

---

Syncope:  
What do don't know *can* harm you

---

ZACHARY HARTSELL, DHA, PA-C



# Objectives

---

Define syncope and its different sub-types

Describe the pathophysiologic mechanisms that lead to syncope

Identify and appropriately apply clinical scoring rules to patients with syncope

Employ evidence-based recommendations to determine who requires in hospital evaluations

# Disclosures

---

None

This presentation does not discuss off-label uses of products

# Definition

---

A transient loss of consciousness, associated with loss of postural tone, with spontaneous return to baseline neurologic function, requiring no resuscitative efforts

- Prodrome → presyncope

## Underlying mechanism

- Global hypoperfusion of both cerebral cortices
- Focal hypoperfusion of reticular activating system

# Prevalence

---

Impacts patients on a medical, social, and economic basis

Accounts for 3-5% of emergency department visits and 1-6% of hospital admissions

- Most are benign

The underlying cause is established in  $\approx 50\%$

- Often remain undiagnosed
- In one study, the cause was determined in 13/121 (11%) patients at a cost of \$23,000 for each patient diagnosed.

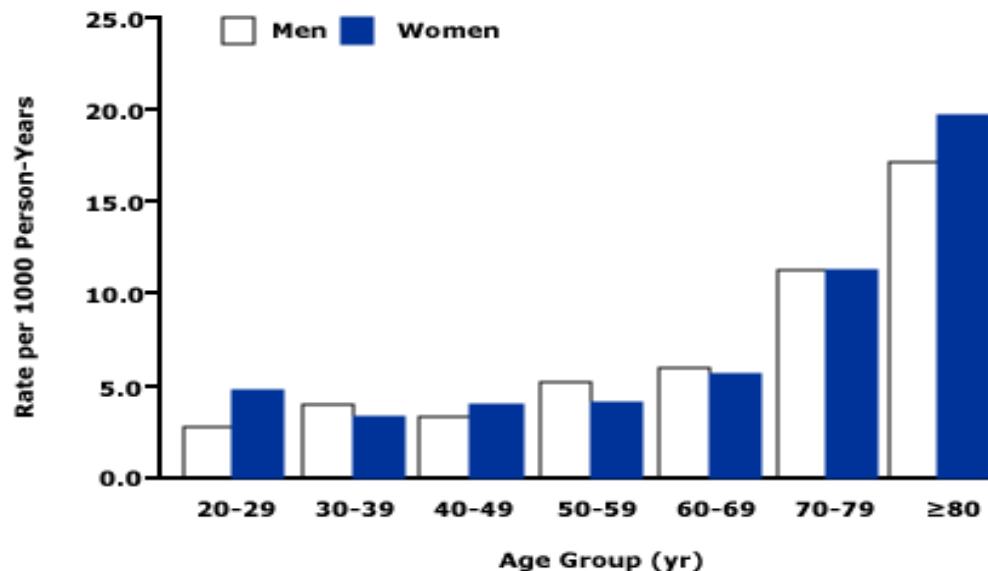


1/3 of people will pass out in their lives

1/3 of people who pass out will have a recurrence

1/3 of people who pass out will injure themselves (requiring treatment)

# Rates of Syncope



The incidence rates of syncope per 1000 person-years of follow-up increased with age among both men and women. The increase in the incidence rate was steeper starting at the age of 70 years. Syncope rates were similar among men and women.

# Utilization of Resources

---

Admission rate = 27-35%

Readmissions = 23%

Median length of stay = 2 days

Median hospital charges have increased, mainly due to invasive procedures

- 2005: \$20,023
- 2011: \$28,175

Mortality rate = 0.9% for primary and secondary syncope

- 13.7% in 1983!

Despite all this...undiagnosed syncope rates have remained relatively the same!



