Syncope
Epidemiology, Etiologies, Assessment and Management

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Definition

- Syncope is a clinical syndrome in which transient loss of consciousness is caused by a period of inadequate cerebral oxygen and nutrient flow, most often the result of an abrupt drop of systemic blood pressure and by definition, spontaneously self-limited.
- Loss of postural tone is inevitable with loss of consciousness which may trigger injury
- Recovery from true syncope is usually complete and rapid, with episodes rarely lasting more than a minute or two.

Epidemiology

- Syncope is a common clinical problem
- One of the many causes of transient loss of consciousness (TLOC)
- Syncope has a lifetime prevalence of approximately 20%
- Syncope is responsible for between 1 and 3% of all emergency department visits and 1% of all hospital admissions

Causes of Syncope

Reflex-mediated*
▪ Vasovagal • Orthostatic vasovagal syncope: usually after prolonged standing, frequently in a warm environment, etc • Emotional vasovagal syncope: secondary to fear, pain, medical procedure, etc • Unknown trigger
▪ Situational • Micturition, defecation • Swallowing • Coughing/sneezing
▪ Carotid sinus syndrome

Brignole M, Moya A, de Lange FJ, et al. 2018 ESC Guidelines for the diagnosis and management of syncope. Eur Heart J 2018; 39:1883.

Causes of Syncope

Orthostatic hypotension*
▪ Medication-related • Diuretics (eg, thiazide or loop diuretics) • Vasodilators (eg, dihydropyridine calcium channel blockers, nitrates, alpha blockers, etc) • Antidepressants (eg, tricyclic drugs, SSRIs, etc)
▪ Volume depletion • Hemorrhage • Gastrointestinal losses (ie, vomiting or diarrhea) • Diminished thirst drive (primarily in older patients)
▪ Autonomic failure • Primary: pure autonomic failure, Parkinson disease, multiple system atrophy, Lewy body dementia • Secondary: diabetes mellitus, amyloidosis, spinal cord injuries, autoimmune neuropathy (eg, Guillain-Barré), paraneoplastic neuropathy

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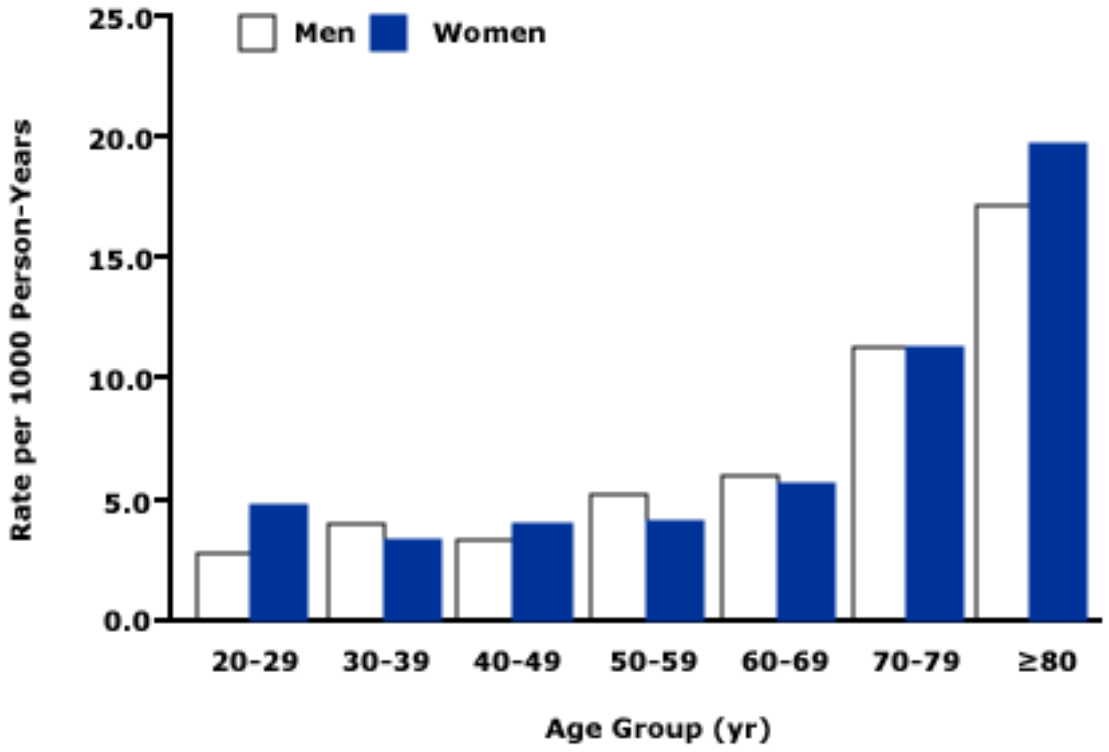
Cardiac
▪ Tachyarrhythmias • Ventricular tachycardia • Supraventricular tachycardias
▪ Bradyarrhythmias (with inadequate ventricular response) • Sinus node dysfunction • Atrioventricular block
▪ Structural disease • Severe aortic stenosis • Hypertrophic cardiomyopathy • Cardiac tamponade • Prosthetic valve dysfunction • Congenital coronary anomalies • Cardiac masses and tumors (eg, atrial myxoma)
▪ Cardiopulmonary/vascular • Pulmonary embolus • Severe pulmonary hypertension • Aortic dissection

Brignole M, Moya A, de Lange FJ, et al. 2018 ESC Guidelines for the diagnosis and management of syncope. Eur Heart J 2018; 39:1883.

Incidence

Cause	Prevalence, percent	
	Men	Women
Cardiac	13.2	6.7
Stroke or transient ischemic attack	4.3	4.0
Seizure disorder	7.2	3.2
Vasovagal	19.8	22.2
Orthostatic hypotension	8.6	9.9
Medication	6.3	7.2
Other	9.5	6.1
Unknown	31.0	40.7

Includes data from 727 patients.



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.

Soteriades ES, Evans JC, Larson MG, et al. Incidence and prognosis of syncope. N Engl J Med 2002; 347:878.

