

Feeling Faint: Evaluation of Syncope and POTS

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Description

Patients presenting with symptoms of “fainting or passing out” are clinically challenging.

This presentation will provide a focused approach to the evaluation and treatment of syncope and postural orthostatic tachycardia syndrome.

Discussion will cover diagnostic approaches, pharmacologic and nonpharmacologic therapy .

Objectives

- Brief review of the function of the autonomic nervous system.
- Identify signs and symptoms associated with syncope and postural orthostatic tachycardia syndrome.
- Discuss diagnostic testing options for evaluation of syncope and postural orthostatic tachycardia syndrome.
- Discuss pharmacologic and non-pharmacologic management of syncope and postural orthostatic tachycardia syndrome.

Sympathetic vs. Parasympathetic Nervous System

Sympathetic “fight or flight”

- Increased pupil size
- Increased blood pressure
- Increased respiratory rate
- Increased heart rate
- Decreased secretions
- Decreased bowel activity
- Decreased bladder activity

Parasympathetic “rest and digest”

- Decreased pupil size
- Decreased blood pressure
- Decreased respiratory rate
- Decreased heart rate
- Increased secretions
- Increased bowel activity
- Increased bladder activity

Definition

Syncope is a sudden loss of consciousness and postural tone associated with loss of cerebral blood flow which recovers spontaneously.

From the Greek “synkoptein” meaning “to cut short.”

Result of cerebral hypoperfusion



Epidemiology

- 3-5% of Emergency Department visits
- 1-6% medical admissions
 - 40% of cases hospitalized
- Overall Mortality 7.5%
- Mortality with a cardiac cause 18-33%

Cost

- Cost is \$750 million/year for diagnosis and treatment
- ~10% falls in older adults are due to syncope resulting in costs greater than \$700 million to health care system
- \$ 2.4 billion annual cost for hospital costs of inpatient workup

Quality of Life Impact

- ADL's
- Depression/Anxiety
- Driving
- Physical Activity
- Employment
- Sexual function
- Relationships



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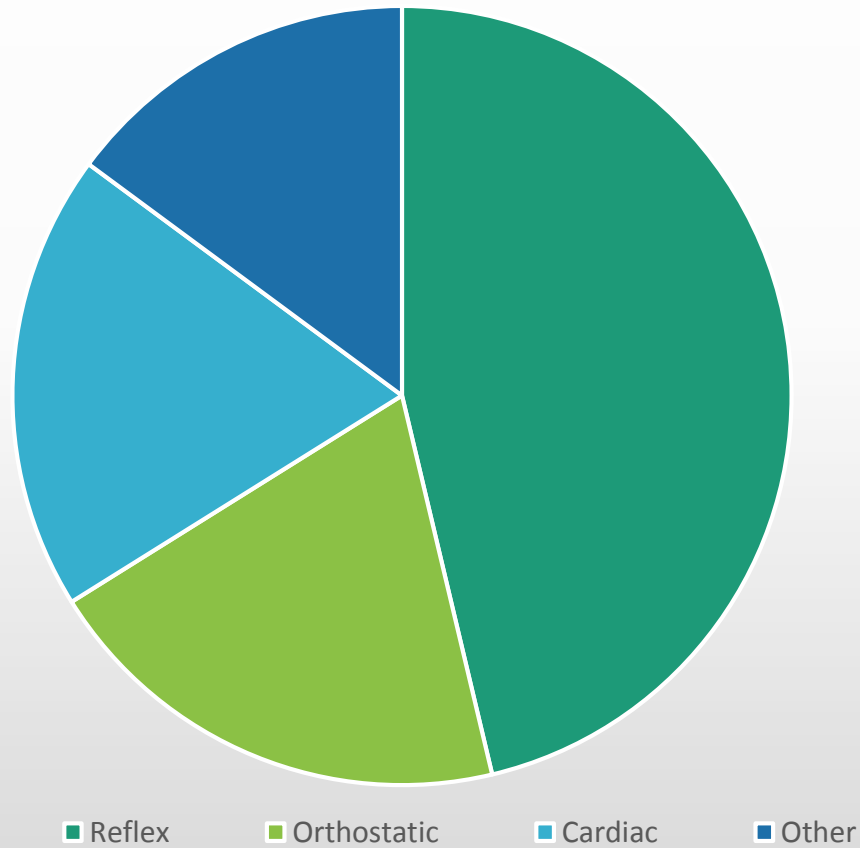
Medicolegal Implications

- Driving restrictions vary by state
- Provider may report to DMV but is NOT required to report in some states.



