

EVALUATION AND MANAGEMENT OF SYNCOPE

(or, how to transform an
unfulfilling workup into a
productive and rewarding
experience)

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The agenda for today

- Classification of syncope
- How to get a history
- Triage in ER
- Tests to order in the hospital
- Special tests

Classification of Syncope

- Reflex (neurocardiogenic) syncope:
 - » Vasovagal (common faint)
 - » Situational (cough, micturation)
 - » Carotid sinus syncope
- Orthostatic hypotension:
 - » Primary autonomic failure (Parkinson's, Shy-Drager)
 - » Secondary autonomic failure (DM, Amyloid)
 - » Drug induced (ETOH, vasodilators, HTN meds)
 - » Volume depletion

Classification of Syncope, part 2

■ Cardiac Syncope

- » Bradycardia
- » Tachycardia
- » Structural Disease (valvular dz, MI, pulm HTN, PE)

■ Vascular steal syndromes

■ Loss of consciousness, NOT syncope

- » Seizure
- » Intoxication
- » Metabolic disorders

A case study

- 72 YO man with history of hyperlipidemia, HTN comes into the ER after a syncopal episode. He was with his wife, walking to the car, when he “passed out”. He seems to be in a bad mood, and is not forthcoming with his answers. His wife is in the waiting room.
- What is your next step?

Good history is CRITICAL in syncope evaluation!!

- You ask the wife to come in to get more information. She says that her husband was feeling fine when he woke up this AM. They went to a friends house, they left the house, as he was walking up the hill to his parked car he complained of palpitations then suddenly fell onto his left side and became unresponsive. He then had some “jerking” of his hands and legs that lasted a few seconds. Soon thereafter he woke up, and had no post-event confusion.

Taking the history:

Before the spell

- What position was the patient in when spell began? (if recumbent → not orthostatic/unlikely vasovagal)
- Prodrome of cerebral hypoperfusion? (lightheadedness, dizziness, nausea, weakness → more consistent with vasovagal)
- Sudden onset, no prodrome? (Cardiac)
- Palpitations (suggestive cardiac/vasovagal)
- Associated with exertion? (Cardiac)
- Emotional or painful stimulus (vasovagal)
- Prolonged motionless standing (vasovagal)
- Straining at urination (situational)
- Rapid change in posture (orthostatic)
- With rapid head turning (carotid sinus syncope)
- Arm movement (subclavian steal)

Taking the history: During the spell

- *“Movement” during syncopal episode does not always mean seizure!!*
 - Seizure: typically about 1 min, rhythmic synchronous movements
 - Cerebral Hypoperfusion: jerking rarely lasts more than 30 sec, asynchronous, non-rhythmic

Taking the history: After the spell

- Recovery of orientation usually rapid in true syncope
- Seizures: Typically 2-20 min period post-ictal confusion

Initial Workup

- Physical examination
 - Orthostatic blood pressure
 - Heart exam (AS murmur, pulm HTN, S3/S4)
 - Neuro examination
 - Consider stool guiac
- EKG
 - Should be done on all patients, occasionally very helpful
- Labs
 - CBC, Basic panel, ? Troponin ... no real guidance from experts, pretty low yield
- *With good hx/PE/EKG: can make dx in 50% of cases!*

The case, continued

- BP 163/94 Pulse 87 98% RA. Not orthostatic
- Heart, Lung, abdominal, neuro exam unremarkable.
- Basic panel, CBC, troponin unremarkable.
- EKG – LBBB
- What do you do next?

The basic approach to syncope

1. Get good history, PE, EKG
2. If you think you know what is doing on (vasovagal, orthostatic, etc) – TREAT
3. If unclear, assess risk factors for adverse events
4. Significant risk factors – Admit for tele, echo, +/- stress test
5. If all this negative, discharge and consider stopping workup (if one episode) or ordering a lot more tests (if recurrent episodes)

Unexplained Syncope: Who are you really worried about?

