SyncopE Evaluation:
EVIDENCE-BASED AND ECONOMICAL

Daniel D Dressler, MD, MSc, MHM, FACP
Professor of Medicine
Director, IM Teaching Services, Emory University Hospital
Master Clinician, Dept of Medicine
Associate Program Director, JW Hurst IM Residency Program
Semmelweis Society Advisor
Emory University School of Medicine
Daniel.Dressler@emory.edu

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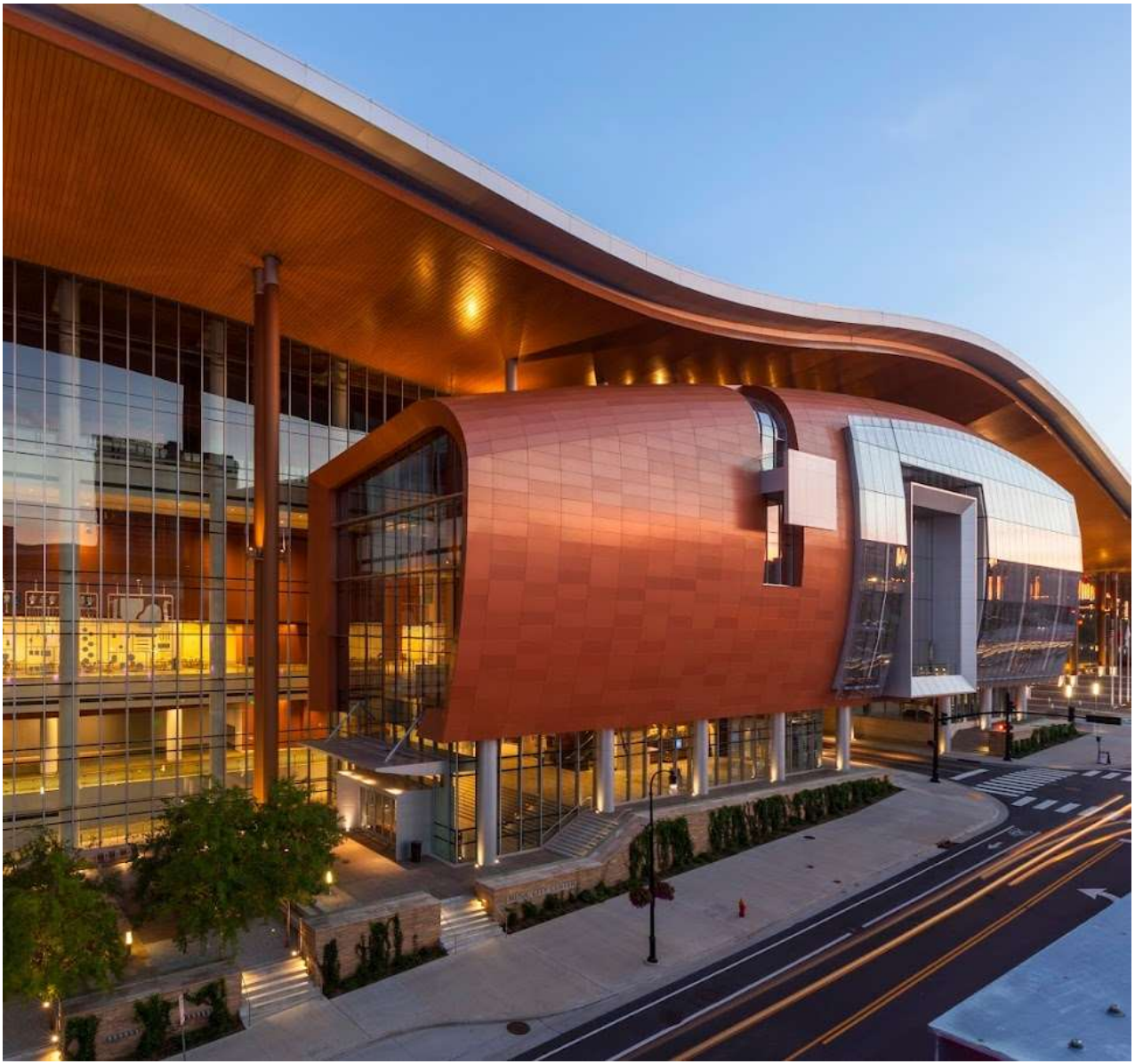

Disclosure of Financial Relationships

Daniel D. Dressler, MD, MSc, MHM, FACP

No relationships with entities producing, marketing, re-selling, or distributing health care goods or services consumed by, or used on, patients.

Deputy Editor, *NEJM Journal Watch General Medicine* *and Contributing Editor NEJM Journal Watch Hospital Medicine* (MMS)
Textbook Editor, *Principles and Practice of Hospital Medicine, 1st and 2nd Editions* (McGraw-Hill)

No other financial conflicts of interest to report

Syncope Objectives

By the end of this session, participants will be able to:

1. **Use H&P findings and clinical decision rules to risk stratify and triage patients with t-LOC and syncope**

2. **Accurately estimate pulmonary embolism (PE) risk in syncope, and implement a structured PE evaluation (when indicated)**

3. **Make prudent evidence-based test-ordering decisions during initial hospital evaluation of syncope patients based on clinical findings**

A Few Cases and Questions to start…

Syncope Q1

- A physician assistant presents after an episode of loss of consciousness…
- Episode occurred after he attended a really painful session at the PA meeting (!)
  - …either dermatology or urology ☺
- Patient initially felt *sweaty* and remembers feeling *nauseated and warm* just prior to losing consciousness
- A group of nearby PAs reported that the patient had several jerking movements…
- …and said they saw a brief episode of whole-body stiffening…
- Patient fully recovered within 1 minute. Normal VS, cardiac, and neurologic examinations.
- EKG NSR

Syncope Q2

- 65 yo man with first episode of syncope while seated in front of computer at work
- Sudden, unexpected, no warning. No seizure activity.
- Recovered after 1 min
- Fractured nose
- No history of heart disease. No medications.

- BP 125/80; P 62. Cardiac and neuro exams normal.
- No carotid bruits
- EKG normal
- Routine labs all normal

- What is the next best test to perform in this patient?

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Syncope Q2:
What is the next best test to perform in this 65 year old patient?

A. CT head

B. Echocardiogram

C. Carotid sinus massage

D. Loop monitor/recorder

E. Tilt table test

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Syncope Q4

In patients with syncope who present with a normal neurologic history and physical exam (i.e. no neurologic signs or symptoms prior to or following a syncope episode), what percentage of patients have a positive finding on neurologic testing (CT/MRI brain, EEG, carotid ultrasound) that explains the syncope?