Etiology

3 Main Causes



Reflex (neurally mediated) syncope

Vasovagal

Mediated by orthostatic or emotional stress

Situational

Cough, sneeze, gastro-intestinal, micturation, post-exercise, post-prandal, others (laugh, brass instrument playing, weightlifting)

Carotis sinus syncope

Atypical forms

Without apparent triggers and/or atypical presentation

Syncope due to orthostatic hypotension

Primary autonomic failure

Pure autonomic failure, Multiple system atrophy, Parkinson's disease with autonomic failure, Lewy body dementia

Secondary autonomic failure

Diabetes, Amyloidosis, Uraemia, Spinal cord injuries

Drug induced

Alcohol, vasodilators, diuretics, phenotiazines, antidepressants

Volume depletion

Haemorrhage, diarrhoea, vomiting etc.

Cardiac syncope

Arrhythmias

Bradycardia

sinus node dysfunction, atrio-ventricular conduction system disease, implanted device malfunction

Tachycardia

supraventricular, ventricular (idiopathic, secondary to structural heart disease or to channelopathies)

Drug-induced

Structural heart disease

Cardiac

cardiac valvular disease (or prosthetic valve dysfunction), acute myocardial infarction/ ischemia, hypertrophic cardiomyopathy, cardiac masses, pericardial disease/ tamponade, congenital anomalies of coronary arteries

Other

pulmonary embolus, acute aortic dissection, pulmonary hypertension

History for Syncope

- Onset/Termination
- Irregular/Regular
- Symptoms
- Precipitating factors
- Alleviating factors
- Medication history
- Recreational drug and alcohol history

History for Syncope

- Family history
- Activity/ exercise habits
- Risk factors for CAD
- Medical history
 - Chemotherapy
 - Thyroid disease
 - AICD or pacemaker

Canadian Syncope Risk Score










Category	Points	Total Score	Estimated Risk of Serious Adverse Event (%)	Risk Category
 Predisposition to Vasovagal Symptoms	-1	-3	0.4	Very Low
 History of Heart Disease	1	-2	0.7	
 Any SBP < 90 or >180 mmHg	2	-1	1.2	Low
 Elevated Troponin (>99 th % of Normal)	2	0	1.9	
 Abnormal QRS Axis (<-30° or >100°)	1	1	3.1	Medium
 QRS Duration > 130 ms	1	2	5.1	
 Corrected QT Interval > 480 ms	2	3	8.1	
 Vasovagal Syncope	-2	4	12.9	High
 Cardiac Syncope	2	5	19.7	
		6	28.9	Very High
		7	40.3	
		8	52.8	
		9	65.0	
		10	75.5	
		11	83.6	

Figure 1: The Canadian Syncope Risk Score (CSRS)

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Cardiac syncope

Dysrhythmias

- Transient V-tach and bradycardia are most common.
- Syncope due to sudden cardiac death has a 6 month mortality of >10%.
 - Bradycardia
 - Heart block
 - Sinus node disease
 - Asystole
 - Pacemaker malfunction
 - Drug induced

Treatment for Bradycardias

- Single vs. Dual chamber pacemaker
- Special features:
 - Rate responsive
 - Mode switching
 - Rate drop
 - Sleep mode

Treatment for Tachyarrhythmias

Ventricular Tachycardia, Torsades de pointes,
Supraventricular Tachycardia

- Medications
 - Calcium channel blockers
 - Beta blockers
 - Antiarrhythmics
- Radiofrequency ablation
- ICD/PM with dual chamber rate responsive pacing. 5-7 yr.
Device lifespan

Reflex Syncope

- Vasovagal
- Situational
- Orthostatic hypotension
- Carotid artery stenosis
- Carotid sinus hypersensitivity

Reflex syncope

- Vasovagal
 - May be provoked by fear, pain, stress, prolonged standing or dehydration
 - Symptoms: Nausea, diaphoresis, bradycardia or tachycardia
 - May present as syncope or presyncope
 - Alleviating factors: cross legs, muscle tensing.

Treatment

- Medications to consider:
 - Beta blockers
 - Theophylline
 - Fluorinef
 - Prozac
 - Disopyramide
- Consider compression stockings

Situational Syncope

- Swallow- may reflect structural abnormalities of esophagus or heart
- Post tussive- often seen in middle age males with smoking &/or alcohol history
- Micturition-older males, orthostasis

Research on Vasomotor Instability

- Evaluation of treatment strategies to control vasovagal syncope.
- Strategies were based on increasing central blood flow and diminishing venous pooling.
- N=20
- Tx: Muscle tensing, leg crossing were successful in activating chemoreflex to stimulate sympathetic response.