- **Structural heart disease and primary electrical disease** are the major risk factors for sudden death
 - In young patients in whom this has been excluded have an excellent prognosis
- Multiple methods have been proposed to assess risk – none have been fully validated
 - In all scoring systems: **STRUCTURAL HEART DISEASE** or **ABNORMAL EKG** are major risk factors for adverse events

Who to admit – “High Risk” Pts

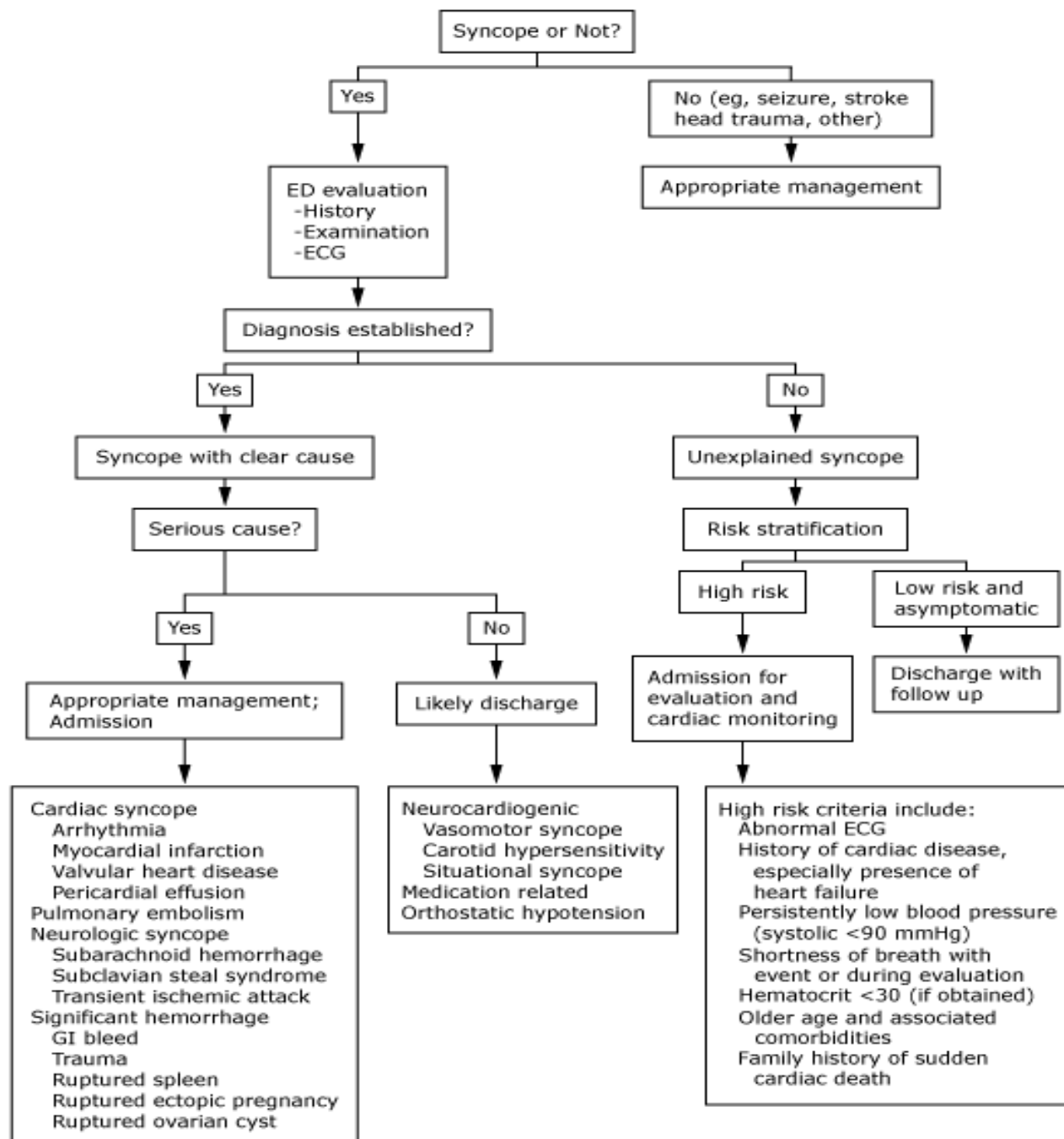
- Documented or suspected structural heart disease or coronary artery disease
- Abnormal EKG
 - Bundle branch block
 - Sinus bradycardia or sinoatrial block (in absence of meds or physical training)
 - Weird stuff: WPW, Brugada, right ventricular dysplasia
 - Prolonged or short QTc
 - Ischemia
- Clinical Features
 - Syncope during exertion or supine*
 - Palpitations during syncope*
 - Family history of sudden death*
 - Severe anemia or electrolyte disturbance*
 - ? Age > 65-70 (a bit arbitrary)**
 - Serious injury**
 - Frequent and recurrent symptoms**