A.0%

B.3%

C.10%

D.25%

E.50%

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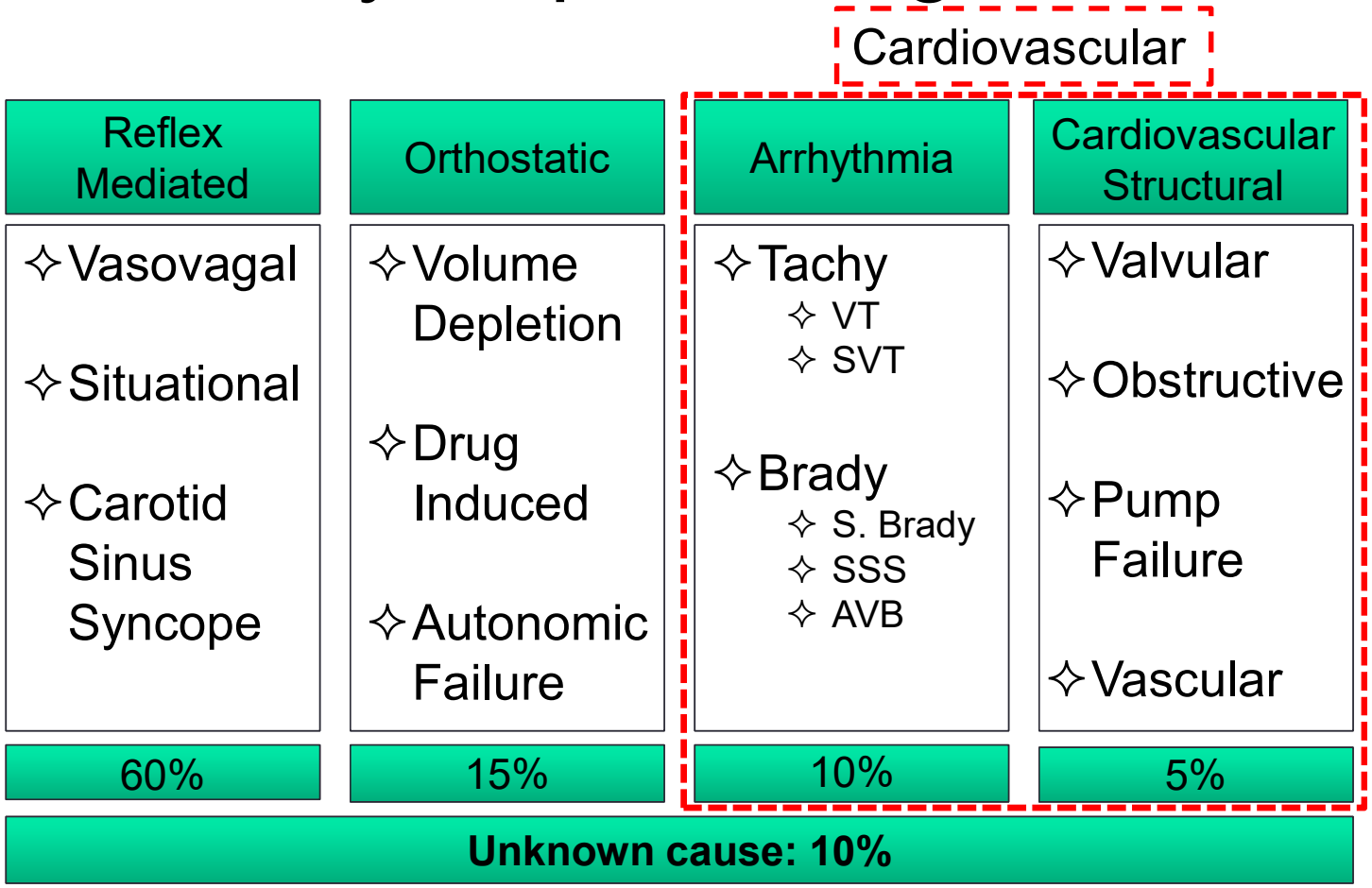
Syncope: Definition

- Loss of consciousness and postural tone
- Sudden
- Transient
- Rapid, spontaneous recovery
- Pathophysiology: Global reduction of blood flow to the reticular activating system (RAS) in the brain

Syncope Etiologies



Jhanjee R, et al. Dis Mon 2009; 55: 532-585. ddoi: 10.1016/j.disamonth.2009.04.004

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INITIAL EVALUATION

All patients should undergo…

1. **History and Physical Exam**
   - **Diagnostic yield: 45%**
   - Additional **8%**, history and PE provided suggestive findings that confirmed the diagnosis on subsequent testing
2. **EKG**

Schnipper JL, Kapoor WN. Med Clin N Amer. 2001; 85(2): 423-456.

Physical Exam (3)

1. **Vital Signs**, including assessment of orthostatic hypotension
   - 2009 cohort of >2100 patients >65 y/o, **only 38%** had documented postural BP (orthostatics)
2. Complete neurologic exam
3. Complete cardiac exam

Mendu ML, et al. Arch Intern Med. 2009; 169: 1299-1305.

History: Is this t-LOC a seizure?

- Suggestive features (Sz):
  - **Tongue biting** → Specificity: 96%, LR(+): 8.6
  - Head turning during T-LOC
  - No memory abnormal behavior b/f, during, or after event
  - **Prolonged limb jerking***
  - **Confusion after event**

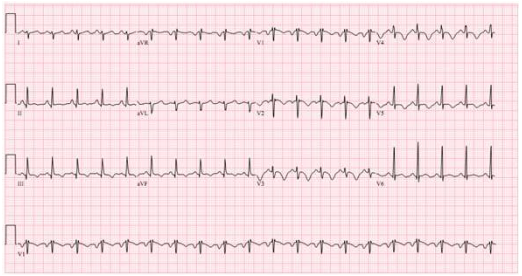
Brigo F et al. Value of tongue biting in the differential diagnosis between epileptic seizures and syncope. *Seizure* 2012 Oct; 21:568.

Syncope Q3: Revisited

Which of the following features, when present, is strongly suggestive of seizure etiology (rather than syncope)?

A. Urinary incontinence
B. Limb jerking for 5 seconds
C. Tongue biting
D. Episode occurred after prolonged standing
E. A, B, and C

EKG



- Abnormal EKG in...
  - 50% of patients presenting with syncope
- EKG diagnostic in...
  - only 5% (range 2-11%)
- Cost...
  - approximately $100-$150

Back to CASE 1: Syncope Q1 Revisited

- A physician assistant presents after an episode of loss of consciousness…
- Episode occurred after he attended a really painful session at the PA meeting (!)
  - …either dermatology or urology ☺
- Patient initially felt *sweaty* and remembers feeling *nauseated and warm* just prior to losing consciousness
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- …and said they saw a brief episode of whole-body stiffening…
- Patient fully recovered within 1 minute. Normal VS, cardiac, and neurologic examinations.
- EKG NSR

Q1: Next step in management?