LOC but Not Syncope

Disorders with partial or complete LOC but without global cerebral hypoperfusion
Epilepsy
Metabolic disorders including hypoglycaemia, hypoxia, hyperventilation with hypocapnia
Intoxication
Vertebrobasilar TIA
Disorders without impairment of consciousness
Cataplexy
Drop attacks
Falls
Functional (psychogenic pseudosyncope)
TIA or carotid origin

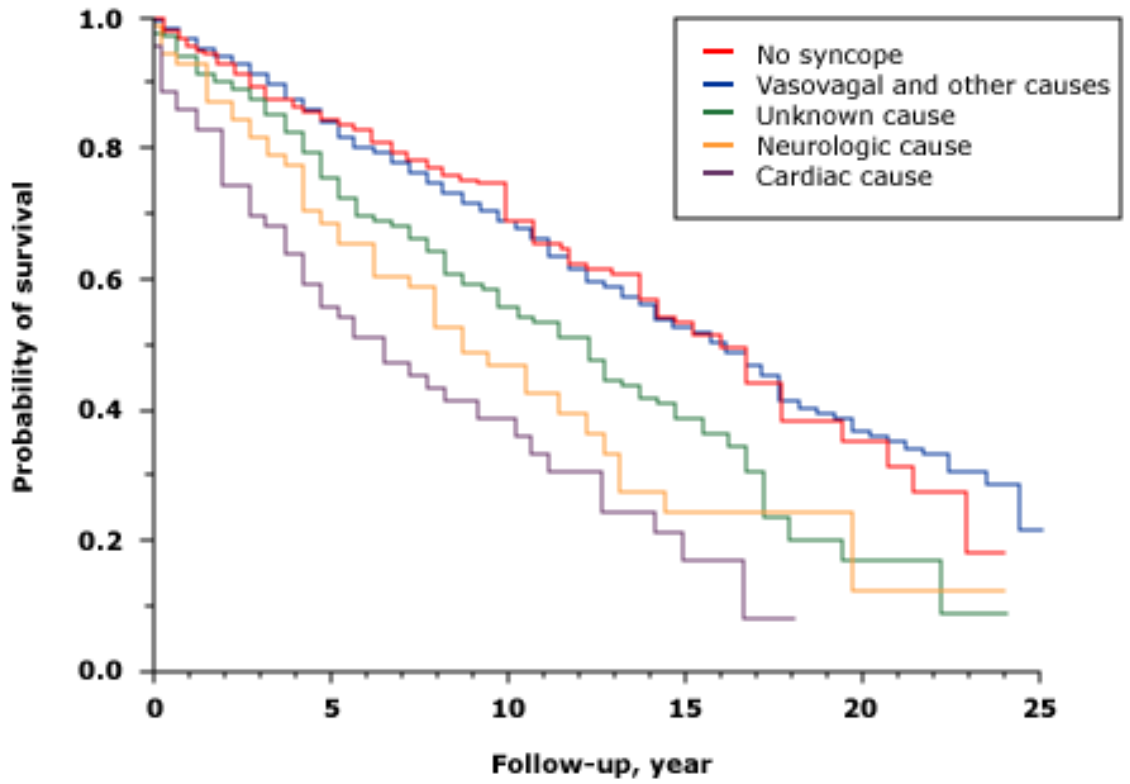
Atherosclerotic disease of the cerebral arteries is almost never the cause of true syncopal symptoms, as the brain has a very redundant blood supply

European Heart Rhythm Association (EHRA), Heart Failure Association (HFA), Heart Rhythm Society (HRS), et al. Guidelines for the diagnosis and management of syncope (version 2009): the Task Force for the Diagnosis and Management of Syncope of the European Society of Cardiology (ESC). Eur Heart J 2009; 30:2631. Copyright © 2009 Oxford University Press.

Syncope & Mortality

- When the initial evaluation, including history, physical examination, and ECG, is nondiagnostic in a patient with suspected syncope, the patient is considered to have **syncope with an unexplained diagnosis**

- As a rule, syncope of unknown cause is generally associated with a good prognosis, suggesting that most are likely "reflex" in origin



Survival was worst for patients with a cardiovascular cause of syncope. P <0.001 for the comparison between participants with and those without syncope. The category "Vasovagal and other causes" includes vasovagal, orthostatic, medication-induced, and other, infrequent cause of syncope.

Sorteriades ES, Evans JC, Larson MG, et al. Incidence and prognosis of syncope. N Engl J Med 2002; 347:878.

Case#1

83-year-old male presents to the emergency room after he “slumped over” while sitting at a restaurant enjoying lunch with his family. Witnesses report he was unresponsive for about a minute before he regained consciousness. In the ED, the patient denies any current symptoms. Reports a medical history of hypertension treated with lisinopril and hydrochlorothiazide. His heart rate is 78 bpm. His blood pressure is 163/92. Respiratory rate and pulse oximetry are within normal range. EKG demonstrates a NSR with a first-degree AV block and a RBBB. The patient denies any prior history of syncope. CT scan of the head was unremarkable. Cardiac markers are unremarkable. Bedside echocardiogram performed in the ED demonstrated an LVEF of 60%

Case #1

Which of the following would be the next best step for management of this patient:

A. Discharge from the ED with recommended follow-up with his primary care physician
B. Initiate Calcium channel blocker therapy for better HTN control
C. Admission to the telemetry ward for further observation and evaluation
D. CT angiography of the pulmonary artery to rule out PE

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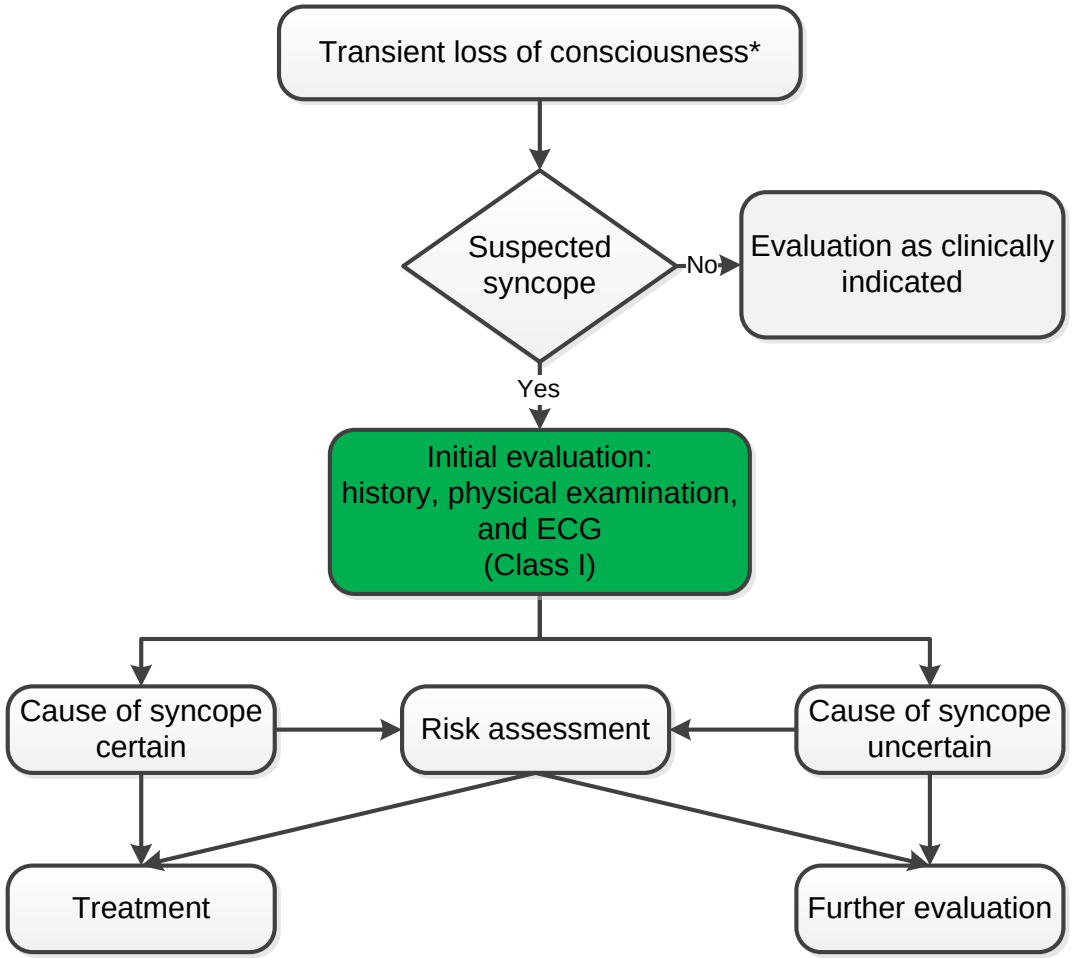
Syncope Initial Evaluation