Evaluation for Orthostatic Hypotension

- Evaluate by assessing HR and BP in 3 positions
 - Supine, sitting, standing
- Interval 1-2 minutes between assessments
- Positive findings
 - 20mm BP dec systolic or 10mm dec diastolic
 - 10 bpm HR increase
 - May or may not have symptoms

Possible Causes

Orthostatic Hypotension

- Autonomic Failure
- Shy-Drager syndrome
- Parkinsons disease
- Diabetes
- CNS infection or lesion
- Amyloid

Carotid Sinus Hypersensitivity

- Provocative situations
 - Backing up car
 - Shaving
- Elicited with carotid sinus massage
 - Prior to CSM
 - R/O cerebrovascular disease
 - R/O carotid bruits or radiating AS
- EKG and BP monitor for patient

Carotid Sinus Massage

- Normal response
 - Slowing of HR by 5-10 with return to baseline
- Use unilateral slow, firm pressure
- Significant finding is hypotension or bradycardia
- Positive test if 3 second pause

Cardiac Syncope

- Left Ventricular obstruction
 - Aortic Stenosis
 - HOCM
 - Mitral Stenosis
 - Left atrial Myxoma
- Pump failure
- Tamponade
- Pulmonary circulation obstruction
- Dissecting aneurysm

Left ventricular outflow obstruction (LVOO)

- Healthy heart:
 - Increase in CO compensates for decreased SVR from arteriolar vasodilation with exercise
- LV outflow obstruction:
 - Can't compensate which results in presyncope, syncope or hypotension.

Syncope associated with LVVO

- History of avoiding sports in youth
- Episodes occur with peak exertion such as Valsalva or coughing
- PE: AS or MR murmurs, S3 or S4

Surgery

- Valve repair/replacement

HOCM

- pacing of the ventricular septum to reroute pressures
- ICD if at risk or presence of arrhythmias

Drugs which may induce Syncope

- Antihypertensives
- Vasodilators
- Beta blockers
- Digoxin

Drug induced syncope

- Look for:
 - concurrent administration
 - time to peak effect
 - polypharmacy
 - drug interactions
 - appropriate dosing
 - antibiotics or other meds which may prolong QT interval

Calculating of QTc

(QT interval corrected for heart rate)

Divide measured QT interval (ms) by square root of the R-R interval (ms)

Corrected QT Interval (QTc)

QT:

Calculate

QTc Bazett^[1]: 641.806 sec

QTc Fredericia^[2]: 565.918 sec

Syncope due to prolonged QT

- May be drug induced or congenital.
- Normal QT is 390-410 ms.
- Most EP physicians agree that >450 ms is suspect.
- Always correct QT interval for rate.

Long QT syndrome

- May be familial
 - Look for unexplained or premature deaths.
- Congenital
 - May be accompanied by deafness
- EKG findings may be subtle; may need stress EKG to evaluate for QT shortening
- Treatment: pacemaker to shorten QT via rate.

Torsades de Pointes (TDP)

“Twisting of the point” around the isoelectric axis similar to a ballet move.

The highest frequency is in patients aged 35-50 years.

Women are affected more than men.

Torsades de Pointes

Risk factors:

- Congenital long QT syndrome
- Hypokalemia
- Hypomagnesemia
- Diuretic use
- High torsadogenic drug concentration
- Bradycardia
- Female sex