A. Head CT/MRI +/- EEG

B. Cardiac enzymes, telemetry

C. Echocardiogram

D. CPR

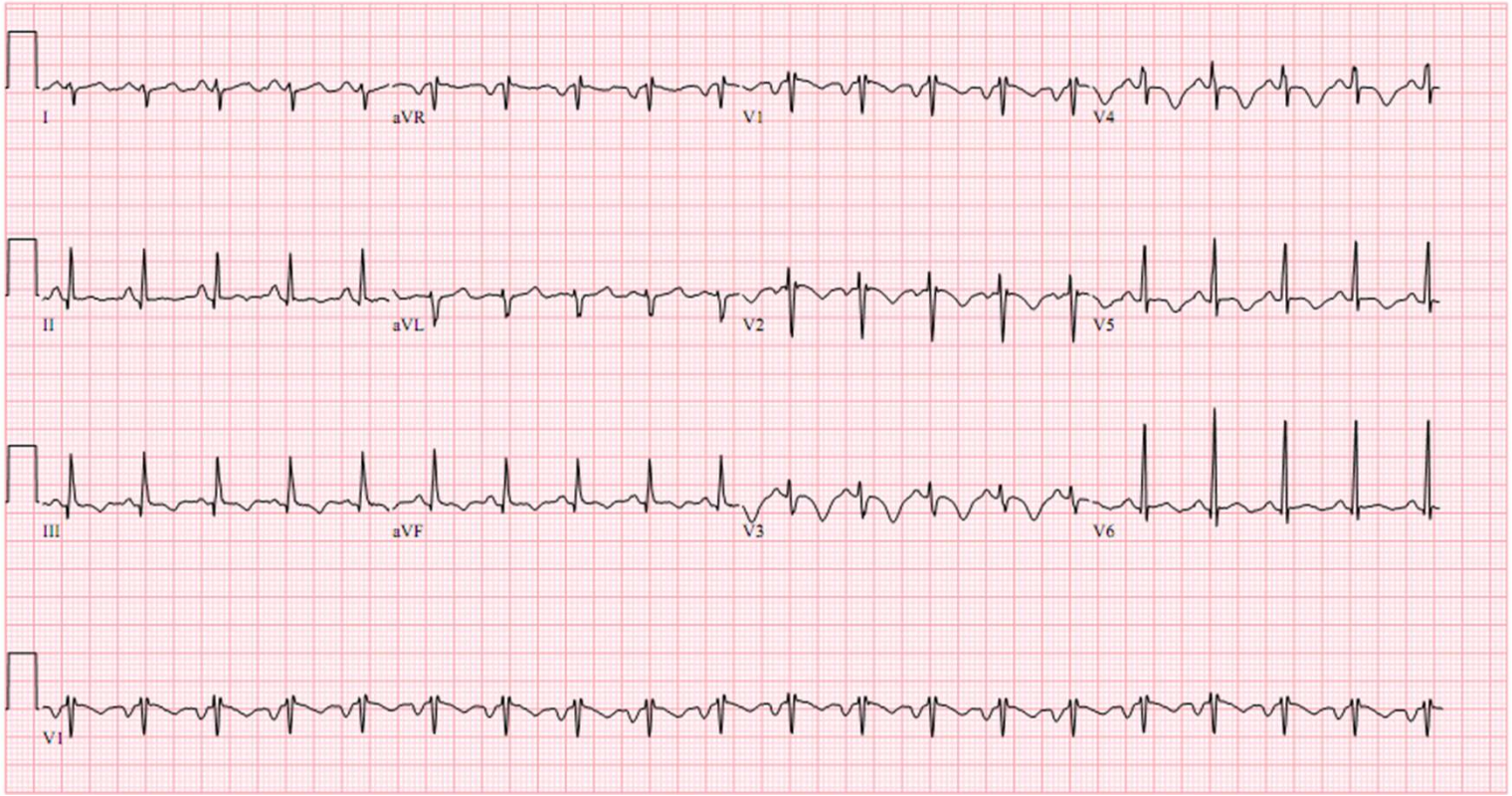
E. No further testing

Syncope Q6

40 year old male with acute CP, tachypnea, diaphoresis and syncope. Troponin-I: 0.28. EKG shown.

Likely Diagnosis?

A. Acute MI
B. WPW
C. SVT
D. PE
E. Hyperkalemia



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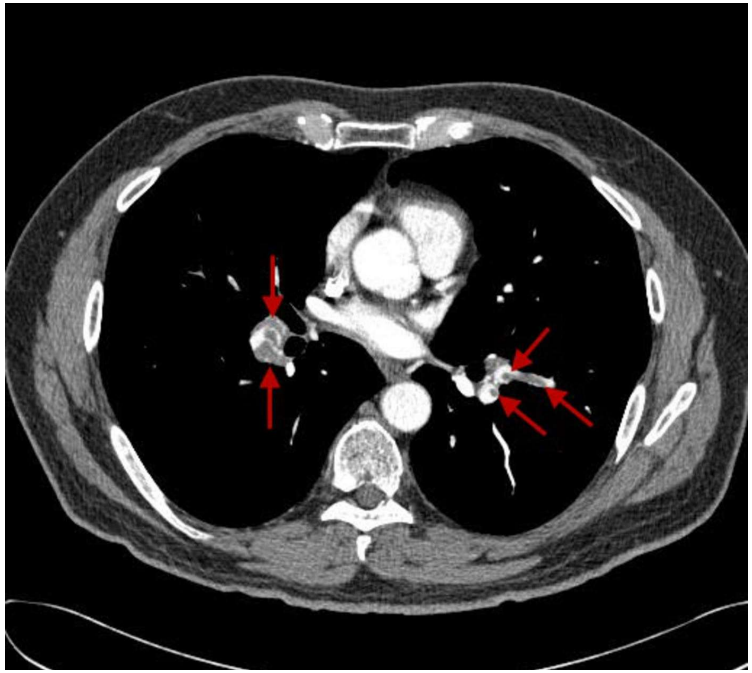

The NEW ENGLAND JOURNAL of MEDICINE

Prevalence of Pulmonary Embolism among Patients Hospitalized for Syncope

- PESIT Trial
- Cross-sectional (cohort-like…) study 2584 ED patients w syncope
- 11 Italian hospitals (2 academic, 9 community)

Prandoni, et al. N Engl J Med 2016;375:1524-31.

Pulmonary Embolism in Syncope Italian Trial

NEJM, October 2016

2583

patient visits for syncope

717 (28%)

patients admitted

560 (22%) patients

enrolled

(sWells' score + D-Dimer)

330 patients
PE ruled out

230 (9% of ED
presenting patients)
required imaging

1867 Discharged
Reflex-mediated
Drug-induced hypoTN
Volume depleted

157 Excluded
On anticoagulation
Recurrent syncope

Prandoni, et al. N Engl J Med 2016;375:1524-31.

PE in Syncope: Results

The NEW ENGLAND JOURNAL of MEDICINE

- **3.8%** of ED presenters with syncope had PE
  - 17% (n=97) of admitted syncope patients had PE
  - **2/3 of diagnosed PE had large vessel PE**
    - = main pulmonary artery or lobar artery
    - Others were segmental (26%) or subsegmental (7%)
  - ¼ of PE patients had no clinical manifestations of PE
    - i.e. no tachypnea, tachycardia, hypotension, clinical signs of DVT

Prandoni, et al. N Engl J Med 2016;375:1524-31.

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

Prevalence of pulmonary embolism in patients presenting with syncope. A systematic review and meta-analysis

Zardasht Oqab, MD FRCPC *, Heather Ganshorn, MLIS, Robert Sheldon, MD PhD

Libin Cardiovascular Institute of Alberta, University of Calgary, Calgary, AB, Canada

- 12 retrospective and prospective studies
- Inconsistently syncope definitions
- Majority of the included studies were low quality
- Pooled PE prevalence in syncope of 0.8% and PE prevalence in hospitalized syncope of 1.0%

JAMA Internal Medicine | Original Investigation | LESS IS MORE

Prevalence of Pulmonary Embolism in Patients With Syncope

Giorgio Costantino, MD; Martin H. Ruwald, MD, PhD; James Quinn, MD; Carlos A. Camargo Jr, MD, DrPH; Frederik Dalgaard, MD; Gunnar Gislason, MD, PhD; Tadahiro Goto, MD, MPH; Kohei Hasegawa, MD, MPH; Padma Kaul, PhD; Nicola Montano, MD, PhD; Anna-Karin Numé, MD; Antonio Russo, MD; Robert Sheldon, MD, PhD; Monica Solbiati, MD; Benjamin Sun, MD; Giovanni Casazza, PhD

- Retrospective cohort >1.6 million patients, 4 countries, 5 administrative databases (ICD-10 codes)
- Prevalence of VTE in patients with syncope: ~<0.5% for all ED patients, and <2.5% for all hospitalized patients

Prevalence of Pulmonary Embolism Among Emergency Department Patients With Syncope: A Multicenter Prospective Cohort Study

Ann Emerg Med. 2019;■:1-11.

- 9000 pts, combo of 2 prospective cohorts (1 US, 1 Canada)
- Admits: US 78%; Canada 13%
- 4% patients imaged
- PE prevalence: 0.6%
- Verification bias risk

PE in Syncope: Bottom Line

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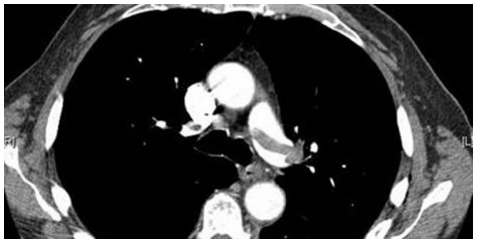

- Conclusion: Up to ~4% of ED syncope patients after a structured workup (H&P, EKG) may have PE
  - If ED has a high admit rate (50-80%) for syncope, much lower % will have PE
- Comparator publications: Large, mostly retrospective, cohorts using ICD-10 codes

- **Impact in the ED:**
  - Thorough w/u. No change in imaging ordering.
- **Impact on HM**:
  - In admitted patients with syncope (without clear etiology after initial w/u)…
  - **Check D-dimer** ➔ if positive, image for PE

Prandoni, et al. N Engl J Med 2016;375:1524-31.