# Diagnosis

---

The underlying cause is established in  $\approx 50\%$

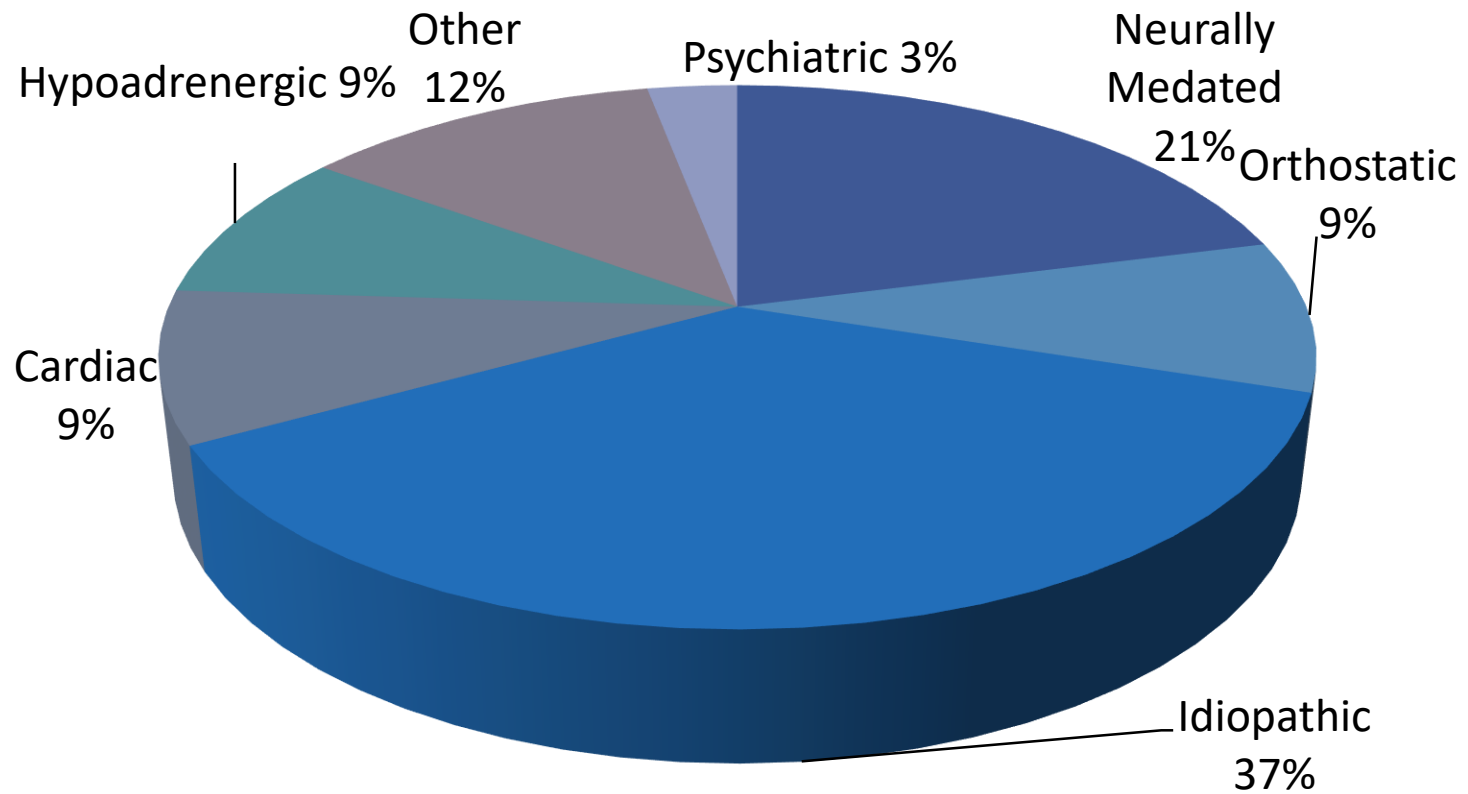
- Often remain undiagnosed
- In one study, the cause was determined in 13/121 (11%) patients at a cost of \$23,000 for each patient diagnosed.

Study of 341 patients

- 23% cardiac cause (brady- or tachyarrhythmia)
- 58% neurally-mediated cause
- 1 % neurologic or psychiatric cause
- 18% unexplained cause

# Presumed Etiology of Syncope

---



# Triaging Syncope

---

## Life threatening

- Cardiovascular syncope
- Acute blood loss
- Pulmonary embolism
- ICH

## Consider (but not true syncope)

- Stroke
- Seizure



# Cardiovascular Syncope

---

## Arrhythmia

- Ventricular tachycardia
- Brugada syndrome
- Bradycardia

## Ischemic

- Acute coronary syndrome

## Structural abnormalities

- Valvular heart disease (AS, MS)
- Cardiomyopathy (ischemic, dilated, hypertrophic)
- Atrial myxoma
- Cardiac tamponade



# Life-Threatening Causes

---

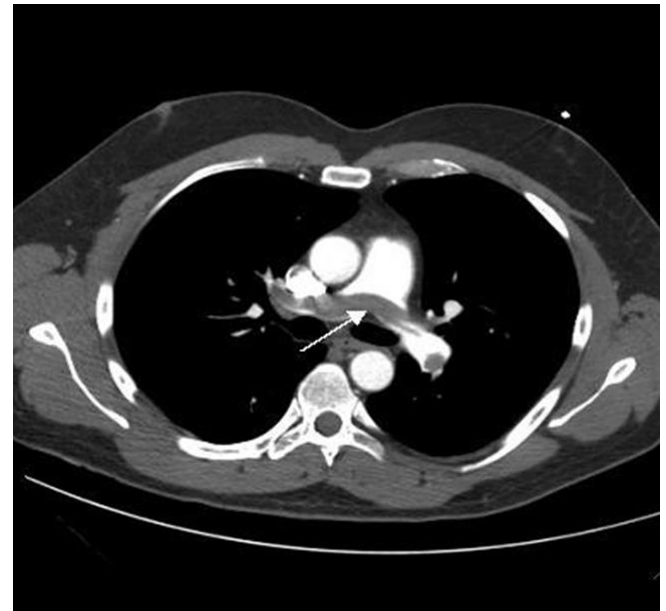
## Blood loss

- Trauma with significant blood loss
- Gastrointestinal bleeding
- Tissue rupture

## Pulmonary embolism

- Saddle embolus

## Intracranial Hemorrhage



# Not Immediate Life-Threatening Causes

---

Neurocardiogenic syncope (vasovagal)

Carotid sinus hypersensitivity

Orthostatic syncope

Medication-related syncope



# Orthostatic

---

Volume loss

Autonomic dysfunction

Deconditioning, prolonged bed rest

# Medication Related

Vaso-active medications

Anti-HTNs,  $\alpha$  and  $\beta$ -blockers, CCB, nitrates, diuretics, ED medications

