomography or magnetic resonance imaging).

Do not perform imaging of the carotid arteries for simple syncope without other neurologic symptoms.

American College of Emergency Physicians

American College of Physicians

American Academy of Neurology

Tilt Table Testing

- Patients with recurrent episodes of **syncope of unknown cause** in the absence of structural heart disease.
- Patients with **suspected vasovagal** syncope who lack a confident diagnosis.
- Patients with a **single unexplained syncopal episode in high-risk settings**
- Patients for whom there is clinical value of demonstrating **susceptibility to reflex syncope**. Most importantly, this may help to reassure the patient that a diagnosis has been established.
- To discriminate between suspected reflex syncope (vasovagal) and orthostatic hypotension syncope.
- Patients being assessed for **postural tachycardia syndrome (POTS)**.

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Canadian Syncope Risk Score

- 4030 patients, age > 16yo, average age = 54, 56% women, 2010-2014
- 147 patients (3.6%) had a serious adverse event (SAE) within 30 days
  - 2.4% cardiac causes; 1.2% noncardiac
- Nine clinical data points used to calculate future risk of SAE
  - Predisposition to vasovagal syncope
  - Heart disease
  - Any systolic pressure reading in the ED < 90 or > 180 mm Hg
  - Troponin level above 99th percentile for the normal population
  - Abnormal QRS axis (< -30° or > 100°)
  - QRS duration longer than 130 ms
  - QTc interval longer than 480 ms
  - Emergency department diagnosis of cardiac syncope
  - Emergency department diagnosis of vasovagal syncope

CMAJ September 06, 2016

188 (12) E289-E298
## Canadian Syncope Risk Score

Score ≥1 → consider evaluation

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**Formula**

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<td>Cardiac syncope</td>
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*Triggered by being in a warm crowded place, prolonged standing, fear, emotion, or pain.

**Facts & Figures**

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Case #1: 34-year-old man with syncope

- A 34-yr man presents to the ED via EMS after the abrupt onset of dull, midsubsternal chest pressure at rest. He also c/o nausea, SOB, and lightheadedness. As he stood up to call his mother for help, he “blackened out” and fell to the floor.
- He spontaneously awoke after approximately 10 seconds and remained on the floor until EMS arrived.
- Initial vital signs: BP 94/50, P 118, RR 24, SpO2 94% on room air
- En route to the hospital, supplemental O2 and a peripheral IV with NS at wide open rate were initiated.

Case #1: 34-year-old man with syncope (Cont’d)

- In the ED, his blood pressure improved to 118/64, pulse decreased to 104, and IV fluid was decreased to 100 cc/h. Supplemental O2 was continued at 4 LPM via nasal cannula with Sp02 at 99%.
- Exam: appears mildly dyspneic but alert
  - Heart: Slightly tachycardic, no murmur
  - Lungs: Clear; no wheezes, rales, ronchi
  - Extremities: Trace bilateral pedal edema; no focal calf abnormality
- CXR: No acute infiltrate or effusion
- Lab: Normal CBC, CMP; d-dimer 4.98 (normal <3.00)
Poll Question 1

In this 34-yo male with syncope, mild stable tachycardia, hypotension responsive to IVF, mild hypoxia, and labs normal except d-dimer 4.98 (NI < 3.0), what is the most likely cause?

A. Supraventricular tachycardia
B. Atrial fibrillation
C. Pulmonary embolism
D. Pulmonary hypertension
• Chest CT angiogram:
  • Large bilateral pulmonary emboli located at the level of the distal main pulmonary vessels and extending into the primarily lower lobes bilaterally.
  • Pulmonary artery mildly dilated suggesting pulmonary arterial hypertension.
Pulmonary Embolism: Mortality Risk

• Retrospective review of 549 patients with confirmed PE:
  • 30-day all-cause mortality: 13%
  • 1 year: 26%
  • 3 years: 35%

• Hypotension predicts higher risk of early mortality:
  • Patients with SBP <90 mm Hg had 90-day all-cause mortality: 52.4%
  • Normotensive patients: 14.7%


Pulmonary Embolism: Worrisome EKG findings

• EKG findings of RV strain are associated with increased risk of hemodynamic collapse and 30-day mortality:
  • HR >100 bpm [OR 4.46]
  • Large S wave in lead I, Q wave in lead III, inverted T wave in lead III (S1Q3T3 pattern) [OR 2.06]
  • Complete RBBB [OR 5.24]
  • Atrial fibrillation [OR 1.75]

• EKG is typically not helpful in the diagnosis of pulmonary embolism.