RISK STRATIFICATION

Who is at Risk?

Who Should Be Hospitalized?

Practical Risk Stratification: **Canadian Syncope Risk Score (CSRS)**

- Identification of patients at-risk for serious adverse events within 30 days of ED disposition (adults in ED within 24 hrs of LOC)
  - **Death, MI, arrhythmia, structural heart disease, aortic dissection, PE, severe pulm HTN, SAH, significant hemorrhage, or serious condition requiring intervention**
- Large prospective derivation cohort and 2nd large prospective validation cohort
  - Total >8000 patients (~5% loss to f/u)
  - 3.6% serious adverse events

Thiruganasambandamoorthy V, et al. CMAJ 2016; 188: E289-298.
Thiruganasambandamoorthy V, et al. JAMA Intern Med. 2020;180(5):737-744.

Canadian Syncope Risk Score*

For Adults (Age ≥ 18 years) with Syncope and No Serious Condition obvious during ED evaluation

Items

I. Clinical evaluation

1) **Vasovagal predisposition[†] (-1)**
2) **History of heart disease[‡] (+1)**
3) **Any ED systolic BP <90 or >180 mmHg[§] (+2)**

II. Investigations

4) **Troponin elevated (>99%ile normal population) (+2)**
5) **Abnormal QRS axis (<-30 or >100) (+1)**
6) **QRS duration > 130 milliseconds (+1)**
7) **Corrected QT interval > 480 milliseconds (+2)**

III. *Diagnosis in the emergency* department

8) **Vasovagal syncope (-2)**
9) **Cardiac syncope (+2)**

*Warm-crowded place, prolonged standing, fear, emotion or pain
†Includes history of coronary or valvular heart disease, cardiomyopathy, non-sinus rhythm, pacemaker or defibrillator insertion; or congestive heart failure
‡Includes blood pressure values from triage to emergency department disposition

Thiruganasambandamoorthy V, et al. CMAJ 2016; 188: E289-298.

Test **Sensitivity**, **Specificity** and **Likelihood Ratios (LR)** based on Cut-Off Selected

	Canadian Syncope Risk Scale Score†	Sensitivity	Specificity	Estimated Probability of Serious Outcome	Likelihood Ratios	
					LR (+)	LR (-)
Very Low	-3	1.000	0.000	0.4%	1.0	0
	-2	0.992	0.263	0.6%	1.3	0.03
Low	-1	0.977	0.457	1.1%	1.8	0.05
	0	0.931	0.564	1.9%	2.1	0.12
Med	1	0.854	0.775	3.3%	3.8	0.19
	2	0.762	0.840	5.6%	4.8	0.28
High	3	0.654	0.910	9.4%	7.3	0.38
	4	0.508	0.952	15.3%	10.6	0.52
Very High	5	0.339	0.974	23.9%	13.0	0.68
	≥6	0.169	0.988	35.3%	14.1	0.84

Thiruganasambandamoorthy V, et al. JAMA Intern Med. 2020;180(5):737-744.

CARDIOLOGY / EMERGENCY

Calculate by QxMD

Canadian Syncope Risk Score (CSRS)

Estimate prognosis among patients presenting to emergency with syncope

App on QxMD or MDCalc

Predisposition to Vasovagal Symptoms?

Triggered by being in a warm crowded place, prolonged standing, fear, emotion or pain.

Yes

No

History of Heart Disease?

Includes coronary or valvular heart disease, cardiomyopathy, congestive heart failure and non-sinus rhythm (electrocardio
documented history of ventricular or atrial arrhythmias, or device implantation)

Yes

No

Any Systolic Pressure Reading <90 or >180 mm Hg

Includes blood pressure values from triage until disposition from the emergency department.

Yes

No

Elevated Troponin Level?

>99th percentile of normal population

Yes

>99th percentile of normal population

Yes

No

Abnormal QRS Axis (<–30° or >100°)?

Yes

No

QRS Duration >130 ms?

Yes

No

Corrected QT Interval >480 ms?

Yes

No

Diagnosis in Emergency Department of Vasovagal Syncope?

Yes

No

Diagnosis in Emergency Department of Cardiac Syncope?

Yes

No

Results

Please answer all questions. The results will be computed once all questions are answered.

CSRS: International Validation

- Validation of CSRS in 2283 pts in US, Europe, Australia
  - 60% patients triaged as low risk or very low risk
  - Better discrimination than European OESIL score
  - Clinical “gestalt” possibly similar to CSRS (in the study setting)
- Wide variation in hospital admission rates for syncope…
  - 12% in parts of Canada, 80% in some U.S. centers
- …implementation of the CSRS might reduce hospital admissions for syncope

Zimmermann T, et al. International Validation of the Canadian Syncope Risk Score. Ann Intern Med. 2022. doi:10.7326/M21-2313

Syncope Q5: Revisited

Which risk stratification tool can reliably predict % risk of an adverse outcome in patients with syncope?