Medications affecting conduction

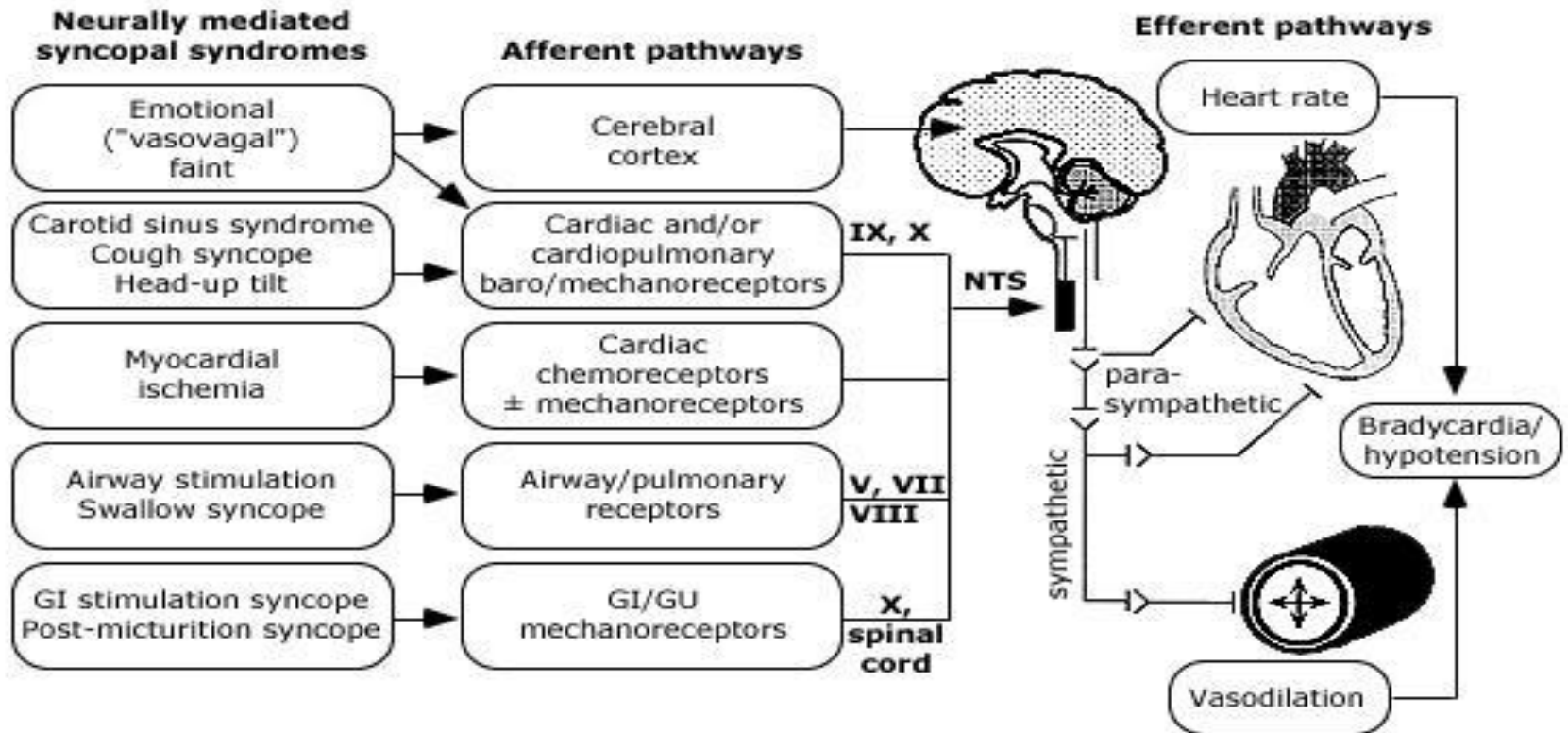
Antiarrhythmics, digoxin

Medications affecting the QT interval

Antiemetics, antipsychotics, antidepressants

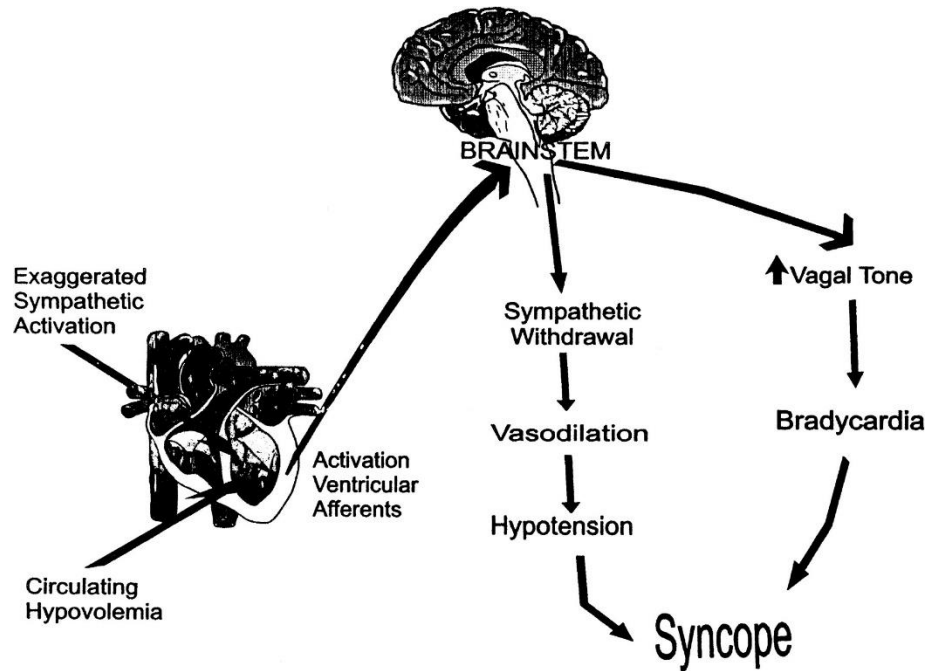


# Neurally Mediated Syncope



# Neurally Mediated Syncope

---



# Zebras

---

Atrial Myxoma

Carcinoid

Takayasu's arteritis

Arrhythmogenic Right Ventricular Dysplasia (ARVD)