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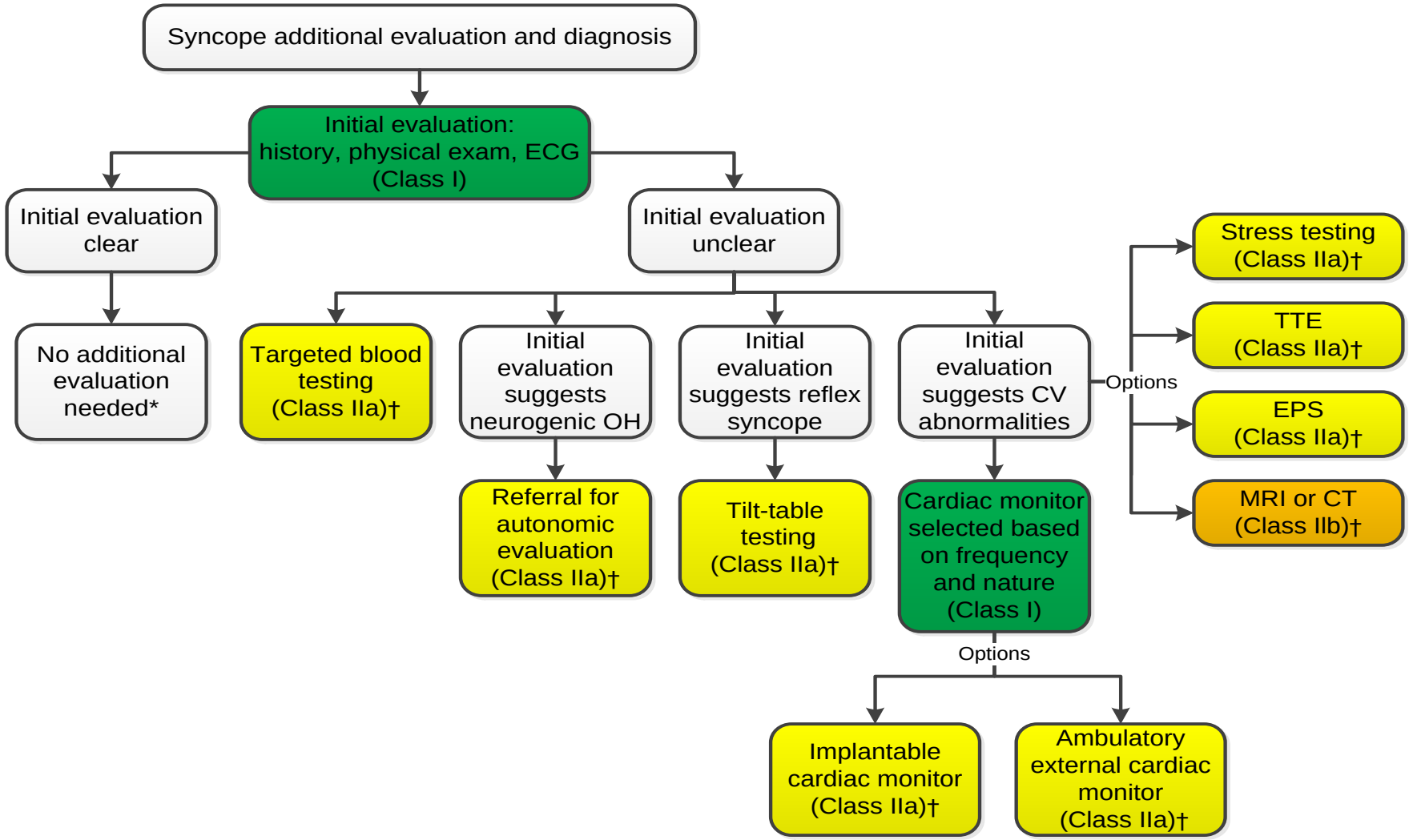
Syncope Initial Evaluation

Summary of Key Findings on History, Physical Examination, and Electrocardiograms in Patients With Syncope

Parameter	Key Points
History	
Syncope details	Time of day, location, relationship to eating (before/after/during), urination, defecation, coughing, following or during exercise, age at onset, duration of syncope history, number of syncopal spells, recurrent headaches, fatigue following syncope
Patient position	Standing, sitting, lying, or immediately after standing from sitting/lying
Associated symptoms/signs	Palpitations, nausea/vomiting, chest pain, fatigue, pallor
Risk factors for cardiac disease	Hypertension, dyslipidemia, diabetes mellitus, family history of premature vascular disease, cigarette smoking
Symptoms of cardiac disease	Angina pectoris, shortness of breath on exertion, paroxysmal nocturnal dyspnea, pedal edema, orthopnea, palpitations
Medication use	QT-prolonging medications, antihypertensive medications
Family history	Syncope, sudden death, drownings, recurrent seizures, single-vehicle motor vehicle accidents, sudden infant death syndrome, miscarriages
Physical Examination	
Blood pressure	Lying, supine, standing, and 3 minutes standing
Auscultation	Murmurs of HCM, aortic stenosis
	Heart sound changes with structural heart disease: S3, S4, mitral regurgitation
Other	JVP, cardiac apical impulse characterization, peripheral pulses, edema
ECG	
Underlying rhythm	Sinus rhythm or alternative rhythm origin (atrial fibrillation or flutter, junctional, idioventricular)
Conduction	Hemiblock, bifascicular or bundle branch block
	First-, second-, or third-degree AV block
	Pre-excitation
Repolarization	ST-segment changes, T-wave inversion, QT interval
Other	Chamber hypertrophy, low voltage