A. Canadian Syncope Risk Score (CSRS)

B. Evaluation of Guidelines in Syncope Study (EGYSIS)

C. Rose Score

D. San Francisco Syncope Rule (SFSR)

E. Risk stratification rules cannot predict % risk of adverse outcome

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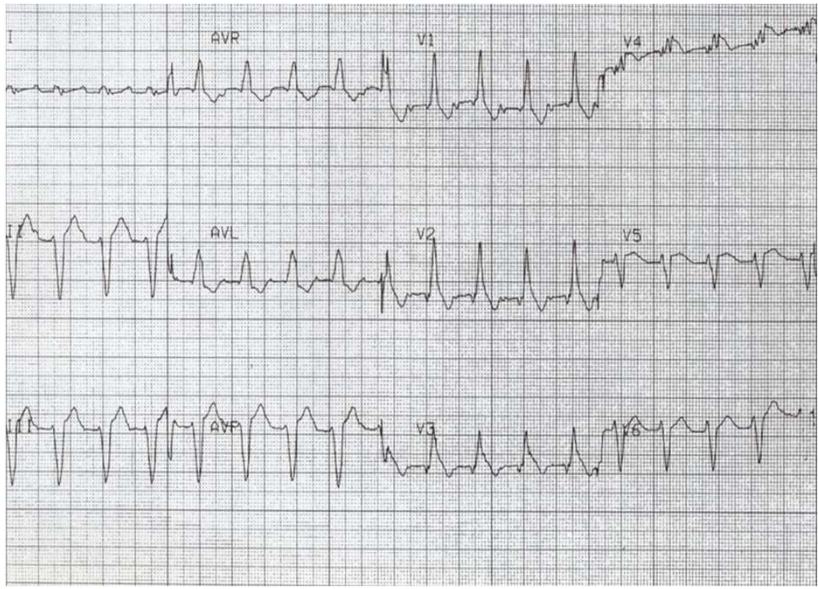
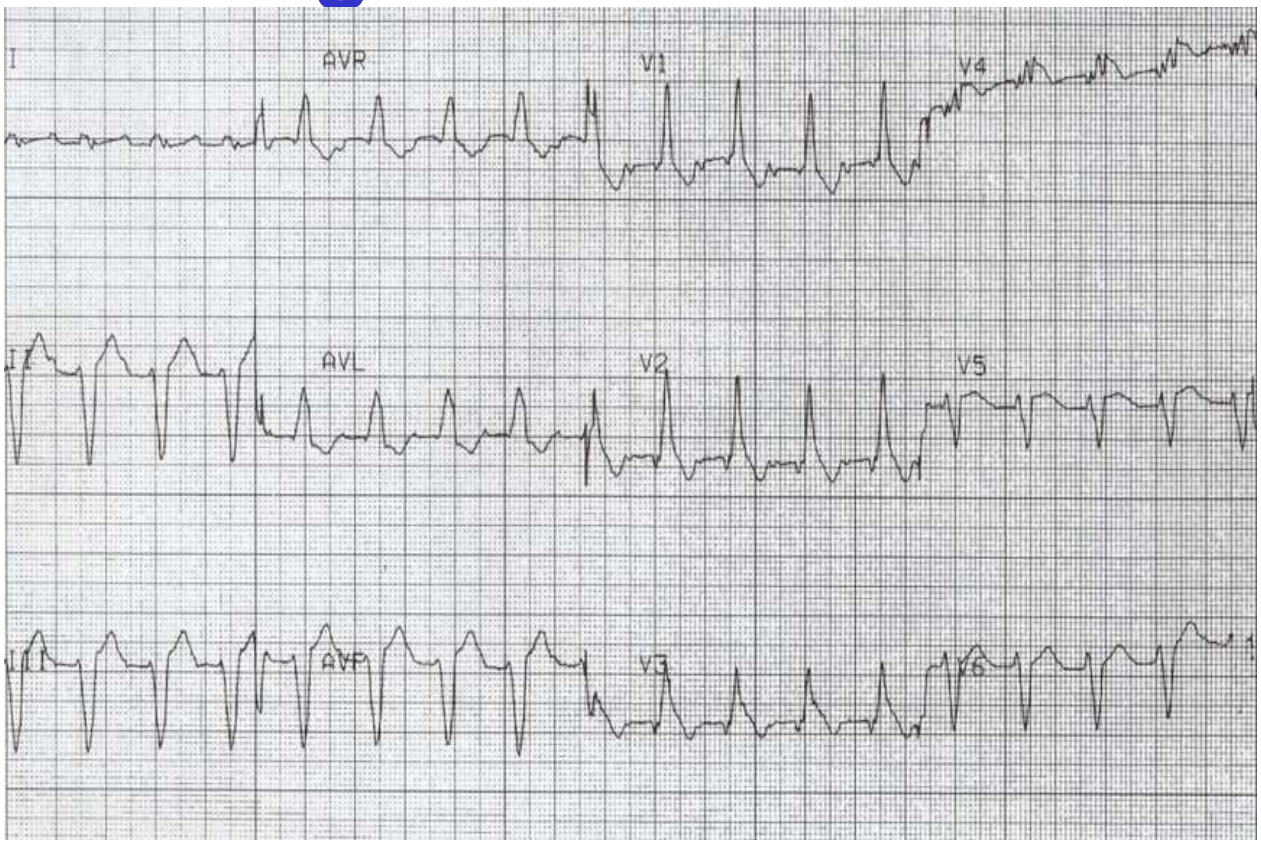
Syncope Case

- 62 y/o M passed out while voiding just after awakening from sleep.
- Denies symptoms beforehand and awakened promptly. Denies chest pain, SOB, any prodrome.
- Broke his humerus in the fall.
- PMH: HTN (controlled on HCTZ and BB)
- SH: 40 pck-yr tob
- PE VS normal
- Normal Neuro and CV exam. Distant breath sounds.
- EKG shown
- Echocardiogram: mild LVH



Syncope Case
What is your next step for further testing?

A. Head CT
B. Treadmill stress test
C. Tilt Table Test
D. Electrophysiologic (EP) Study
E. No further testing



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CARDIOLOGY / EMERGENCY

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Canadian Syncope Risk Score (CSRS)

Estimate prognosis among patients presenting to emergency with syncope

App on QxMD

Predisposition to Vasovagal Symptoms?

Predispo

Triggere

Yes

No

History of Heart Disease?

Includes c
document

non-sinus rhythm (electrocardio

Yes

No

History of Heart Disease?

Any Systolic Pressure Reading <90 or >180 mm Hg

Includes bl

Yes

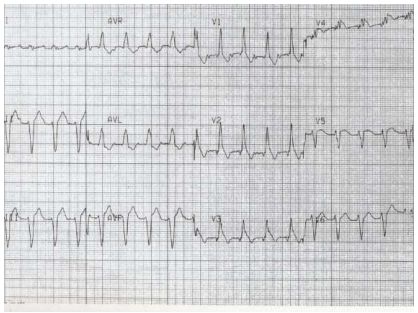
No

Any SBP<90 or >180?

Elevated Troponin Level?

>99th percentile of normal population

Yes



>99th percentile of normal population

Yes

No

Elevated Troponin?

Abnormal QRS Axis (<–30° or >100°)?

Yes

No

√

Abnormal QRS axis (<-30º or >100º)?

QRS Duration >130 ms?

Yes

No

√

QRS Duration >130ms?

Corrected QT Interval >480 ms?

Yes

No

√

QTc > 480ms?

Diagnosis in Emergency Department of Vasovagal Syncope?

Yes

No

ED Dx Vasovagal Syncope?

Diagnosis in Emergency Department of Cardiac Syncope?

Yes

No

√

ED Dx Cardiac Syncope?

Results

Please answer all questions. The results will be computed once all questions are answered.

QxMD Result: CSRS

Results

CSRS Score
6

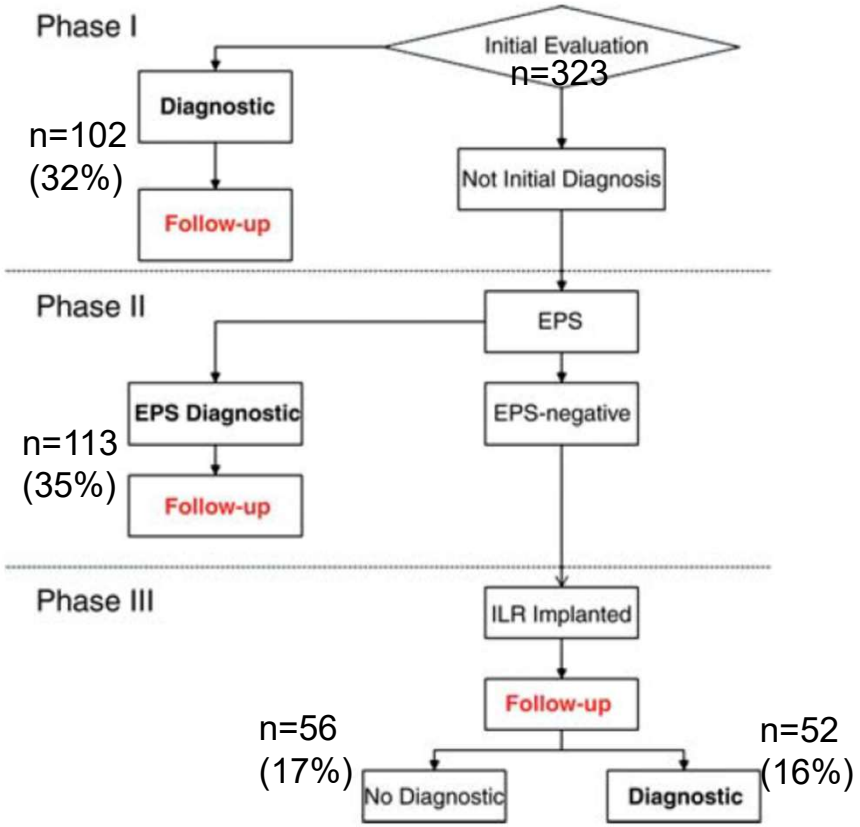
Risk Category
Very High

Risk of Serious Adverse Event at 30 days*
28.9%

*A serious adverse event is defined as the detection or occurrence of any serious condition related to syncope within 30 days after disposition from the emergency department. The composite outcome included any of the following serious adverse events: death, arrhythmia, myocardial infarction, serious structural heart disease, aortic dissection, pulmonary embolism, severe pulmonary hypertension, severe hemorrhage, subarachnoid hemorrhage, any other serious condition causing syncope and procedural interventions for the treatment of syncope.