LV Noncompaction

Takotsubo Cardiomyopathy

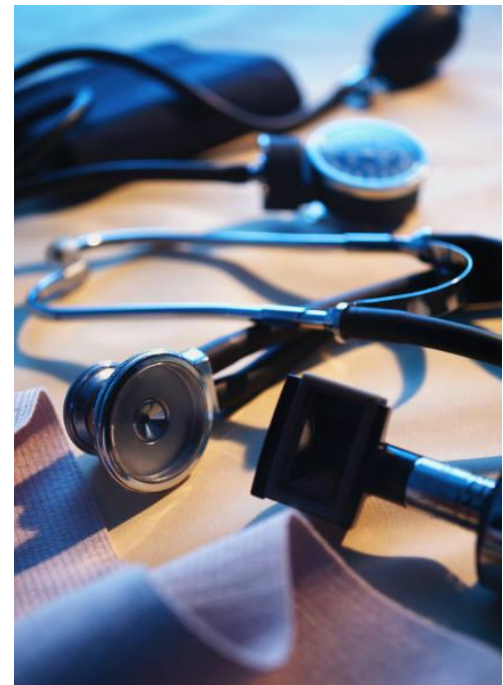
Pheochromocytoma

# Clinical Presentation

---

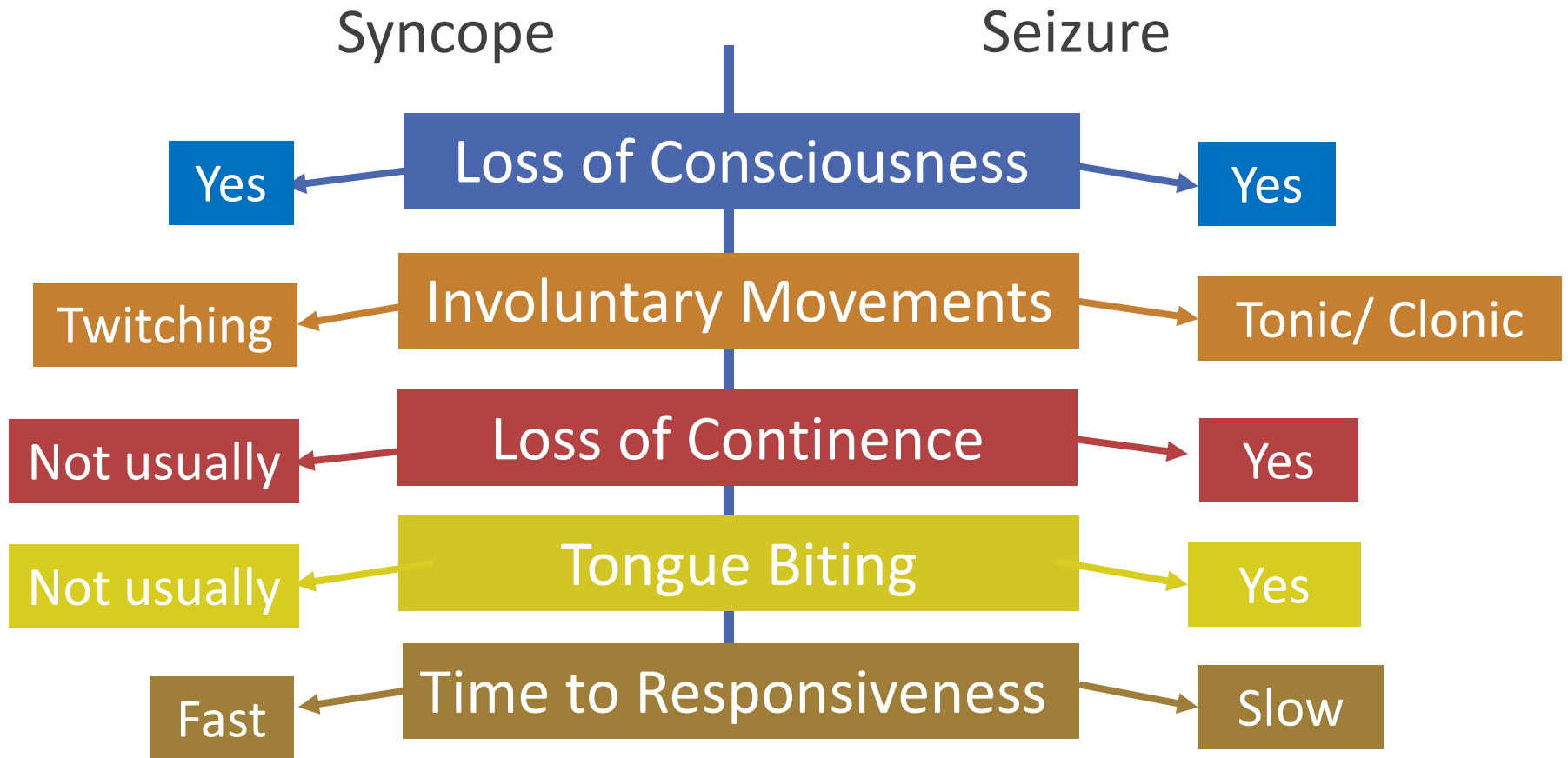
## Highly variable

- Dizziness
- Lightheadedness
- Nausea/vomiting
- Pallor
- Diaphoresis
- Vertigo
- Unsteadiness
- Chest pain



# Syncope vs. Seizure

---



# History & Physical Exam

---

H& P lead to the cause of syncope in 45% of cases

- Number of episodes
- Position (erect vs. supine to erect vs. supine)
- Preceding events
- Duration of symptoms
- Recovery
- Past medical history
- Medications
- Vitals
- Cardiac murmurs
- Orthostatic BP

## Characteristics Associated with Increased Probability of Cardiac Cause

>60 year old

Male

History of known ischemic heart disease, structural heart disease, congenital heart disease, arrhythmia, or reduced LVEF