Pulmonary Embolism Severity Index (PESI)

- Age = 1 point for each year of age
- Male sex = 10 points
- Cancer = 30 points
- Heart failure = 10 points
- Chronic lung disease = 10 points
- Pulse >110 per minute = 20 points
- Systolic blood pressure (SBP) < 100 mm Hg = 30 points
- Respiratory rate at least 30 per minute = 20 points
- Temperature <36°C (97°F) = 20 points
- Altered mental status (disorientation, lethargy, stupor, or coma) = 60 points
- Arterial oxygen saturation <90% = 20 points


Class I: Very low risk <65 points
Class II: Low risk 66-85 points
Class III: Intermediate risk 86-105 points
Class IV: High risk 106-125 points
Class V: Very high risk >125 points

PESI: External Validation

• Prospective cohort of 367 patients with pulmonary embolism:
  • Class I patients (18%): 0% mortality
  • Class II patients (26.7%): 1% mortality
  • Class III patients (26.2%): 3.1% mortality
  • Class IV patients (16.9%): 12.9% mortality
  • Class V patients (12.3%): 24.4% mortality

Eur Heart J 2006;476.

Wells Clinical Decision Rule for Risk of PE

• Clinical signs of DVT (leg pain/swelling): 3 points
• Alternative diagnosis less likely than PE: 3 points
• Heart rate >100 bpm: 1.5 points
• Immobilization >3 days: 1.5 points
• Surgery in previous 4 weeks: 1.5 points
• Previous DVT or PE: 1.5 points
• Hemoptysis: 1 point
• Malignancy with treatment in last 6 months: 1 point
Wells Clinical Decision Rule for Risk of PE

• **Interpretation:**
  - <2 points: Low risk of PE (<7%)
  - 2-6 points: Intermediate risk of PE
  - >6 points: High risk of PE (>45%)

• **Other risk prediction rules:** Geneva, PISA
How Common Is Pulmonary Embolism as a Cause of Syncope?

• Not very.

• Retrospective observational study of 1.67 million patients who presented to the ED for syncope found **prevalence of PE 0.06–0.55% for all patients**; 0.15–2.10% for hospitalized patients.

• PE should be on the differential diagnosis for every patient with syncope, but **not all patients should undergo evaluation for PE**.

34-year-old man with syncope

• Follow up:
  • Uneventful anticoagulation with unfractionated heparin, followed by warfarin
  • Protein S deficiency diagnosed
  • He continues to do well

Case #2: 73-year-old man with syncope

• 73-yo male presents to the ED after passing out while walking to his mailbox.
• No chest pain or palpitations prior.
• Lasted 15-30 seconds, quick recovery.
• PMHx notable for controlled HTN and T2DM.
• Meds include lisinopril 40 mg daily and metformin 1000 mg bid, both for >5 years.
Case #2: 73-year-old man with syncope

- In ED, vital signs are:
  - BP 130/80 sitting → 125/85 standing; pulse 66; RR 14;
    PO2 96% on RA; Temp 98.8
- Lungs CTA
- CV: RRR with NI S1 S2 with 2-3/6 Murmur at URSB
  
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- Legs: No edema
- CBC, CMP, and troponins normal
AES Question

Poll Question 2

In this 73-yo male with syncope, a 2-3/6 sys murmur, and EKG showing LVH/LAE, the most likely etiology is:

A. Aortic dissection
B. Aortic stenosis
C. Aortic regurgitation
D. Takayasu’s arteritis
Aortic Stenosis

• Risk Factors
  • Age: For every 10-year increase in age there is a twofold increase in risk
  • Male: Female 2:1
  • Current cigarette smoking: Relative risk ↑35%
  • HTN: Relative risk ↑25%

Aortic Stenosis: Clinical Findings

• II-III/VI midsystolic murmur at upper right sternal border radiating into the carotids
• Carotid pulse – slow upstroke
  • Pulsus parvus et tardus
• PMI prolonged
  • LVH
• PMI laterally displaced
  • Dilated left ventricle
Diagnostic Testing

• 12 lead ECG: Often shows LVH, Left atrial enlargement
• CXR may show:
  • Cardiomegaly
  • Pulmonary congestion
  • Aortic valve calcification
• Echocardiogram: Indispensable!