Patient Disposition and Evaluation After Initial for Syncope



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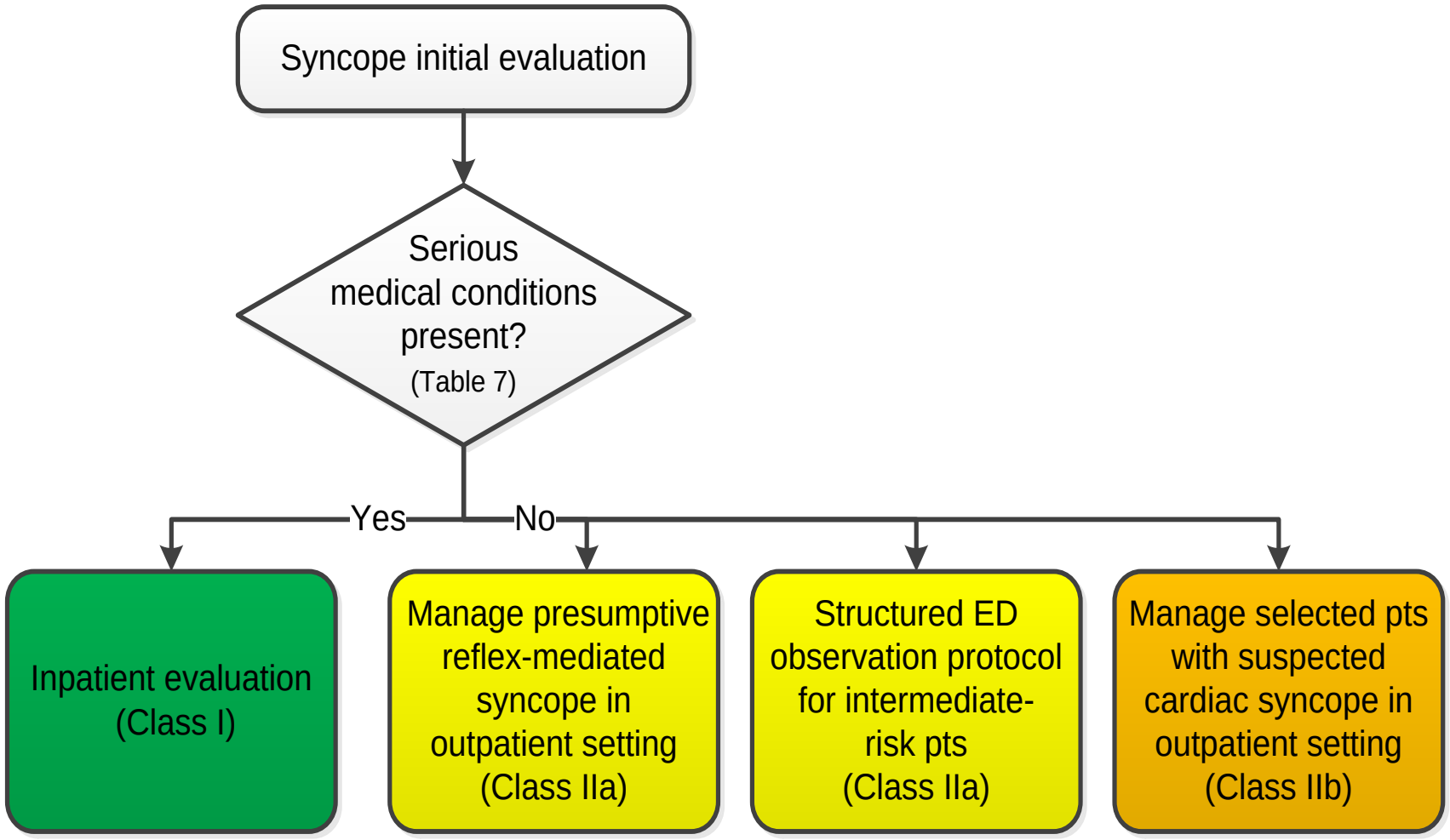
Patient Disposition and Evaluation After Syncope



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Patient Disposition - Factors Associated with Cardiac Syncope

More Often Associated With Cardiac Causes of Syncope
• Older age (>60 y) • Male sex • Presence of known ischemic heart disease, structural heart disease, previous arrhythmias, or reduced ventricular function • Brief prodrome, such as palpitations, or sudden loss of consciousness without prodrome • Syncope during exertion • Syncope in the supine position • Low number of syncope episodes (1 or 2) • Abnormal cardiac examination • Family history of inheritable conditions or premature SCD (<50 y of age) • Presence of known congenital heart disease

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Patient Disposition - Factors Associated with Cardiac Syncope

Table 6 Examples of Serious Medical Conditions That Might Warrant Consideration of Further Evaluation and Therapy in a Hospital Setting

Cardiac Arrhythmic Conditions	Cardiac or Vascular Nonarrhythmic Conditions	Noncardiac Conditions
• Sustained or symptomatic VT • Symptomatic conduction system disease or Mobitz II or third-degree heart block • Symptomatic bradycardia or sinus pauses not related to neurally mediated syncope • Symptomatic SVT • Pacemaker/ICD malfunction • Inheritable cardiovascular conditions predisposing to arrhythmias	• Cardiac ischemia • Severe aortic stenosis • Cardiac tamponade • HCM • Severe prosthetic valve dysfunction • Pulmonary embolism • Aortic dissection • Acute HF • Moderate-to-severe LV dysfunction	• Severe anemia/gastrointestinal bleeding • Major traumatic injury due to syncope • Persistent vital sign abnormalities

COR	LOE	Recommendation
I	B-NR	Continuous ECG monitoring is useful for hospitalized patients admitted for syncope evaluation with suspected cardiac etiology.

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Cardiovascular Imaging and Testing

COR	LOE	Recommendations
IIa	B-NR	Transthoracic echocardiography can be useful in selected patients presenting with syncope if structural heart disease is suspected.
IIb	B-NR	CT or MRI may be useful in selected patients presenting with syncope of suspected cardiac etiology.
III: No Benefit	B-R	Routine cardiac imaging is not useful in the evaluation of patients with syncope unless cardiac etiology is suspected on the basis of an initial evaluation, including history, physical examination, or ECG.

Neurological Testing

COR	LOE	Recommendations
IIa	C-LD	Simultaneous monitoring of an EEG and hemodynamic parameters during tilt-table testing can be useful to distinguish among syncope, pseudosyncope, and epilepsy.
III: No Benefit	B-NR	MRI and CT of the head are not recommended in the routine evaluation of patients with syncope in the absence of focal neurological findings or head injury that support further evaluation.
III: No Benefit	B-NR	Carotid artery imaging is not recommended in the routine evaluation of patients with syncope in the absence of focal neurological findings that support further evaluation.
III: No Benefit	B-NR	Routine recording of an EEG is not recommended in the evaluation of patients with syncope in the absence of specific neurological features suggestive of a seizure.

Tilt Table Testing

COR	LOE	Recommendations
IIa	B-R	If the diagnosis is unclear after initial evaluation, tilt-table testing can be useful for patients with suspected VVS.
IIa	B-NR	Tilt-table testing can be useful for patients with syncope and suspected delayed OH when initial evaluation is not diagnostic.
IIa	B-NR	Tilt-table testing is reasonable to distinguish convulsive syncope from epilepsy in selected patients.
IIa	B-NR	Tilt-table testing is reasonable to establish a diagnosis of pseudosyncope.
III: No Benefit	B-R	Tilt-table testing is not recommended to predict a response to medical treatments for VVS.