*European Society of Cardiology

**Various other guidelines

San Francisco Syncope Rules To Guide Inpatient Admission

1. *C* – (History of *Congestive* heart failure)
 2. *H* – (*Hematocrit* < 30%)
 3. *E* – Abnormal *ECG*
 4. *S* – *Shortness* of breath
 5. *S* – *SBP* < 90
- 1st validation study: 96% sensitive, 62% specific for predicting serious outcome at 7 days
 - 2nd validation study: not as good
 - Main point: “further validation is needed before can be widely applied...[but] advantage is that it is easy to remember” (Mayo Clinic Proceedings, 2009)



Syncope of unclear etiology – what to order in the hospital?

- Telemetry

- Echocardiogram

- American College of Cardiology → “Echo is helpful screening test if hx, PE and ECG do not provide dx or heart disease is suspected”
- European Society of Cardiology → “Echo is indicated... in pts who are suspected of having structural heart disease”

Syncope of unclear etiology – what to order in the hospital?

■ Exercise stress testing

- American College of Cardiology: “Evaluation for ischemia is appropriate for patients *at risk for or with a history of coronary artery disease*”
- European Society of Cardiology: “Exercise testing should be performed in patients who have experienced episodes of syncope *during or shortly after exertion*”

The case, continued

- You determine that the “jerking” during the patient’s episode was likely a reflection of syncope (not seizures) given that it was short lived and the patient did not have post event confusion. His neuro exam is normal.
- Given his multiple risk factors he is admitted to the hospital for tele, an echo is ordered, with plans for a stress echo afterwards if his echo is normal.
- Do you order brain imaging?

Cerebrovascular disorders and syncope

- **Subclavian steal:** vigorous arm movement, reroutes blood flow to arm through vertebral artery secondary to stenosis of subclavian artery
- **TIA of carotid artery:** can rarely cause LOC when almost all cerebral arteries are occluded and transient obstruction of remaining vessel may affect consciousness in standing position
- **TIA of vertebrobasilar system:** can cause LOC
- *ALL of these syndromes are associated with post-event focal neurological findings*

Brain Imaging and Syncope

- If nonfocal neuro exam, **brain imaging** (CT/MRI/Carotid Ultrasound) **NOT recommended**
- Reasonable to order if suspect seizure or concern that syncope resulted in head injury



Another case study

- You see a 62 YO man with a syncopal episode two nights ago. On his way the bathroom during the night, he felt very dizzy and the next thing he remembered was waking up on the floor in the hallway to the bathroom.

- PE 135/72, Pulse 76 97% RA

Heart, Lungs, Abd, Neuro exam unremarkable.

EKG: Normal

What do you do next?

Recent Study on Syncope

- 2106 patients' charts over 65 years old evaluated for syncope in ER, different tests evaluated for their “cost effectiveness” and utility

Mendu ML, et al. Archives Intern Med. 2009; 169: 1299.