Diagnosis, management, and outcomes of patients with syncope and bundle branch block

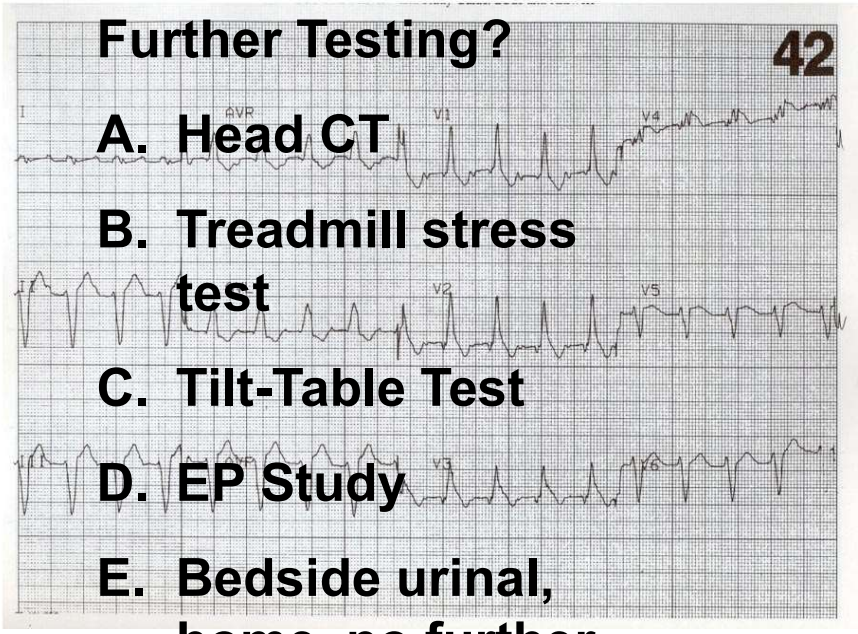
- ≥1 syncope in the last 6 months, with QRS duration ≥120ms (i.e. BBB)
- 323 patients (avg LVEF >55%)
- Dx established in 267 (83%) patients using strategy of electrophysiologic study (EPS) and implantable loop recorder (ILR)
- Diagnoses:
  - Bradyarrhythmia (202), CSS (20), VT (18)
  - Pacemaker placed in 220 (68%), ICD in 19 (6%), RFA in 3 (1%)



European Heart Journal (2011) 32, 1535–1541. doi:10.1093/eurheartj/ehr071

Syncope Q7

- 62 y/o M passed out while voiding just after awakening from sleep.
- Denies symptoms beforehand and awakened promptly.
- Denies CV symptoms.
- PMH: HTN. SH: 40 pck-yr tob.
- PE Normal Neuro and CV exam. Distant breath sounds.
- EKG RBBB, LAFB, 1^{o}AVB



Further Testing?

A. Head CT

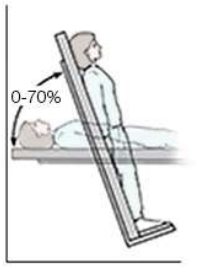
B. Treadmill stress test

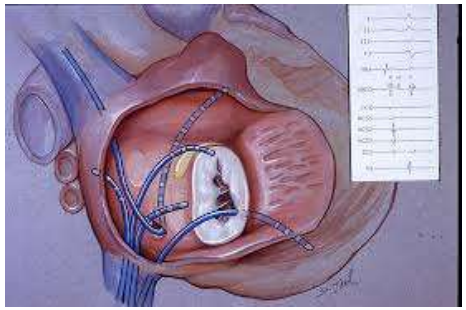
C. Tilt-Table Test

D. EP Study

E. Bedside urinal, home, no further testing

What testing is available for patients with syncope, and when do I decide to request specific (more expensive) testing?



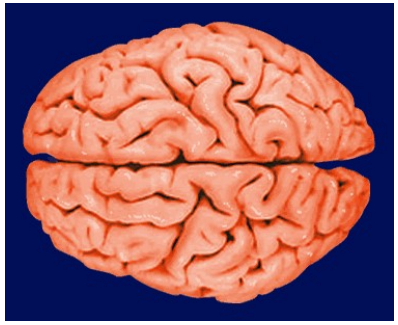


Neurologic Diagnostic Modalities

Study	Yield (%)	Indications
EEG	1-2	Witnessed seizure, postevent confusion, history of seizure, focal neurologic symptoms or signs
Head CT	4*	Patients with focal neurologic symptoms or signs, seizure, or head trauma
Neurovascular studies	Unknown**	May consider in patients with signs/symptoms suggestive of TIA or stroke

*all positive findings were in patients with focal neurologic findings or a witnessed seizure

**No studies to assess the utility of carotid U/S or transcranial Doppler



Cost Conscious Care

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An initiative of the ABIM Foundation

American College of Physicians

Five Things Physicians and Patients Should Question

ACP American College of Physicians® INTERNAL MEDICINE | *Doctors for Adults*

In the evaluation of simple syncope and a normal neurological examination, don't obtain brain imaging studies (CT or MRI).

In patients with witnessed syncope but with no suggestion of seizure and no report of other neurologic symptoms or signs, the likelihood of a central nervous system (CNS) cause of the event is extremely low and patient outcomes are not improved with brain imaging studies.

2010 ACR-ASNR CT of the brain guideline; 2010 NICE transient loss of consciousness guideline; 2000 ECS syncope guideline.

Choosing Wisely®

An initiative of the ABIM Foundation

American College of Emergency Physicians

American College of Emergency Physicians®

ADVANCING EMERGENCY CARE

Five More Things Physicians and Patients Should Question

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

Gallagher EJ. Hospitalization for fainting: high stakes, low yield. Ann Emerg Med. 1997 Apr;29(4):540-2.

Pires LA, Ganji JR, Jarandila R, Steele R. Diagnostic patterns and temporal trends in the evaluation of adult patients hospitalized with syncope. Arch Intern Med. 2001Aug 13-27;161:1889-95.

Giglio P, Bednarczyk EM, Weiss K, Bakshi R. Syncope and head CT scans in the emergency department. Emerg Radiol. 2005 Dec;12(1-2):44-6.

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Grossman SA, Fischer C, Bar JL, Lipsitz LA, Mottley L, Sands K, Thompson S, Zimetbaum P, Shapiro NI. The yield of head CT in syncope: a pilot study. Intern Emerg Med. 2007 Mar;2(1):46-9.

Mendu ML, McAvay G, Lampert R, Stoehr J, Tinetti ME. Yield of diagnostic tests in evaluating syncopal episodes in older patients. Arch Intern Med. 2009 Jul 27;169(14):1299-305.

Choosing Wisely®

An initiative of the ABIM Foundation

American Academy of Neurology

AMERICAN ACADEMY OF NEUROLOGY®

Five Things Physicians and Patients Should Question

Don't perform imaging of the carotid arteries for simple syncope without other neurologic symptoms.

Occlusive carotid artery disease does not cause fainting but rather causes focal neurologic deficits such as unilateral weakness. Thus, carotid imaging will not identify the cause of the fainting and increases cost. Fainting is a frequent complaint, affecting 40% of people during their lifetime.