Little to no prodrome

Syncope during exertion

Syncope while supine

Less than 2 syncopal episodes

Family history of sudden cardiac death age <50

## Characteristics Not Associated with Increased Probability of Cardiac Cause

Younger age

No known cardiac disease

Syncope while standing

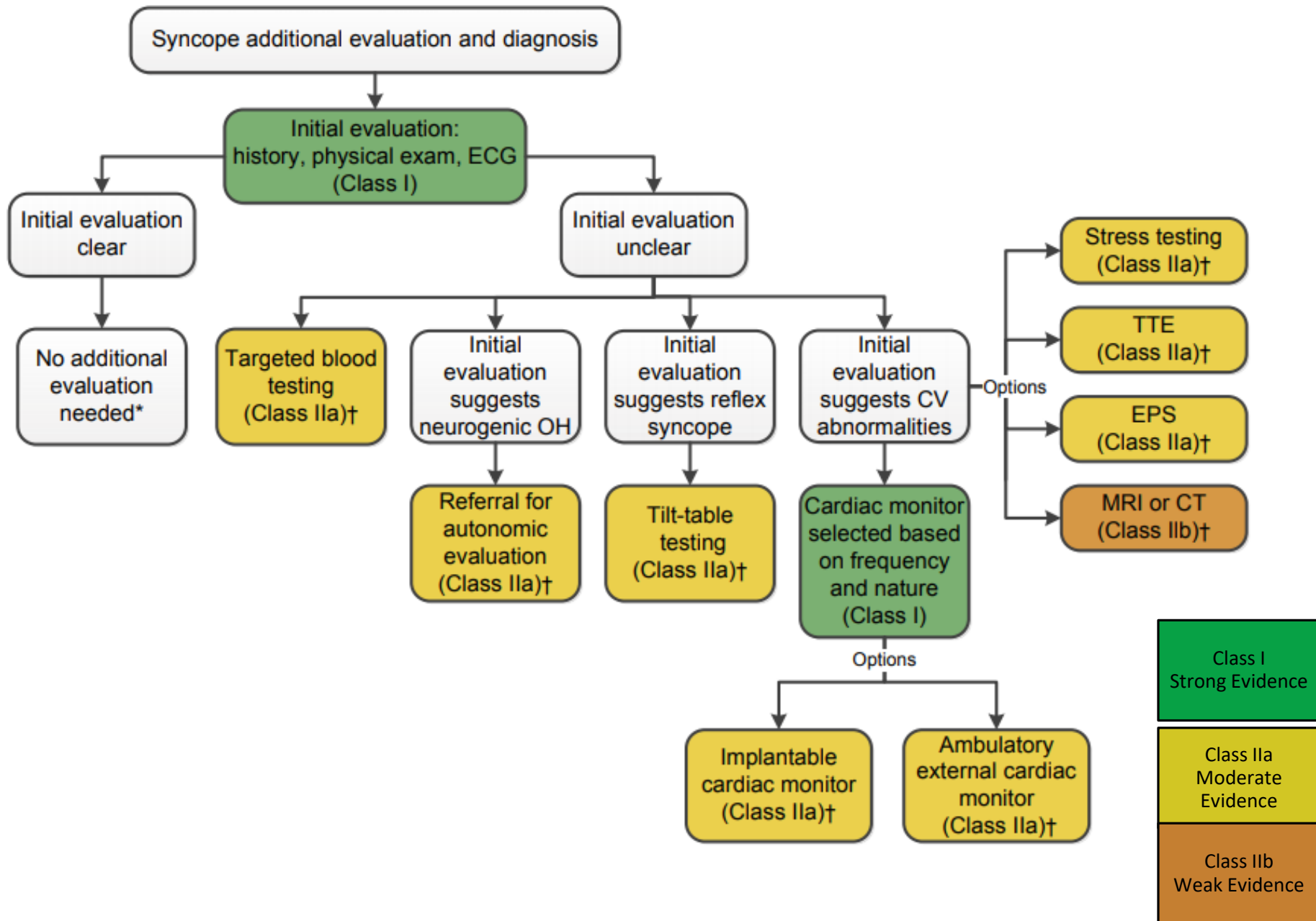
Prodrome

Identified trigger: Dehydration, pain, stress, stimulus, cough, micturition, defecation