Table 3. Costs of Diagnostic Tests in the Evaluation of Syncopal Episodes^a

Tests Obtained	Cost Per Test, \$ ^b	Total Cost, \$ ^c	Cost per Test Affecting Diagnosis or Management, \$ ^d
EEG	$1115 \times 0.34 = 379$	$65\,946 = (379 \times 174)$	$65\,946/2 = 32\,973$
Head CT scan	$1545 \times 0.34 = 525$	$696\,675 = (525 \times 1327)$	$696\,675/28 = 24\,881$
Cardiac enzymes test	$357 \times 0.34 = 121$	$694\,298 = (121 \times 5738 \text{ sets})$	$694\,298/31 = 22\,397$
Troponin I alone	$78 \times 0.34 = 26$	$149\,188 = (26 \times 5738 \text{ sets})$	$149\,188/31 = 4813$
Carotid US	$1294 \times 0.34 = 440$	$117\,480 = (440 \times 267)$	$117\,480/6 = 19\,580$
Head MRI	$3316 \times 0.34 = 1127$	$173\,558 = (1127 \times 154)$	$173\,558/20 = 8678$
Cardiac stress test	$2492 \times 0.34 = 848$	$109\,392 = (848 \times 129)$	$109\,392/13 = 8415$
Echocardiogram	$809 \times 0.34 = 275$	$225\,775 = (275 \times 821)$	$225\,775/36 = 6272$
Electrocardiogram	$221 \times 0.34 = 75$	$156\,075 = (75 \times 2081)$	$156\,075/153 = 1020$
Telemetry	$255 \times 0.34 = 87$	$174\,087 = (87 \times 2001)$	$174\,087/245 = 710$
Postural BP ^e	5	$4040 = (5 \times 808)$	$4040/241 = 17$

Abbreviations: BP, blood pressure; CT, computed tomography; EEG, electroencephalogram; MRI, magnetic resonance imaging; US, ultrasonography.

^aA total of 2106 admissions in 1920 patients.

^bCost per test was calculated as the charge per test multiplied by the cost to charge ratio of 0.34, based on the 2007 Yale–New Haven Hospital cost to charge ratio from the State of Connecticut's Annual Report on the Financial Status of Connecticut's Acute Care Hospitals for Fiscal Year 2007.³¹

^cThe total cost is equal to the number of tests obtained multiplied by the cost per test.

^dCost per test affecting diagnosis or management was calculated as the total cost divided by the number of tests that affected diagnosis or management. An "affected diagnosis" was defined as any test results that were noted in test reports, progress notes, or discharge summary to have contributed to, confirmed, or established any diagnosis; examples included an electrocardiogram identifying atrial fibrillation or postural BP measurements meeting criteria for postural hypotension. An "affected management" was defined as any test results that were noted in test reports, progress notes, or discharge summary to have contributed to any management decision; examples included electrocardiogram resulting in the management of atrial fibrillation with anticoagulation and β -blockers or postural BP recordings resulting in the management of orthostatic hypotension with hydration.

^eA cost of \$5 calculated based on 5 minutes of a nurse's time at a \$60 per hour wage. Loose criteria for postural BP, as defined in the "Methods" section, were used to calculate costs. If strict criteria, as defined in the "Methods" section, were used, then the cost per test affecting diagnosis or management was \$20.

- Bottom line: Orthostatics should be checked on most patients, as this approach is not only cost effective, but can yield a diagnosis in significant number of patients
- To diagnose:
 - Manual intermittent BP supine and during active standing for 3 min
 - Diagnostic if symptomatic fall in SBP > 20 or DBP > 10
 - Likely diagnostic if asymptomatic fall in SBP > 20 , DBP > 10 , or decrease SBP < 90

(European Society of Cardiology, 2009)

Case, continued

- Blood pressure 142/79 (supine) → 106/64 (standing)
- Pulse 74 (supine) → 104 (standing)
- On further questioning, he tells you that his PMD started him on doxazosin 2 mg PO QHS two weeks ago for BPH.

What do you do now?