Aortic Stenosis

• When the classic symptoms of angina, syncope, and heart failure develop, survival declines precipitously.
  • 50% of symptomatic patients die within 2-5 years unless aortic valve is surgically replaced.
• Prompt recognition of symptoms and evaluation for possible severe aortic stenosis are crucial in managing the disease.
Treatment

The only proven effective therapy for **symptomatic** aortic stenosis is **aortic valve replacement**.

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Case #3: 61-year-old woman with syncope

- A 61-year-old woman presents to clinic with a complaint of progressively worsening exertional dyspnea over the past several months. She had previously been able to walk 8-10 blocks with her grandson but has recently struggled to walk to her mailbox and back.
- The day prior to her visit she became lightheaded after climbing a flight of stairs in her home. She fell to her knees but did not lose consciousness. She reported vague chest heaviness but no diaphoresis or nausea.
- She has a history of hypertension but has never smoked and does not use alcohol.
Case #3: 61-year-old woman with syncope

• Vital signs: BP 126/64, P 66, RR 14
• Alert, no overt distress
• HEENT: Prominent periorbital purpura; moderate macroglossia
• Heart: No murmur
• Lungs: Few bibasilar crackles but otherwise clear
• Abdomen: Liver edge palpable at right costal margin; no ascites
• 2+ pedal edema
Case #3: 61-year-old woman with syncope

- Echocardiogram:
  - Moderate left ventricular hypertrophy
  - Impaired ventricular relaxation
  - Diminished LV end-diastolic volume
  - Trace pericardial effusion
  - EF 55-60%

AES Question
Poll Question 3

In this 61-yr female with dyspnea and near syncope, macroglossia, periorbital purpura, and echo showing impaired relaxation, the most likely diagnosis is:

A. Hemochromatosis
B. Chagas’ disease
C. Growth hormone adenoma
D. Amyloidosis

Cardiac Amyloidosis

• Rare infiltrative disorder
• Most commonly systemic; may be localized to the heart
• Characterized by aggregation of insoluble fibrous deposits of misfolded amyloid proteins
• IgG light chains, transthyretin (TTR)
Cardiac Amyloidosis

• Symptoms
  • Exertional dyspnea
  • Exertional syncope
  • Angina with normal coronary arteries
  • Peripheral sensory and motor neuropathy, especially with amyloid light chain (AL) amyloidosis
  • Autonomic neuropathy

Cardiac Amyloidosis

• Clinical findings
  • Easy bruising, commonly causing periorbital ecchymosis/purpura
  • Macroglossia
  • Hepatomegaly
  • Peripheral edema
  • Intracardiac thrombus may be seen with echocardiography; TEE may be required for evaluation of LA appendage.
Cardiac Amyloidosis

• Classic presentation is heart failure with preserved ejection fraction (HFpEF)
• Right heart failure presentation may predominate
  • Lower extremity edema
  • Hepatomegaly
  • Ascites
  • Elevated jugular venous pressure
  • RV dilation
• Atrial arrhythmia may be initial manifestation

Cardiac Amyloidosis

• EKG findings:
  • Low voltage in approximately 50% of patients
• Echocardiographic findings:
  • Increased wall thickness, primarily involving the left ventricle
  • LV wall more echogenic than is typically seen with hypertrophy
  • Low end-diastolic volume
  • Pericardial effusion
Cardiac Amyloidosis

- Cardiac MRI
  - Late gadolinium enhancement over entire subendocardial circumference is highly specific for cardiac amyloidosis
- Serum cardiac biomarkers
  - May be elevated; helpful in risk stratification
- Serum, urine immunofixation
  - IgG light chains

Cardiac Amyloidosis

- Diagnosis
  - Bone marrow biopsy or subcutaneous fat aspiration may confirm systemic amyloid light chain (AL) amyloidosis
  - Noncardiac biopsy may confirm transthyretin-related amyloidosis: bone marrow, skin, minor salivary gland
Macroglossia and periorbital purpura