Recurrent episodes







# Further Evaluation

Let the history and physical guide you

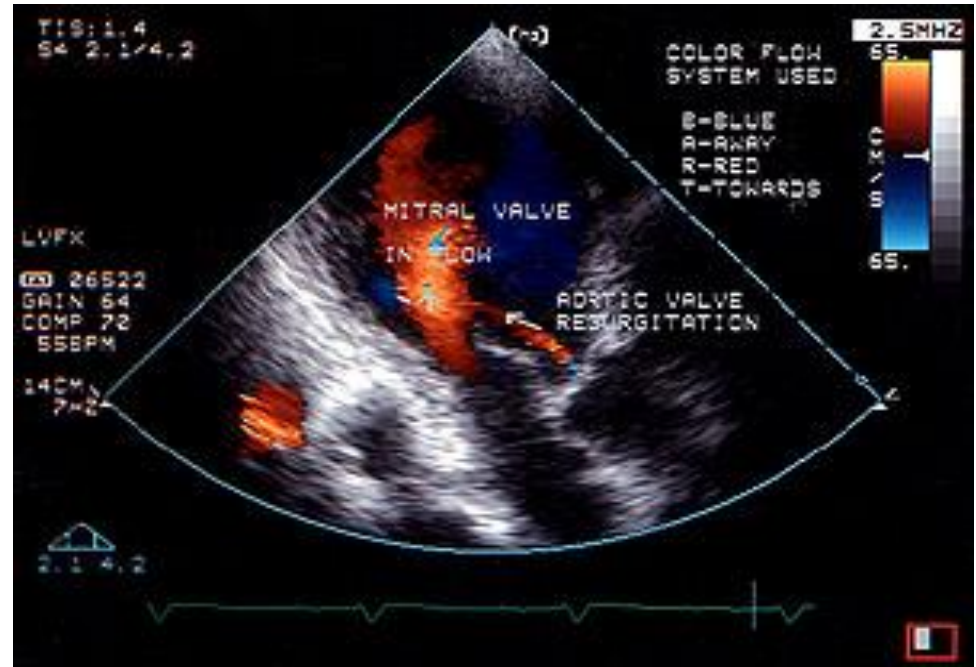
Lab

ECG

Echocardiography

Neurodiagnostics

- Imaging
- EEG
- Carotid ultrasound



# EKG

---

Normal ECG does not rule out an arrhythmic cause!

## **Suggestive of arrhythmia:**

- Persistent sinus bradycardia, sinus pause >3 sec., Mobitz II, 3<sup>rd</sup> degree AV block, VT or PSVT, pacemaker malfunction, alternating BBB

## **Suggestive of other abnormalities:**

- Bifascicular block, wide QRS, Mobitz I, long or short QT interval, ischemia/infarct pattern, WPW or Brugada patterns

# CT Scan

---

Several studies have shown little benefit

## 2014 Review

- >1000 patients with syncope reviewed

*Syncope with normal neurological exam - none had abnormal head CT*

Insufficient evidence to recommend routine head CT in patients with normal neurologic exam and syncope

# Cost v. Benefit

---

| Test                    | Cost         | Diagnostic Yield |
|-------------------------|--------------|------------------|
| EKG                     | \$100-\$500+ | 7%               |
| Troponin                | \$95         | 3%               |
| External Event Recorder | \$200        | 38% *            |
| Telemetry (inpatient)   | \$2000       | 3%               |
| Tilt test               | \$600        | 58%              |
| Holter Monitor          | \$300        | 21%              |
| Internal Loop Recorder  | \$3000       | 88%              |
| EP Study                | \$20,000+    | 52%              |
| Echo                    | \$1000       | 3%               |

# Choosing Wisely

---

## Choosingwisely.org

- American Board of Internal Medicine Foundation Initiative
- Syncope testing recommendations:
  - American Academy of Neurology: Occlusive carotid artery disease causes focal neurologic deficits, not syncope...carotid imaging not recommended
  - American College of Emergency Physicians: “In the absence of signs of a stroke, CT scan of the brain should not be ordered”

# Implantable Loop Recorder

---

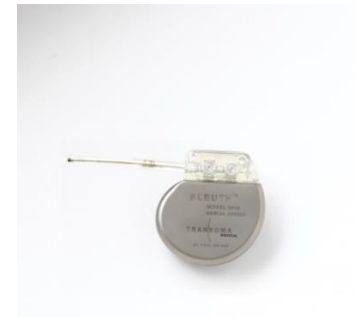
Subcutaneous monitoring device (left chest)

Device is automatically activated according to programmed criteria

Patient can activate device to record

Useful in patients with:

- Infrequent symptoms
- Suspected arrhythmia but non-invasive testing has been negative or inconclusive



# Internal Loop Recorder

---

In patients with suspected cardiac etiology

Lowers average cost of diagnosis

No change in outcomes from traditional methods

Requires cardiology referral



# But What About Tilt Table Testing?

---

What is Tilt Table Testing?

# Tilt Table Test

---

Useful in patients who are:

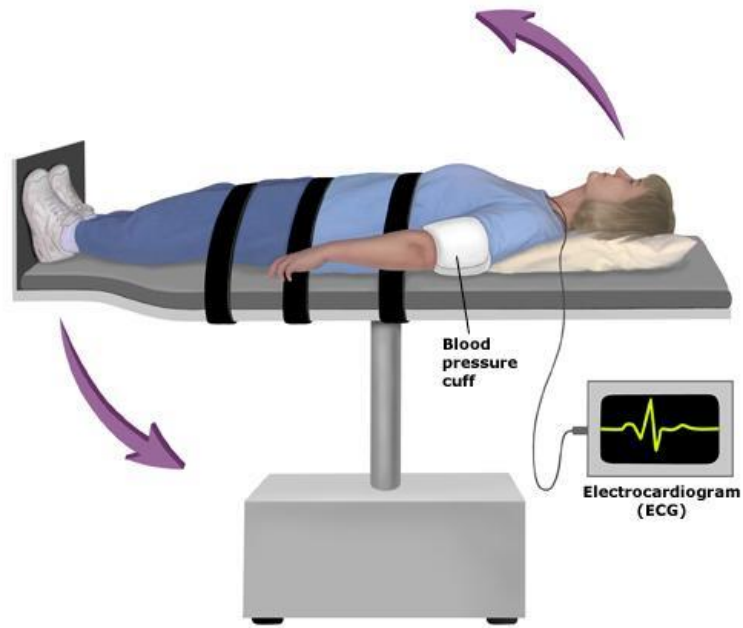
- Young and otherwise healthy and neurocardiogenic syncope is suspected

Monitored in supine position for five minutes to obtain baseline BP and HR

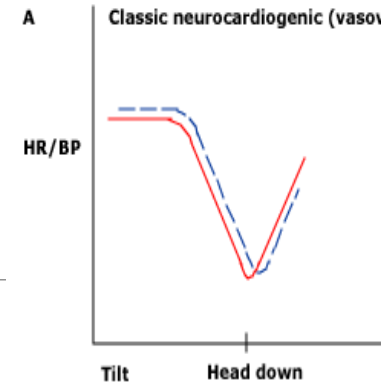
Positioned in a head-up tilt position and passively moved from a supine position to a head-up position between 60° and 90°