Case #2

71-year-old well-established male patient presents to the office With a complaint of loss of consciousness about 3 weeks ago. He reports that he was walking his dog and the next thing he knows he wakes up on the ground. He has no recollection of any preceding symptoms. He sustained a small laceration over his eyebrow and abrasion to his knee. The patient has no complaints today. His vital signs in the office are within normal range. He has a prior history of hypertension, dyslipidemia and coronary artery disease and prior percutaneous interventions. He has been compliant with his medications. Recent echocardiogram demonstrated an LVEF of 45 to 50%. Pharmacological nuclear stress testing about 3 months ago demonstrated an LVEF of 44% with an inferior wall fixed defect and no concern for reversible or active ischemia.

Case #2

Which with the following is the best neck step in the management of the patient:

A. Reassurance with follow-up if symptoms recur
B. Prescribed a 30-day Cardiac Event monitor
C. Referral to neurology for further work-up
D. Refer to specialist for invasive electrophysiology testing
E. Cardiology consultation for loop recorder implantation

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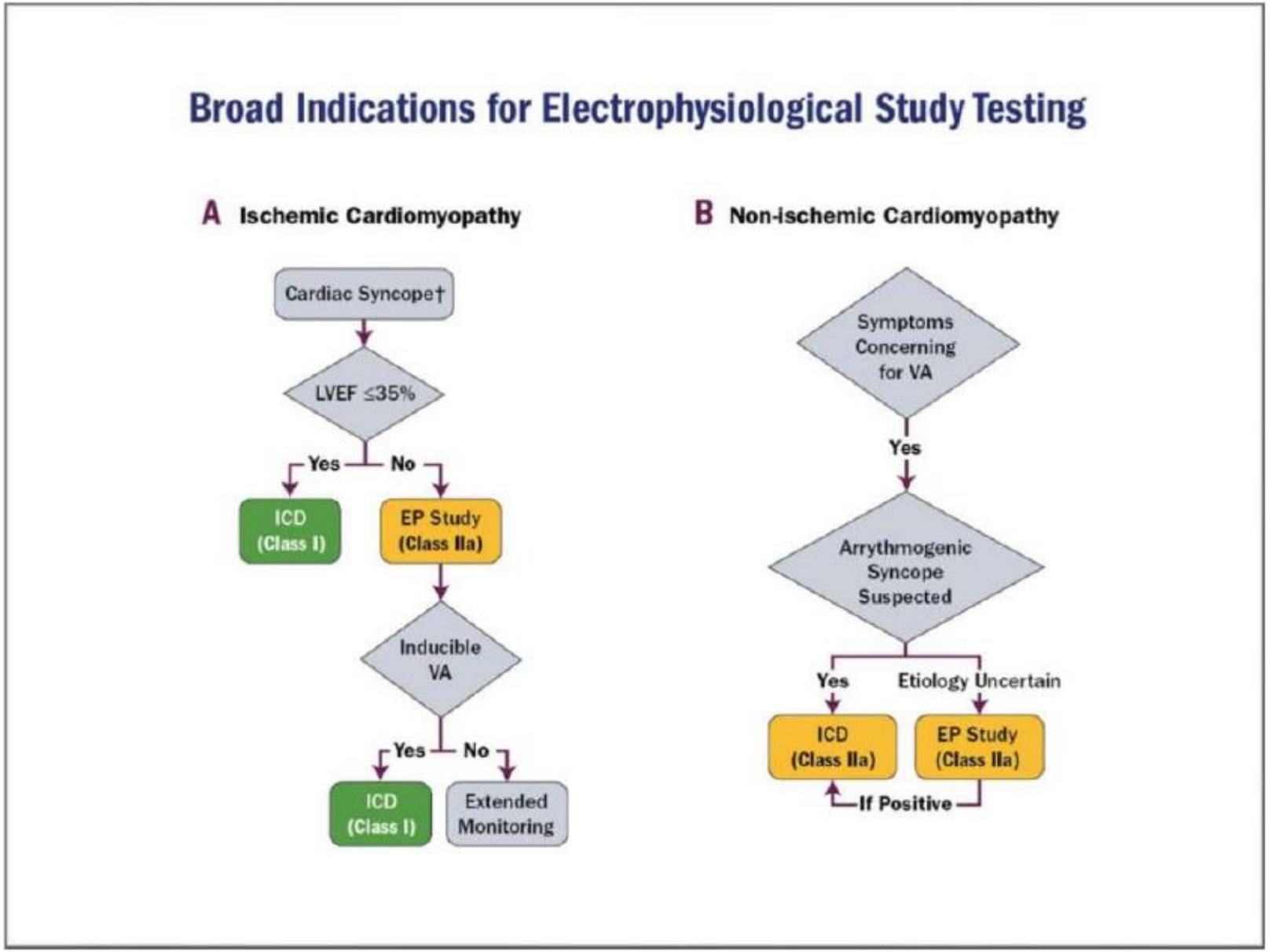
Electrophysiology Testing:

Ischemic HD
Structural HD
Complex Congenital HD



Management of Syncope

Case #3

24-year-old female presents with her mother for follow-up after recent 30-day heart monitor for recurrent syncope. The patient has suffered dozens of syncopal events over the course of the last several years. She denies a family history of sudden cardiac death. Cardiac work-up including EKG, echocardiogram and treadmill stress testing were unremarkable. MRI/MRA of the brain were felt to be normal. Episodes are preceded by several minutes of lightheadedness, diaphoresis and nausea. She can at times abort episodes by laying down. Cardiac monitor demonstrated predominantly sinus rhythm and sinus tachycardia with 2 episodes of transient bradycardia down to 38 bpm and no prolonged pauses. The patient reported symptoms of near syncope associated with these rhythm events.

Case #3

Which showed the following would not be appropriate in the management of this patient:

A. Referral for tilt table testing
B. Education and reassurance to the patient and her family without any further work-up
C. Recommend hydration and increased salt intake
D. Referral for permanent pacemaker implantation
E. Situational avoidance

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Syncope in patients with autonomic syndromes

Approach to Syncope in Patients With Autonomic Syndromes

Etiology	Diagnostic Testing	Interventions
Vasovagal syncope	Structured history Tilt-table test	Patient education 2-3 L fluid/day and 10 g salt/day Physical counterpressure maneuvers Beta-blockers (in patients >42 years of age) Alpha agonists (midodrine) Mineralocorticoid* Selective serotonin reuptake inhibitors* Device therapy*
Postural tachycardia syndrome (POTS)	Holter monitor Tilt-table test Occasional exercise testing Exclusion echocardiogram	Reassurance, hydration, recumbent exercise First-line medical therapy with fludrocortisone or pyridostigmine Secondary agents include low-dose beta-blockers and midodrine Clonidine or alpha-methyldopa with hyperadrenergic features Ablation not indicated
Inappropriate sinus tachycardia	Holter monitor Occasional exercise testing Exclusion echocardiogram	Beta-blockers typically ineffective Ivabradine may be useful Ablation strongly discouraged
Orthostatic hypotension	Postural blood pressure Ambulatory blood pressure Select autonomic testing for etiology	Lifestyle changes: 2-3 L fluid/day and 10 g salt/day Remove offending medications Alpha agonist (midodrine, droxidopa) Mineralocorticoid

Vasovagal Syncope

COR	LOE	Recommendation
IIb	B-R [SR]	Dual-chamber pacing might be reasonable in a select population of patients 40 years of age or older with recurrent VVS and prolonged spontaneous pauses.