<https://crediblemeds.org/pdftemp/pdf/CombinedList.pdf>

Diagnostic Testing

- EKG
 - Low cost/low risk
 - Useful in 5% of cases

- Echo
 - Useful to document normal vs abnormal structures

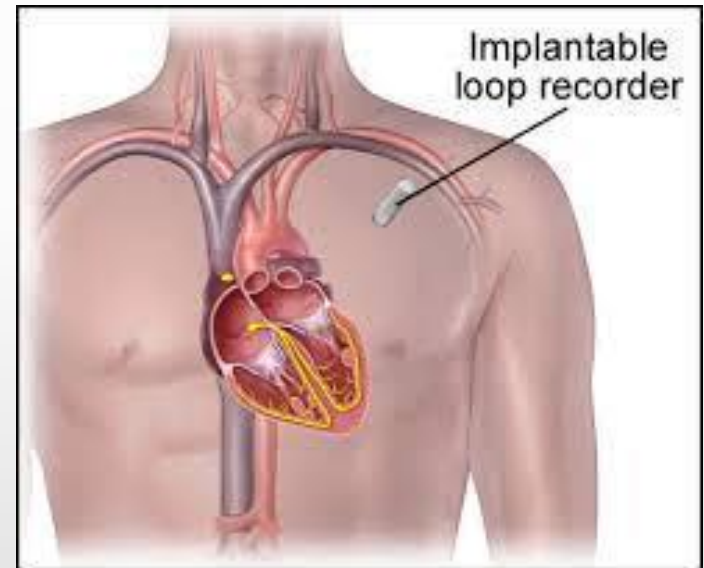
Diagnostic Testing

May be most useful in excluding arrhythmia

- Holter Monitor
 - Establishes baseline
 - Useful for daily frequency
- Event monitor
 - Infrequent events
 - Pt must be able to trigger

Implantable Loop Recorder

- Records and stores EKG 40 minutes before and 2 minutes after patient trigger
- 15-18 month lifespan
- Implanted subcutaneously



Tilt Table Testing

- Emergency resuscitation equipment is readily available
- Continuous EKG monitoring
- Place pt. at angles for 20-30 minutes
- May need to induce with Isuprel
- Positive response if symptoms are reproduced with brady, asystole or BP

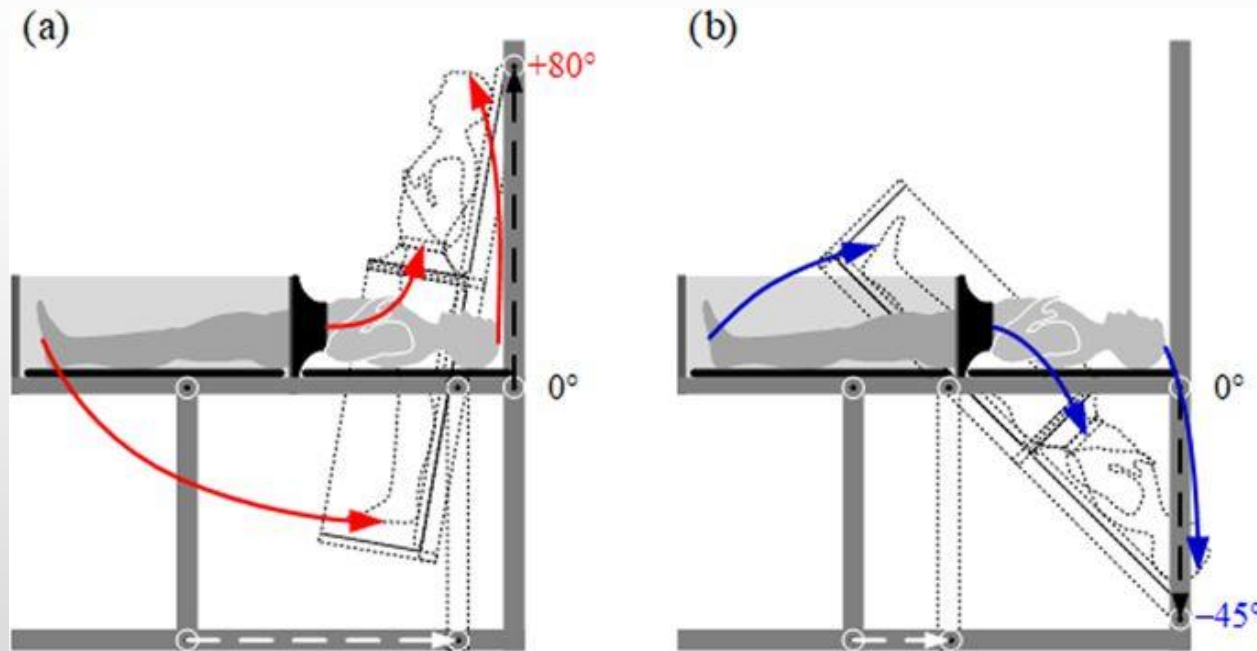


Tilt Testing

- Sensitivity is 61-69%
- Specificity is 92-94%
- Contraindicated:
 - Pregnancy
 - Aortic stenosis
 - Orthostatic Hypotension
 - Cerebrovascular disease

Tilt Table testing

- Complete after underlying heart disease is ruled out
- Positive = BP drops and symptoms occur
- Negative: No symptoms are provoked



Tilt Table Test Results

Diagnosis	Response to TTT
Classic orthostatic hypotension	Reduction in systolic BP ≥ 20 mmHg and diastolic BP ≥ 10 mmHg during first 3 minutes after being upright.
Vasovagal syncope	BP falls to systolic < 60 mmHg. HR does not decrease more than 10% of peak value.