- a) Admit to hospital
- b) Brain MRI
- c) Stop doxazosin, discharge home
- d) 24 hour holter monitor

Causes of orthostasis

- Volume depletion
- Medications
 - Anti-HTN, Diuretics, Tricyclic
- Aging
- Physical deconditioning (after prolonged illness with recumbency)
- Autonomic neuropathy
 - Central: Shy Drager, Parkinsons, lewy body dz
 - Peripheral: Diabetic, alcoholic, amyloid
- Endocrine
 - Adrenal Insufficiency
 - Pheochromocytoma

Syncope in the Elderly

- **Orthostatic hypotension** may be cause in 30% of elderly patients
- Polypharmacy with HTN or depression meds often a contributor – *Review meds carefully!*
- For frail, older patients “evaluation should be modified according to prognosis and expectation of benefit”

Another case

- A 19 YO college student is evaluated in the ER after collapsing suddenly while waiting in line at a New Kids on the Block concert. Prior to this happening, he felt diaphoretic, lightheaded, he then sat on the ground and lost consciousness. He exhibited some “twitching” movements when he lost consciousness, then woke up immediately.
- PE VSS, no orthostasis. Cardiac and neuro exam WNL. EKG WNL.

What do you do?

- a) Echocardiogram
- b) EEG
- c) ETT
- d) Tilt-table
- e) Nothing



“Mass Fainting at Rock Concerts”

New England Journal of Medicine

1995; 332:1721

- Methods: Infirmary interview of 40 of the 400 people who fainted during a German concert by New Kids On The Block
- Results:
 - All were girls between 11-17 YO
 - Many still breathing rapidly backstage during interview
- Reported combination provoking factors
 - Sleeplessness during previous night
 - Fasting since early AM
 - Long periods of standing in large crowds
 - Hyperventilation
- Dx: ROCK CONCERT SYNCOPE
 - Multifactorial pathophysiology
 - Preventive measures: sleep, sit, eat, keep cool

- You see a 76 YO man with H/O HTN in clinic, he tells you he had a syncopal episode a few weeks earlier. He was standing in a grocery store and lost consciousness without any preceding symptoms. He has two other episodes in the past 3 years, one while sitting, one during a walk. He reports no orthostatic symptoms, CP or CHF sx.

- PE: 140/85, no orthostasis. Cardiac/lung/neuro exam WNL.
- Echo, EKG WNL. ETT – went 9 min with no CP or EKG abnormalities

What do you do next?

- a) 24 hour telemetry
- b) 30 day event monitor
- c) Implantable loop recorder
- d) Electrophysiology study

Syncope

History, Physical Examination, Electrocardiogram

Diagnostic for orthostatic hypotension
or neurocardiogenic syncope

Unexplained Syncope

Echocardiogram, exercise test, and ischemia evaluation

If found, treat for structural heart disease and ischemia.
For arrhythmia evaluation, consider electrophysiological
testing if there is a history of a myocardial infarction.
Consider implantable defibrillator if the left ventricular
ejection fraction is ≤ 0.30 , with or without a history of a
myocardial infarction.

Normal

Single, benign episode

Evaluation complete

Frequent episodes

Correlate symptoms with
rhythm with Holter or event
monitor, or implantable loop
recorder, as appropriate.

Infrequent episodes

Implantable
loop recorder

Sinus rhythm
with symptoms

Cardiac evaluation complete

Arrhythmia with
symptoms

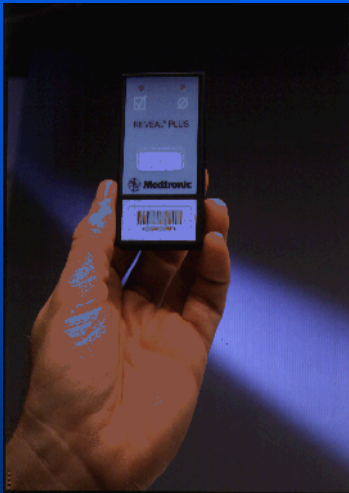
Treat



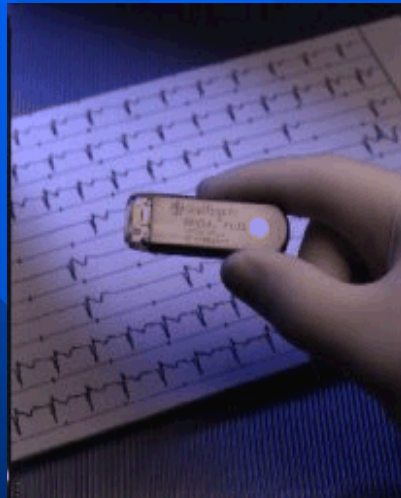
Arrhythmia evaluation for syncope

Method	Comments
Holter (24-48 hours)	Useful for frequent events
Event Recorder (typically 30 days)	■ Useful for infrequent events
Loop Recorder	■ For very infrequent events ■ Battery life can last 36 months
Electrophysiology study	Mostly helpful in structural heart disease (but these pts usually get AICD anyway)