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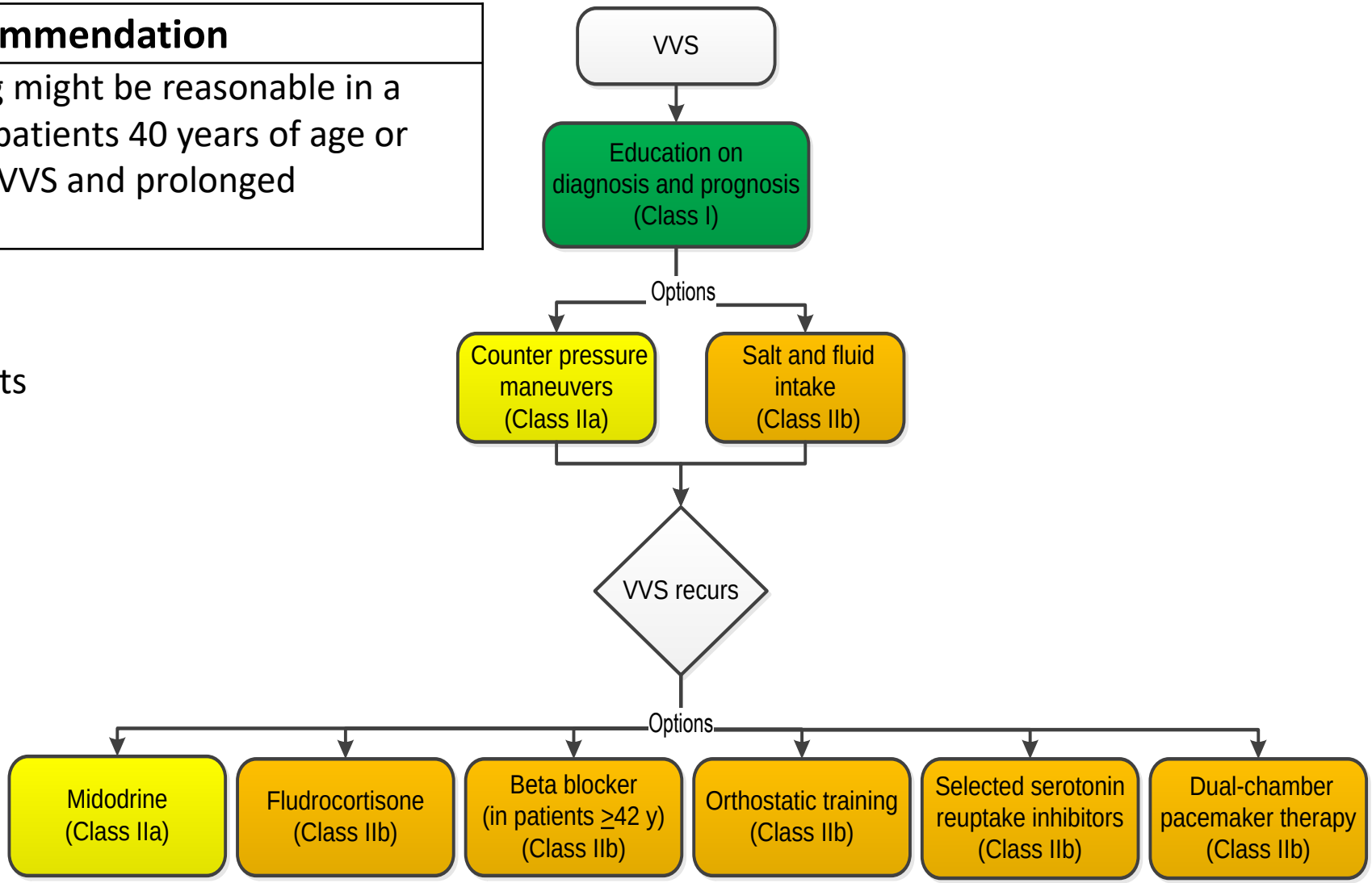
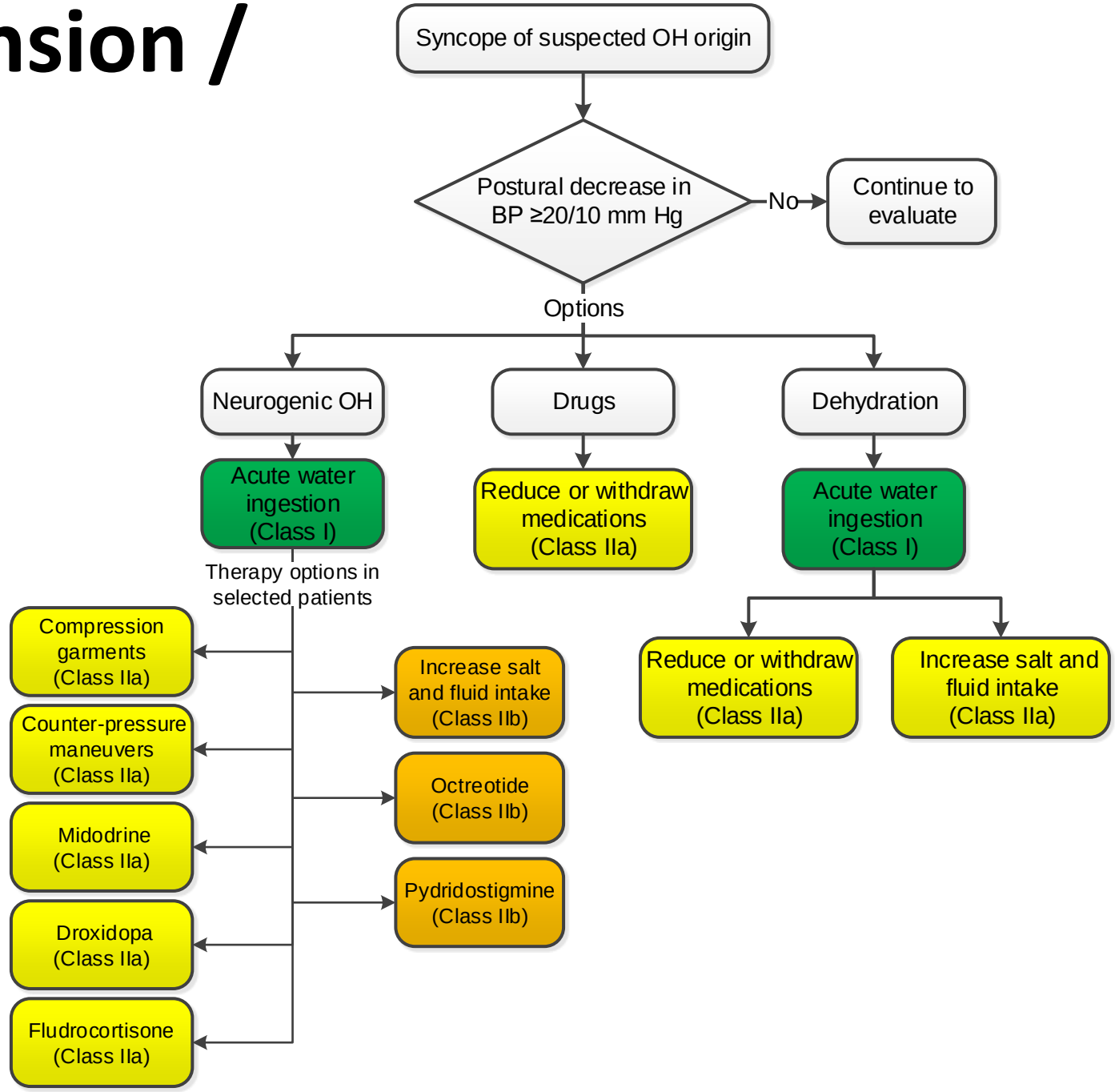