Strickberger SA, Benson DW, Biaggioni I, Callans DJ, Cohen MI, Ellenbogen KA, Epstein AE, Friedman P, Goldberger J, Heidenreich PA, Klein GJ, Knight BP, Morillo CA, Myerburg RJ, Sila CA. AHA/ACCF scientific statement on the evaluation of Syncope: From the American Heart Association councils on clinical cardiology, cardiovascular nursing, cardiovascular disease in the young, and stroke, and the quality of care and outcomes research interdisciplinary working group; and the American College of Cardiology Foundation in collaboration with the Heart Rhythm Society. J Am Coll Cardiol [Internet]. 2006 January 17;47(2):473-84.

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Syncope Q4: Revisited

In syncope patients who present with a normal neurologic history and physical exam (i.e. no neurologic signs or symptoms prior to or following a syncope episode), what percentage of patients have a positive finding on neurologic testing (CT/MRI brain, EEG, carotid ultrasound) that explains the syncope?

A.0%

B.3%

C.10%

D.25%

E.50%

Diagnostic Modalities – Summary

Study	Yield (%)	Indications in Syncope Patients
Echocardiography	5-10	Patients with known or suspected heart disease
Exercise Tolerance Testing	1	Suspected CAD or exertional syncope
Carotid Sinus Massage$	46	Elderly pts w/ unexplained syncope or suggestive history
Tilt-Table Testing#	49@	Recurrent unexplained syncope w/o evidence of organic heart disease or with neg. cardiac w/u
Signal Averaged EKG	Unknown*	Identification of patients with ischemic heart disease and unexplained syncope who are (un)likely to have inducible sustained ventricular tachycardia
EP studies#	60	Organic heart disease and high suspicion for arrhythmia OR clinically normal heart but high risk for bradyarrhythmia (esp. if frail/injury risk)

$ Selected elderly patients (monitored)

Selected patients

@yield **without** use of isoproterenol

*Negative predictive value 90%

Schnipper JL, Kapoor WN. Med Clin N Amer. 2001; 85(2): 423-456.

Should We Consider Echocardiography in Patients with Syncope?

- 2006 Guidelines (AHA/ACC): "…echo…a helpful screening tool if the history, physical examination and ECG do not provide a diagnosis or if underlying heart disease is suspected."

CHOOSING WISELY®: THINGS WE DO FOR NO REASON

Things We Do For No Reason:
Echocardiogram in Unselected Patients with Syncope

Charles L. Madeira, MD[1], Michael J. Craig, MD[2], Andrew Donohoe, MD[2], John R. Stephens, MD[2*]

Journal of Hospital Medicine Vol 12 | No 12 | December 2017

Transthoracic Echo in Patients with Syncope and Normal H&P and ECG

	Study Type	Population	Result
Recchia, et al. (1995)	Retrospective Cohort (n=128)	38 patients had TTE after normal Hx, PE, ECG	0/38 TTE explained syncope
Sarasin, et al. (2002)	Prospective Cohort (n=155)	67 patients had TTE after normal Hx, PE, ECG	0/67 TTE explained syncope
Mendu, et al. (2009)	Retrospective Cohort (n=2106)	488 patients had normal (=0) SFSR score	4/488 patients (<1%) TTE finding that affected dx/mgmt
Anderson, et al. (2012)	Retrospective Cohort (n=323)	235 with normal ECG had TTE	0/235 TTE explained syncope
Chang, et al. (2016)	Retrospective Cohort (n=488)	192 with normal ECG had TTE	8/192 new abnormality on TTE*
Han, et al. (2017)	Retrospective Cohort (n=241)	47 with 'low risk' had TTE	1/47 had abnormal TTE

All single center studies

Recchia D, Barzilai B. *J Gen Intern Med.* 1995;10(12):649-655.
Mendu ML,et al. *Arch Intern Med.* 2009;169(14):1299-1305.
Anderson KL, et al. *Ann Emerg Med.* 2012;60(4):478-484.e1.
Sarasin FP, et al. *Heart.* 2002;88(4):363-367.
Chang NL, et al. Cardiol Res Pract. 2016;2016:1251637.
Han SK, et al. Am J Emerg Med. 2017;35(2):281-284.

Summary of Studies: Yield of Echo

- **Yield of Echo** in Patients with **Normal History, PE, ECG**: ~1%
  - Cost ~$1500-2000 per study
  - Cost per new abnormality discovered ~$100,000
    - …and unclear if abnormality explains syncope

- Yield of Echo in patients with Abnormal ECG, ~17%
  - Cost per new abnormality discovered ~$7000

2017 ACC/AHA/HRS Guideline for the Evaluation and Management of Patients With Syncope

Recommendations for Cardiac Imaging		
COR	**LOE**	**Recommendations**
IIa	**B-NR**	**Transthoracic echocardiography can be useful in selected patients presenting with syncope if structural heart disease is suspected (80,99,124).**

2018 ESC Guidelines for the diagnosis and management of syncope

Echocardiography

Recommendations	Class[a]	Level[b]
Indications		
Echocardiography is indicated for diagnosis and risk stratification in patients with suspected structural heart disease.[235,236]	I	B

Exercise Stress Testing

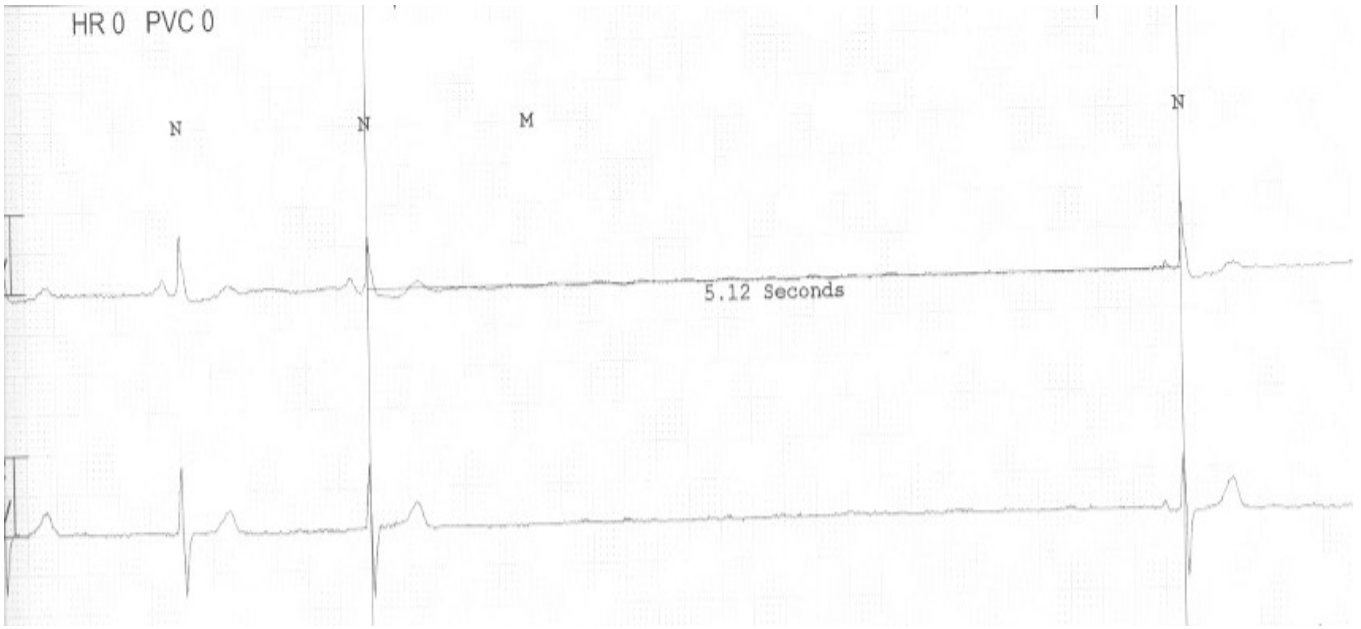
- **Indications**
  1. Suspected ischemia
  2. Exertion-related syncope
  3. Exertion-induced tachyarrhythmias
  4. AVB w/ BBB (AVB can worsen w/exercise)
- **Yield**: 1%
  - Echo may be necessary prior to stress testing to exclude structural heart disease (e.g. AS, HOCM)

Back to Syncope Q2

- 65 yo man with first episode of syncope while seated in front of computer at work
- Sudden, unexpected, no warning. No seizure activity.
- Recovered after 1 min
- Fractured nose
- No history of heart disease. No medications.