Should not be used in patients with baseline orthostatic hypotension

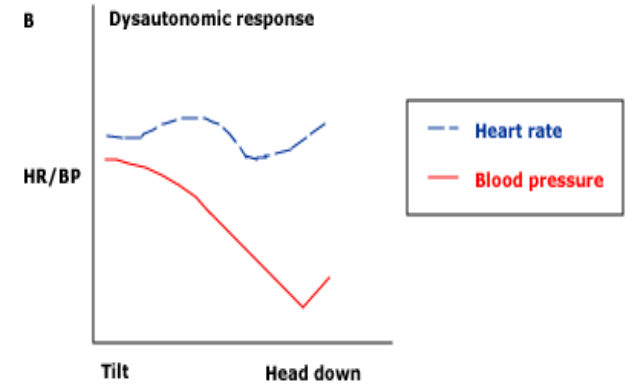
# Tilt Table Test



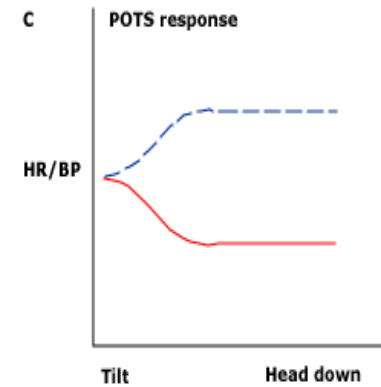
A Classic neurocardiogenic (vasovagal) response



B Dysautonomic response



C POTS response





知

# Management

---

## First Three Questions

1. Is this truly syncope?
2. If syncope, is there a life-threatening cause
3. If syncope, and not immediately life threatening, is the patient at high risk?

# Risk Assessment

---

Is it reasonable to use a risk stratification tool to determine management?

Short-term ( $\leq 30$  days) or Long-term ( $>30$  days) risk factors

Cardiac syncope yields a worse prognosis than reflex syncope

# Risk Stratification

| Risk Stratification |   |
|---------------------|---|
| High Risk           | <ul style="list-style-type: none"><li>• Decompensated heart failure</li><li>• Acute MI</li><li>• Aortic dissection</li><li>• Hemodynamic instability with any underlying structural cardiac disease</li></ul> |
| Intermediate Risk   | <ul style="list-style-type: none"><li>• Structural cardiac disease but no immediate instability</li><li>• No family history of SCD</li></ul>  |
| Low Risk            | <ul style="list-style-type: none"><li>• No evidence of structural heart disease</li><li>• Normal ECG</li><li>• History suggestive of VVS or orthostasis</li></ul>   |

# Risk Stratification

| Short Term Risk Factors ( $\leq 30$ days) | Long Term Risk Factors ( $> 30$ days)               |
|---|---|
| Male sex                                  | Male sex  |
| Older age                                 | Older age   |
| No prodrome                               | Absence of nausea/vomiting preceding syncopal event |
| Palpitations preceding LOC                | Ventricular Arrhythmia                              |
| Exertional syncope                        | Cancer  |
| Structural heart disease                  | Structural heart disease                            |
| Heart failure                             | Heart failure                                       |
| Cerebrovascular disease                   | Cerebrovascular disease                             |
| Trauma                                    | Diabetes mellitus                                   |
| Family history of SCD                     | High CHADS-2 score                                  |



# Risk Stratification

---

Many different risk stratification systems developed

Each has their benefits and limitations

- San Francisco Rule
- Canadian Syncope Arrhythmia Risk Score
- OESIL
- Martin et al 1997

Risk stratification tools have not performed better than clinical judgement

# San Francisco Rule

---

684 consecutive syncope patients

CHES75

- CHF, HCT <30, EKG Abnormal, Acute CHF, SBP<90, Age >75
- Predictive of 7 day mortality

One study examined outcomes of patients admitted with a SFSR score of 0 (low-risk)

- Mean LOS = 1.73 days
- Mean tests = 10.8
- 13% adverse event occurrence rate
- 32% had “incidentalomas” of unclear significance
- 7% had beneficial findings that resulted in treatment

# OESIL

Osservatorio Epidemiologico sulla Sincope nel Lazio

---

Italian Study looked at 1 year mortality

4 predictive factors

- Abnormal EKG
- History of CAD or HF
- Age >65
- Syncope without a prodrome

# Cochrane

---

Insufficient evidence to support any recommended treatment (drugs or device) for the management of syncope

# International Meta-analysis

---

45,000 patients over 20 years

3% of all admissions

42% of patients admitted to the hospital

1 month risk of death 4.4%

Statistically significant risk factors

- Palpitations preceding syncope
- Exertional syncope
- History of HF or CAD
- Evidence of bleeding



# How Do We Manage?

---

## Inpatient Evaluation

- Serious underlying medical condition
  - Cardiac arrhythmia, cardiac or vascular nonarrhythmic conditions, non-cardiac conditions

## Observation Admission

- “Intermediate-risk” patients

## Outpatient management:

- Presumptive reflex-mediated syncope (class IIa)\*\*
- Select patients with cardiac syncope (class IIb)
- Prompt follow-up necessary

# Who Should Be Admitted?

---

## **Bottom Line**

- Patients with life threatening conditions
- Evaluation of potential problems that cannot be examined outside the hospital
- A treatable problem to prevent recurrent syncope
- Patients at risk of injury from syncopal event or risk of SCD



# Barriers to Not Admitting

---

Patients may be fearful of going home after syncopal episode

Patients want an answer!