Orthostatic Hypotension / Syncope



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Carotid Sinus Syndrome

COR	LOE	Recommendations
IIa	B-R	Permanent cardiac pacing is reasonable in patients with carotid sinus syndrome that is cardio-inhibitory or mixed.
IIb	B-R	It may be reasonable to implant a dual-chamber pacemaker in patients with carotid sinus syndrome who require permanent pacing.

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Case #4

46-year-old male presents to the emergency room after 2 weeks of progressive fatigue. He has suffered 2 episodes with loss of consciousness at home. He also admits to several months of dyspnea on exertion. In the emergency room his blood pressure is 158/60. His pulse rate is 40 bpm. Physical exam is remarkable for a couple of abrasions on his extremities and bradycardia. An EKG demonstrates sinus rhythm with complete heart block and a junctional escape rhythm at 42 bpm. He is admitted to the telemetry ward from the emergency room. Echocardiogram demonstrates normal left ventricular function and no significant valvular heart disease.

Case #4

Which of the following is the next best diagnostic study to consider for this patient:

1. Treadmill stress testing with nuclear imaging
2. CT coronary angiography
3. Fluorine 18 fluorodeoxyglucose Positron emission tomography Scan
4. No further testing required, proceed with pacemaker implantation

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Which of the following is the next best diagnostic study to consider for this patient:

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2. CT coronary angiography
3. Fluorine 18 fluorodeoxyglucose Positron emission tomography Scan
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Arrhythmic Cardiovascular Etiologies

Cardiac Conditions Associated With Arrhythmic Syncope

Condition	Presentation	Diagnostic Testing	Therapeutic Considerations
Long QT syndrome	Exercise, swimming, emotion, loud noises, sleep/awakening	Family history/pedigree, resting ECG and exercise testing, genetic testing	Beta-blockers with select use of sympathectomy and ICD
CPVT	Exercise, swimming	Family history/pedigree, exercise testing, genetic testing	Beta-blockers, flecainide with select use of sympathectomy and ICD
Brugada syndrome	Sleep, fever	Family history/pedigree, standard and high-lead ECG, sodium channel blocker challenge	ICD, select use of quinidine
ARVC	No pattern, occasionally exercise	Family history/pedigree, ECG, Holter, SAECG, MRI, genetic testing	ICD, select use of antiarrhythmic drugs, exercise restriction
HCM	No pattern, occasionally exercise	Family history/pedigree, ECG, Holter, treadmill, MRI, genetic testing	ICD, select use of beta-blockers, disopyramide, antiarrhythmic drugs
Sarcoidosis	No pattern	ECG, Holter, chest CT, MRI/PET	Pacemaker (normal LV function), ICD, antiarrhythmic drugs, immunosuppression
Wolff-Parkinson-White syndrome	No pattern	ECG, electrophysiology study	Ablation
Ischemic CM	No pattern, occasionally exercise	Treadmill, CT angiogram, coronary arteriography	Revascularization, pacemaker/ICD
Nonischemic CM	No pattern	Echocardiogram, MRI, Holter or extended monitoring	Pacemaker/ICD

Cardiac Sarcoidosis

COR	LOE	Recommendations
I	B-NR	ICD implantation is recommended in patients with cardiac sarcoidosis presenting with syncope and documented spontaneous sustained VA.
I	C-EO	In patients with cardiac sarcoidosis presenting with syncope and conduction abnormalities, GDMT is recommended.
IIa	B-NR	ICD implantation is reasonable in patients with cardiac sarcoidosis and syncope of suspected arrhythmic origin, particularly with LV dysfunction or pacing indication.
IIa	B-NR	EPS is reasonable in patients with cardiac sarcoidosis and syncope of suspected arrhythmic etiology.

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Brugada Syndrome

COR	LOE	Recommendations
IIa	B-NR	ICD implantation is reasonable in patients with Brugada ECG pattern and syncope of suspected arrhythmic etiology.
IIb	B-NR	Invasive EPS may be considered in patients with Brugada ECG pattern and syncope of suspected arrhythmic etiology.
III: No Benefit	B-NR	ICD implantation is not recommended in patients with Brugada ECG pattern and reflex-mediated syncope in the absence of other risk factors.

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Arrhythmogenic Right Ventricular Cardiomyopathy

COR	LOE	Recommendations
I	B-NR	ICD implantation is recommended in patients with ARVC who present with syncope and have a documented sustained VA.
IIa	B-NR	ICD implantation is reasonable in patients with ARVC who present with syncope of suspected arrhythmic etiology.