Reveal[®] Plus Insertable Loop Recorder



Patient Activator



Reveal[®] Plus ILR



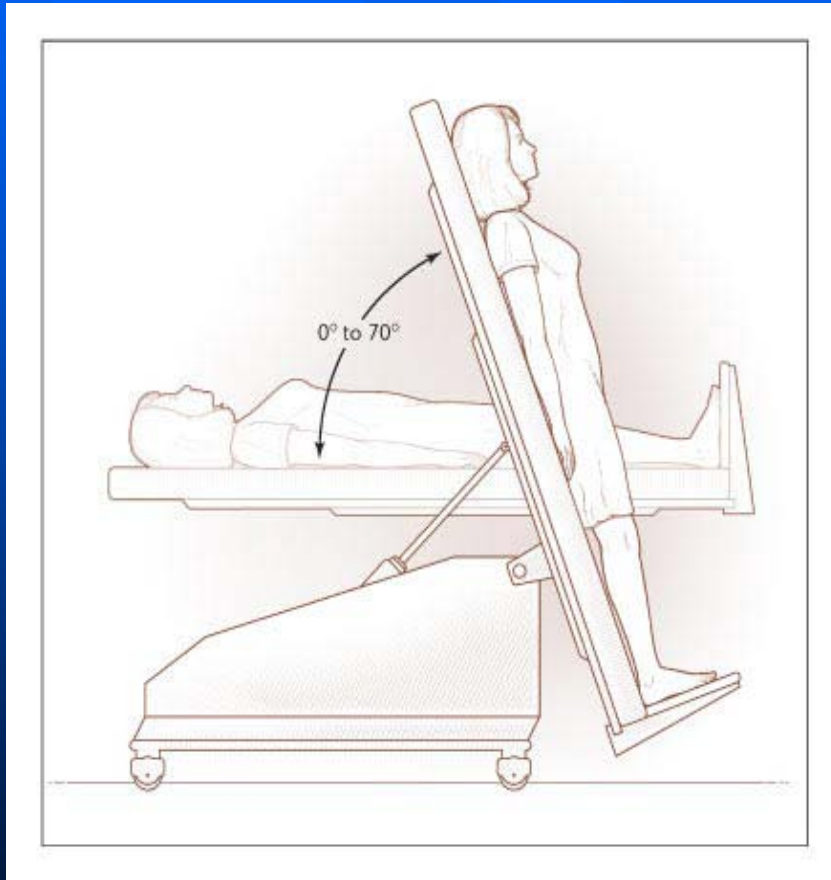
9790 Programmer

Using the Implantable Loop Recorder

- One study: 60 patients assigned to “conventional” testing (tilt table, prolonged monitoring, EPS) vs ILR. Dx was found in 55% with ILR vs 19% with conventional tests
- Per ESC: ILR “may be more cost effective than a strategy using conventional investigation” and can be considered in “an early phase of evaluation in patients with recurrent syncope of uncertain origin”

Tilt Table Test

For dx reflex syncope



- Isoproterenol or nitroglycerin given while patient tilted in different positions
- Positive test if can induce syncope

Tilt table test – Indications (Per European Society Cardiology)

- Unexplained syncopal episode in
 - high risk setting (ie airplane pilot)
 - recurrent episodes after cardiac causes have been excluded

Main points

- A good history, EKG is essential
- Strongly consider getting orthostatic BP
- If you know what is going on: TREAT!
You don't need to order a lot of tests.
- If etiology unclear use risk factors to determine if you should do further testing
- If significant risk factors: admit, tele, echo, +/- ETT
- Don't routinely get neuroimaging
- Usually save further testing for recurrent episodes