- **Syncope goes undiagnosed in 42% of cases!**

No Reliable stratification tool

“Observation” offers a good in-between

- A challenge in itself

# Treatment: General



---

## Immediate treatment

- Assess for pulse
- Assist to the ground, chair, stretcher
  - Elevate legs if possible
- Avoid potential external dangers
- Observe for other signs
- Attempt to arouse
- Call for help if needed

# Treatment: Vasovagal Syncope

---

- Avoidance of triggers, safety mechanism
- Education! Start with counter pressure maneuvers
- With suspected autonomic dysfunction:
  - Liberalize salt intake, water intake
  - Compression stockings
  - Education
- Pacing?

# Treatment: Orthostatic hypotension

---

- If due to dehydration
  - IV fluid bolus
- If drug related
  - Withdraw the drug!
- If neurogenic
  - Midodrine, droxidopa, fludrocortisone can be beneficial
  - Compression stockings – medical grade
- Physical counterpressure maneuvers
- Liberalize salt intake: 6-9g/day
- If recurrence, consider pharmacologic intervention
  - Midodrine, Fludrocortisone

# Treatment

---

## **Carotid Sinus Syndrome**

- Avoid accidental mechanical manipulation of the carotids
- Pacemaker insertion?
  - May depend on response....cardioinhibitory vs. vasodepressor

## **Cardiac Syncope**

- Possible pacemaker insertion, ICD insertion
- Anti-arrhythmics or other medications
- Fluid for preload dependent conditions

# Prognosis

---

Cardiac syncope yields **lower** survival rates than other syncope

A new study published in 2017 showed the risk of death among patients with syncope increased by 31% and that risk DOUBLED among patients with cardiac syncope

- Neurologic syncope associated with 3x risk of stroke
- Reflex syncope was not associated with an increased risk of death from any cause, myocardial infarction or death from coronary heart disease, and fatal or non fatal stroke

# Driving Limitations

---

Wide range of driving limitations

Estimated yearly risk of serious injury and death in VVS  
<0.0017% (POST I and POST II trials)

May be higher in patients with other etiologies of syncope  
or those who have syncope without prodrome or warning

Current laws don't reflect these results

Federal law regulates commercial drivers, state law  
regulates private drivers

- Look at state laws before sending patients home!
- Some states have reporting laws

# Take Home Points

---

Orthostatic vital signs are neither sensitive nor specific!

- Symptomatic orthostasis is more important

OH is a diagnosis of exclusion!!

- Don't stop here in your work-up...rule out other underlying medical conditions/causes

Serious underlying medical conditions need to be admitted to the hospital for work-up

- If patient has risk of injury with recurrent syncope, admit!

Look at the medication list!

- Vasodilatory drugs, cardiotoxic meds, QT prolonging meds



# References

Brignole M, Rivasi G. (2019). New insights in diagnosis and therapies in syncope: a novel approach to non-cardiac syncope. *Heart*. 107(11).

Canzoniero JVL, Afshar E, Hedian H, Koch C, Morgan DJ, Less is More: Unnecessary Hospitalization and Related Harm for Patients With Low-Risk Syncope. *JAMA Internal Medicine*. 2015;175(6):1065-1067.

Chen MY, Goldenberg IF, Milstein S, Buetikofer J, Almgvist A, Lesser J, Benditt DG, Cardiac electrophysiologic and hemodynamic correlates of neurally mediated syncope, *American Journal of Cardiology*. 1989;63(1)66-72.

Joy PS, Kumar G, Olshansky B, Syncope: Outcomes and Conditions Associated with Hospitalization. *The American Journal of Medicine*. 2017;130(6).

Juraschek SP, Daya N, Rawlings AM, Appel LJ, Miller III ER, Wyndham BG, Griswold ME, Heiss G, Selvin E, Association of History of Dizziness and Long-term Adverse Outcome With Early vs Later Orthostatic Hypotension Assessment Times in Middle-aged Adults, *JAMA Internal Medicine* (2017), doi:10.1001/jamainternmed.2017.2937.

Reed MJ. (2019). Approach to syncope in the emergency department. *Emergency Medicine Journal*. 36(2)

Soteriades ES, Evans JC, Larson MG, Chen MH, Chen L, Benjamin EJ, Levy D, Incidence and Prognosis of Syncope, *New England Journal of Medicine*. 2002; 347(12):878-885.

Sheldon R, Rose S, Ritchie D, Connolly SJ, Koshman ML, Lee MA, Frenneaux, Fisher M, Murphy W, Historical Criteria That Distinguish Syncope From Seizures, *Journal of the American College of Cardiology*, 2002;40(1)142-148.

Shen W-K, Sheldon RS, Benditt DG, Cohen MI, Forman DE, Goldberger ZD, Grubb BP, Hamdan MH, Krahn AS, Link MS, Olshansky B, Raj SR, Sandhu RK, Sorajja D, Sun BC, Yancy CW, 2017 ACC/AHA/HRS Guideline for the Evaluation and Management of Patients with Syncope, *Heart Rhythm* (2017), doi: 10. 1016/j.hrthm.2017.03.004.

Tan VH, Ritchie D, Maxey C, Sheldon R, Prospective Assessment of the Risk of Vasovagal Syncope During Driving, *JACC: Clinical Electrophysiology*, 2016;2(2)203-208.

Thiruganasambandamoorthy V, Stell IG, Sivilotti MLA, Rowe BH, Muharram M, Arcot K, Kwangju K, McRae AD, Wells GA, Taljaard M, Predicting Short-Term Risk of Arrhythmia among Patients with Syncope: The Canadian Syncope Arrhythmia Risk Score. *Academic Emergency Medicine* (2017), doi:10.1111/aces.13275-17-262.