- BP 125/80; P 60. Cardiac and neuro exams normal.
- No carotid bruits
- EKG normal
- Routine labs all normal
- What is the next best test to perform?
  A. CT head
  B. Echocardiogram
  C. Carotid sinus massage
  D. Loop monitor/recorder
  E. Tilt table test

Carotid Sinus Massage



Carotid Sinus Hypersensitivity Syndrome

- **Carotid Sinus Massage**
  - Indications: elderly patients with unexplained syncope or suggestive history
  - Contraindications: carotid bruits, recent MI or CVA, h/o ventricular tachycardia
  - Yield: 46% (selected elderly patients)
- Dx:
  - Greater than 3 second pause + symptoms
  - SA arrest or AV block
- Cardioinhibitory, vasodepressor or combination
- Treatment of cardioinhibitory: pacemaker

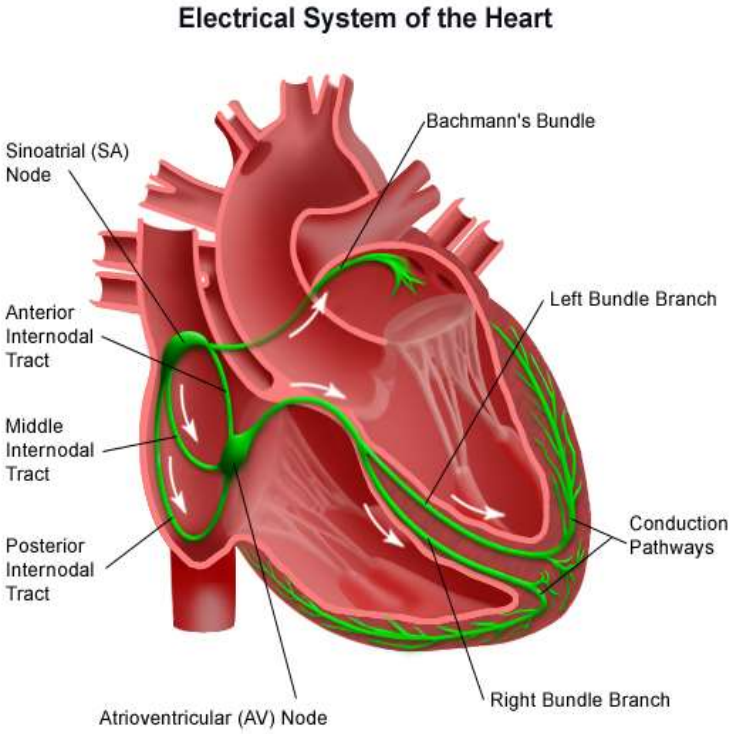
Carotid Sinus Massage

For Video instructions, go to: N Engl J Med 2017; 377:e21
DOI: 10.1056/NEJMvcm1313338

- **Procedure**
  1. Listen for carotid bruits
  2. Head slightly rotated to opposite side
  3. Massage firmly anterior to SCM muscle at the upper border of the thyroid cartilage for 5 seconds
  4. Assess and record changes on cardiac monitor
     - **Diagnosis**: sinus pause > 3 sec, SBP drop > 50 mmHg or SBP 30 mmHg with symptoms
  5. Repeat procedure on other side
- **Indications**: elderly patients with unexplained syncope or suggestive history
- **Contraindications**: *carotid bruits, recent MI or CVA, h/o ventricular tachycardia*
- Low Complication Rate
- **Yield:** 46% (selected elderly patients)

Electrophysiologic Studies

- **Indications**: Structural, ischemic, or conduction system heart disease and/or high suspicion for arrhythmia OR clinically normal heart but high risk for bradyarrhythmia (esp. if frail/injury risk)
- **Yield**: 30-60% (selected patients)
  - Prognostic yield of negative study: 1/3 experience recurrent syncope, but sudden death is rare (esp. w/o CHF)



Outpatient Diagnostic Modalities

Study	Yield (%)	Indications
24 hour Holter Monitoring	19*	Patients with organic heart disease, abnormal EKG, or high suspicion for arrhythmia
External Loop Recorder#	34**	Patients with frequent$ syncope, suspicion for arrhythmia, and either no organic heart disease OR organic heart disease/abnormall EKG with negative cardiac work-up
Insertable Loop Recorder#	59***	Negative cardiac work-up, infrequent syncope, negative tilt, and psychiatric examinations
Psychiatric Evaluation#	21	Recurrent unexplained syncope without evidence of organic heart disease or with negative cardiac workup

***positive yield 4%, negative yield 15%**
****positive yield 13%, negative yield 21%**
*****positive yield 27%, negative yield 32%**
 # selected patients
$ frequent syncope or symptoms = at least 1 episode every 1-2 months

Schnipper JL, Kapoor WN. Med Clin N Amer. 2001; 85(2): 423-456.

Tilt Table Testing

- **Evaluates the predisposition to vasovagal syncope (dysautonomic and POTS rarely diagnosed)**
- **Indications**: Recurrent unexplained syncope without evidence of organic heart disease or with negative cardiac workup
- **Yield**: 49%
  - Without isoproterenol
  - Selected patients
  - Repeat testing results NOT reproducible in 15-35% of patients

COST: Syncope Inpatient Diagnostic Evaluation

Retrospective cohort: 2100 patients with syncope admitted to hospital

Test	Obtained	Affected Diagnosis	Cost per Dx/Mgmt
Postural BP	38%	26%	$17
EKG	99%	7%	$1020
Echo	39%	4%	$6272
Carotid U/S	13%	1%	$19,600
CV enzymes	95%	2%	$22,400
Head CT	63%	2%	$25,000
EEG	8%	1%	$33,000

Mendu ML, et al. Arch Intern Med. 2009; 169: 1299-1305.

Take Home Points

- **Structured, comprehensive history (…to design DDx)**
- **Physical Examination focusing on orthostatics, cardiac and neurologic**
- **Risk Stratification:**
  - **Use Canadian Syncope Risk Score (CSRS) to rapidly determine patient's risk and triage to inpatient vs. home**
  - **QxMD Calculate or MedCalc Apps to help assess risk with CSRS**
- **Admitted patients without a clear low-risk etiology for syncope should be considered for imaging to r/o PE**
  - **if D-Dimer +**
- **Selected other advanced testing based on initial evaluation**
  - **Echo not likely helpful in low to moderate risk syncope patients with normal ECG**

Special Thanks…

- Thank you to Dr. Lawrence Lesser (R.I.P.) for sharing a few of the extra cases included here

- Thank you to Dr. Dustin Staloch for collaborative slides related to PESIT Trial

SyncopE Evaluation:
Evidence-Based and Economical

Daniel D Dressler, MD, MSc, MHM, FACP
Professor of Medicine
Director, IM Teaching Services, Emory University Hospital
Master Clinician, Dept of Medicine
Associate Program Director, JW Hurst IM Residency Program
Semmelweis Society Advisor
Emory University School of Medicine
Daniel.Dressler@emory.edu

QUESTIONS?

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