Classification of Transient Loss of Consciousness (TLOC)

Real or Apparent TLOC

Syncope

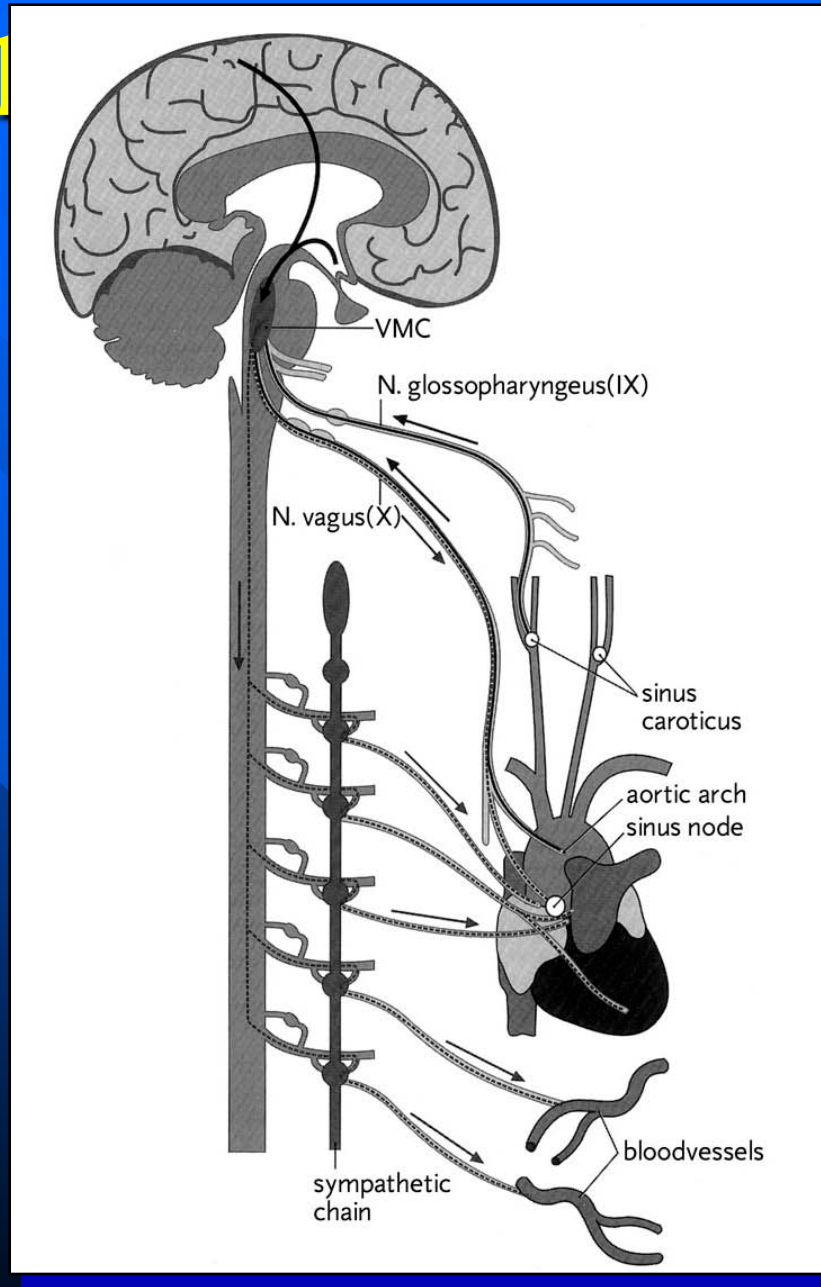
- Neurally-mediated reflex syndromes
- Orthostatic hypotension
- Cardiac arrhythmias
- Structural cardiovascular