Amyloid infiltration
Apple green birefringence

- Amyloid is an extracellular, proteinaceous deposit exhibiting beta sheet structure
- Beta sheet structures demonstrate apple green birefringence when stained with congo red and viewed under polarized light

Cardiac Amyloidosis

• Treatment
  • Diuretics are mainstay
  • ACEI and ARB tend to be poorly tolerated
  • Digoxin may bind to amyloid fibrils, resulting in accumulation and digoxin toxicity
  • ICD generally does not improve survival
  • Cardiac transplantation may be considered in more severe cases
Case #4: 33-year-old female postpartum syncope

• Mrs. Jones is a 33-yo female who presents with syncope. Got up from chair to turn on the TV and passed out.
• G3 now P3, 3 weeks postpartum s/p NSVD.
• Feels more tired than prior deliveries.
• Had a cold/URI one week ago.
• Breastfeeding without problem.
• Late pregnancy edema has not resolved.

Case #4: 33-year-old female postpartum syncope

• Exam notable for:
  • VS: BP 95/55 sitting → 90/60 standing; P 105; RR 18; PO2 94% on RA; Temp 99.6
  • Neck veins: Elevated at 8-10 cm > RA at 30 degrees
  • Neck: No TMG
  • Lungs: Rales bases to 1/3 of the way up; no dullness
  • Legs: 2-3+ edema
Case #4: 33-year-old female postpartum syncope

- Labs:
  - CBC with H/H = 10/30.5; WBC and Plt normal
  - CMP with BUN/Cr 17/1.1; AST/ALT 17/25
  - TSH = 0.5 → free T4 normal at 0.15
  - UA normal, no protein or glucose

AES Question
Poll Question 4

In this 33-yo postpartum patient with syncope, which of the following is most likely?

A. Peripartum cardiomyopathy
B. Mitral stenosis
C. Takotsubo cardiomyopathy
D. Sheehan’s postpartum hemorrhagic necrosis

Peripartum Cardiomyopathy

• Usually occurs >36 weeks EGA
• LF EF <45% with sx/signs of heart failure
• Etiology unknown
• Clinical presentation similar to that of HFrEF
• Avoid use of ACEIs/ARBs/Aldo Inhib in pregnancy
• Mortality 10% at 2 years
• 20-60% of patients have complete recovery
Viral Cardiomyopathy

• Enterovirus in 1960s → now 20 viruses identified
• Parvovirus B19 (slapped cheek) and human herpesvirus 6 (roseola) more common in one study
• Virus obtained from endomyocardial biopsy
• Treat for heart failure

An 18-yo high school athlete is referred to your office for passing out while playing soccer. No injury. Happened while running on the field. Is noted to have a 2-3/6 systolic murmur at LLSB. Which of the following is most likely?

A. Supraventricular tachycardia
B. Tachy-brady syndrome
C. Kawasaki’s disease with coronary aneurysms
D. Hypertrophic cardiomyopathy
ECG for HCM:
- LVH voltage
- Note large Q waves
  → septal hypertrophy

ECGs of Note
A 55-yo male presents urgently to the ED with crushing, substernal chest pain. His ECG shows:

AES Question
Poll Question 5
A 62-yo female presents with onset of nausea and vomiting for 1 hour. What is the diagnosis?

A. Anterior wall MI
B. Pericarditis
C. Inferior wall MI
D. Septal MI

Inferior wall MI
Slow and regular – sinus bradycardia?

Complete Heart Block
Wellens Syndrome

- Associated with critical proximal LAD stenosis
- Symmetrical, deep, T-wave inversions in the anterior precordial leads (V1 – V3)
- First described in 1982
Brugada Syndrome

- Genetically inherited
- Increased risk for SCD
- Described in 1992
- Death by V. Fib.
- Sodium channelopathy
- RBBB with ST elevation in V1-3
Best Practice Recommendations

1. All patients with syncope should receive an ECG.
2. Other diagnostic studies should only be ordered based on the history and physical exam.
3. Do not routinely order a Head CT, MRI of the brain, or carotid studies.
Answers

1. C
2. B
3. D
4. A
5. C

Thank you for your attention

Contact information:
Eddie.Needham.MD@AdventHealth.com
Questions