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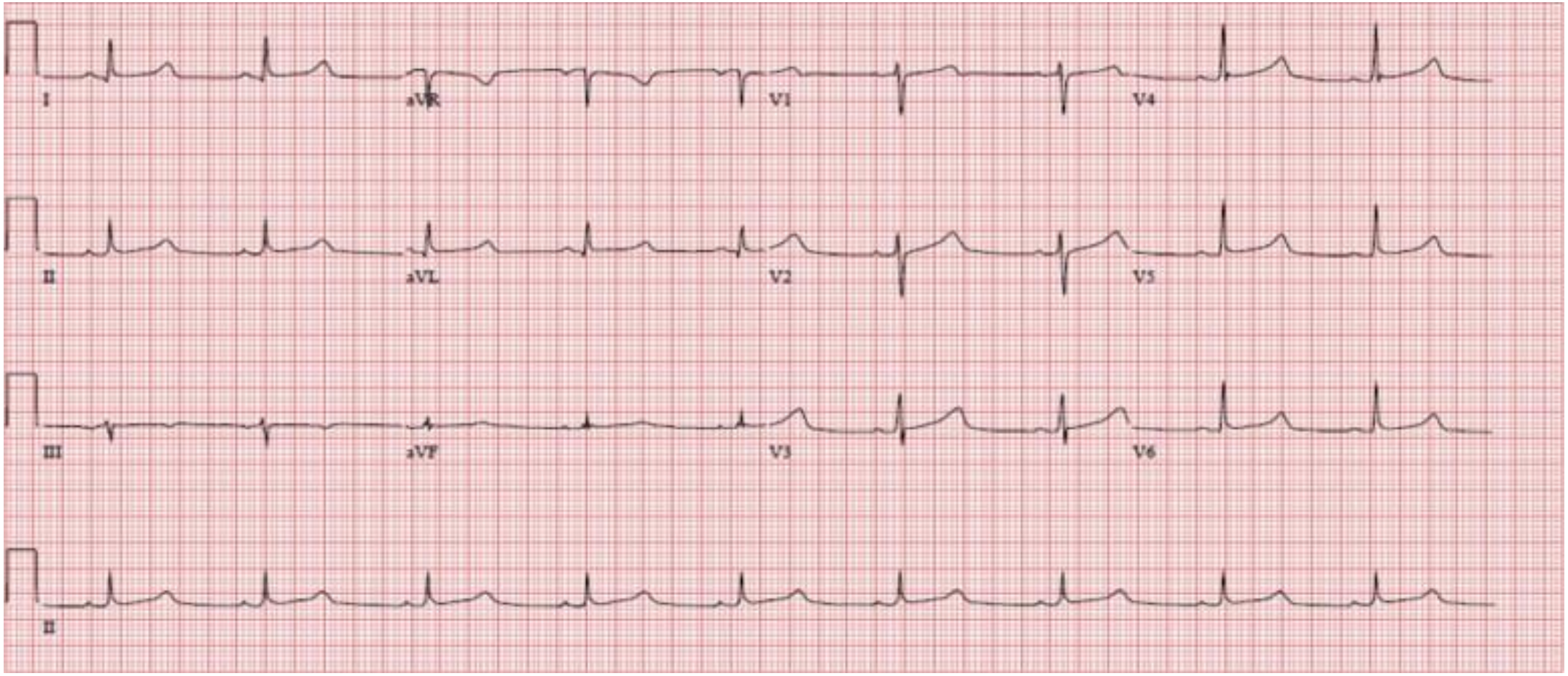
Case #5

22-year-old college student presents to our office with complaint of episode of loss of consciousness 3 weeks ago while she was racing from one class to the next. She reports she had been under a lot of stress and was very concerned about being late to an exam. She reports that she is otherwise healthy and has never had any prior long-term medical conditions. She reports one prior event in high school where she lost consciousness in PE class. She recalls being seen by the school nurse and her pediatrician at the time and was reassured. She is currently on no medications. Her vital signs in the office are within normal limits. Physical examination is unremarkable with normal findings. EKG is obtained and shown below:

Case #5



Case #5

Which of the following is an appropriate Neck step in the management of this patient:

A. Schedule treadmill stress test
B. Schedule the patient for CT scan of the head
C. Reassured the patient with extensive education on situational avoidance
D. Start the patient on beta-blocker therapy and refer to a specialist

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Long-QT Syndrome

COR	LOE	Recommendations
I	B-NR	Beta-blocker therapy, in the absence of contraindications, is indicated as a first-line therapy in patients with LQTS and suspected arrhythmic syncope.
IIa	B-NR	ICD implantation is reasonable in patients with LQTS and suspected arrhythmic syncope who are on beta-blocker therapy or are intolerant to beta-blocker therapy.
IIa	C-LD	Left cardiac sympathetic denervation (LCSD) is reasonable in patients with LQTS and recurrent syncope of suspected arrhythmic mechanism who are intolerant to beta-blocker therapy or for whom beta-blocker therapy has failed.

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Short-QT Syndrome

COR	LOE	Recommendation
IIb	C-EO	ICD implantation may be considered in patients with short-QT pattern and syncope of suspected arrhythmic etiology.

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Catecholaminergic Polymorphic Ventricular Tachycardia

COR	LOE	Recommendations
I	C-LD	Exercise restriction is recommended in patients with CPVT presenting with syncope of suspected arrhythmic etiology.
I	C-LD	Beta blockers lacking intrinsic sympathomimetic activity are recommended in patients with CPVT and stress-induced syncope.
IIa	C-LD	Flecainide is reasonable in patients with CPVT who continue to have syncope of suspected VA despite beta-blocker therapy.
IIa	B-NR	ICD therapy is reasonable in patients with CPVT and a history of exercise- or stress-induced syncope despite use of optimal medical therapy or LCSD.
IIb	C-LD	In patients with CPVT who continue to experience syncope or VA, verapamil with or without beta-blocker therapy may be considered.
IIb	C-LD	LCSD may be reasonable in patients with CPVT, syncope, and symptomatic VA despite optimal medical therapy.

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Driving and Syncope

- Region and State Dependent
- Guidelines: It can be beneficial for healthcare providers managing patients with syncope to know the driving laws and restrictions in their regions and discuss implications with the patient.

Condition	Symptom-free waiting time*
OH	One month
VVS, no syncope in prior year[1]	No restriction
VVS, one to six syncope per year[2]	One month
VVS, >6 syncope per year[2,1]	Not fit to drive until symptoms resolved
Situational syncope other than cough syncope	One month
Cough syncope, untreated	Not fit to drive
Cough syncope, treated with cough suppression	One month
Carotid sinus syncope, untreated[1]	Not fit to drive
Carotid sinus syncope, treated with permanent pacemaker[1]	One week
Syncope due to nonreflex bradycardia, untreated[1]	Not fit to drive
Syncope due to nonreflex bradycardia, treated with permanent pacemaker[1,3]	One week
Syncope due to SVT, untreated[1]	Not fit to drive
Syncope due to SVT, pharmacologically suppressed[1]	One month
Syncope due to SVT, treated with ablation[1]	One week
Syncope with LVEF <35% and a presumed arrhythmic etiology without an ICD[4,5]	Not fit to drive
Syncope with LVEF <35% and presumed arrhythmic etiology with an ICD[6,7]	Three months
Syncope presumed due to VT/VF, structural heart disease, and LVEF ≥35%, untreated	Not fit to drive
Syncope presumed due to VT/VF, structural heart disease, and LVEF ≥35%, treated with an ICD and guideline-directed drug therapy[6,7]	Three months
Syncope presumed due to VT with a genetic cause, untreated	Not fit to drive
Syncope presumed due to VT with a genetic cause, treated with an ICD or guideline-directed drug therapy	Three months
Syncope presumed due to a nonstructural heart disease VT, such as RVOT or LVOT, untreated	Not fit to drive
Syncope presumed due to a nonstructural heart disease VT, such as RVOT or LVOT, treated successfully with ablation or suppressed pharmacologically[1]	Three months
Syncope of undetermined etiology	One month

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