Disorders Mimicking Syncope

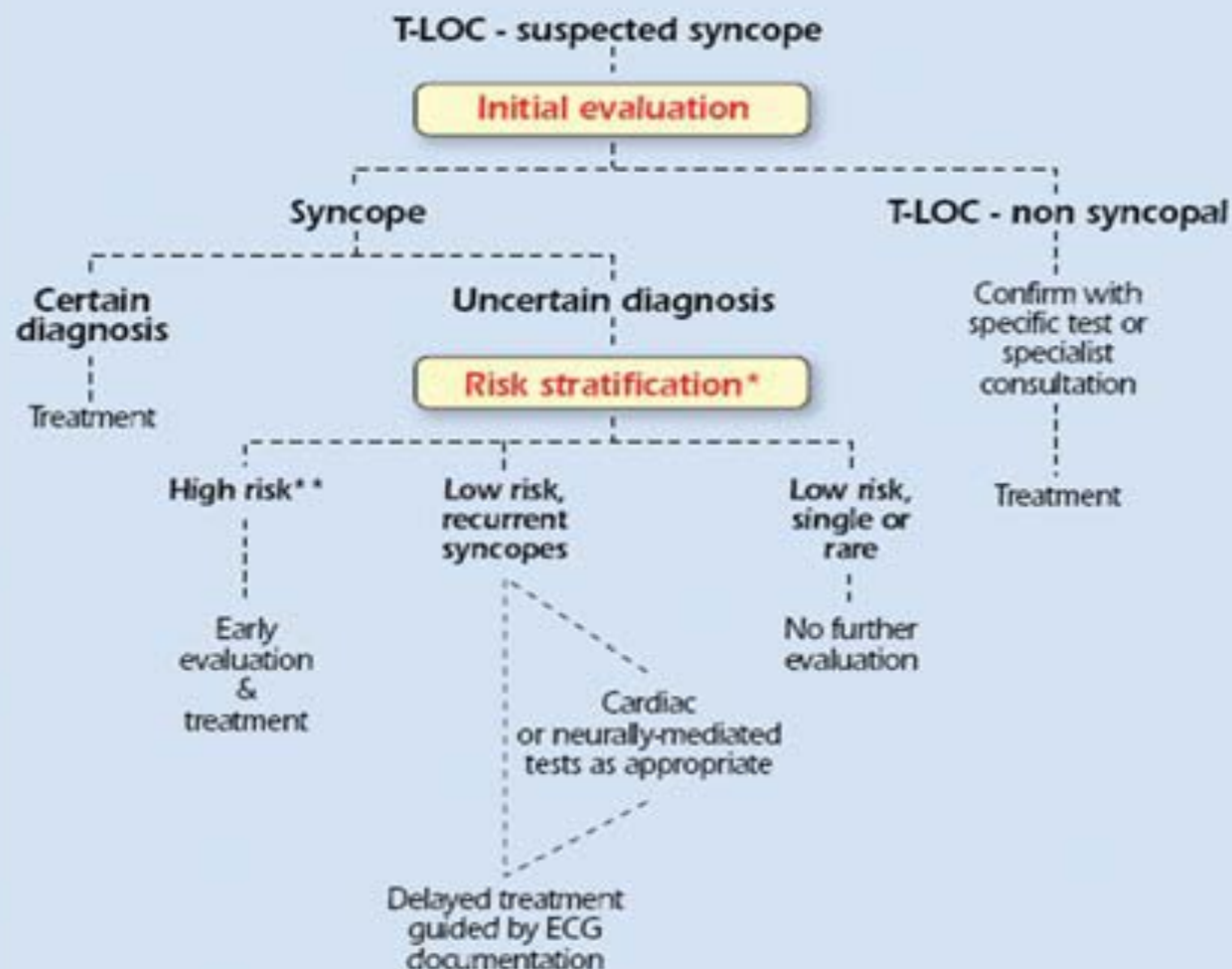
- With loss of consciousness, i.e., seizure disorders, concussion
- Without loss of consciousness, i.e., psychogenic “pseudo-syncope”

Path

Autonomic Nervous System



Diagnostic flowchart in patients with suspected T-LOC



* May require laboratory investigations

** Risk of short-term serious events