Diagnostic Testing

- Cardiac catheterization
 - Done prior to electrophysiology study to evaluate for ischemia.
- Electrophysiology study
 - Done to rule out conduction abnormalities
 - Try to induce dysrhythmias

What is Postural Orthostatic tachycardia Syndrome?

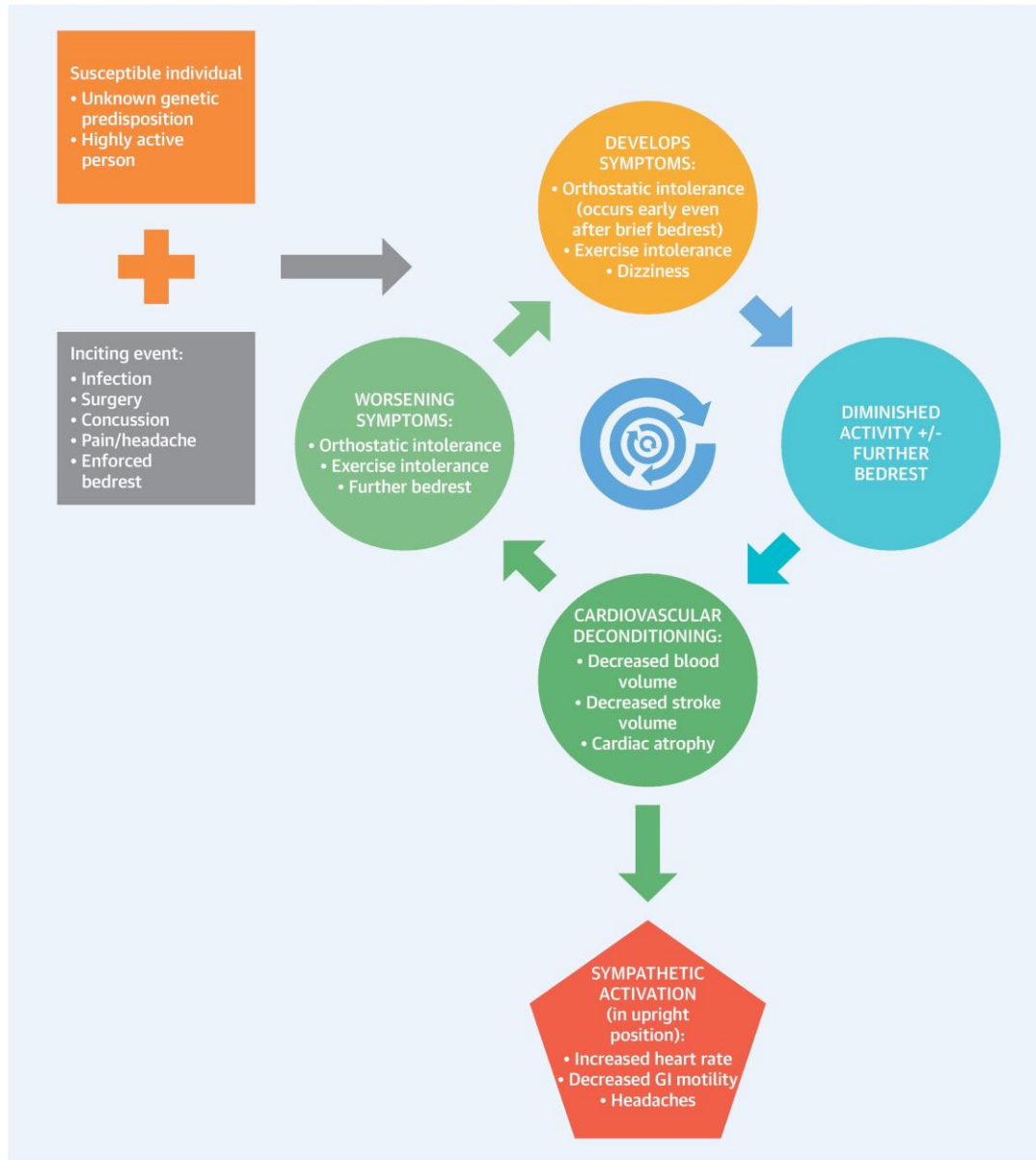
- Orthostatic intolerance for at least 3-6 months with increase in HR of 30 bpm (or HR exceeds 120 bpm) within first 10 minutes of standing or head-up tilt.
- Not accompanied by drop in systolic BP ≥ 20 mmHg

- Most commonly seen in young adults age 20-40 yrs
- Women more often than men.

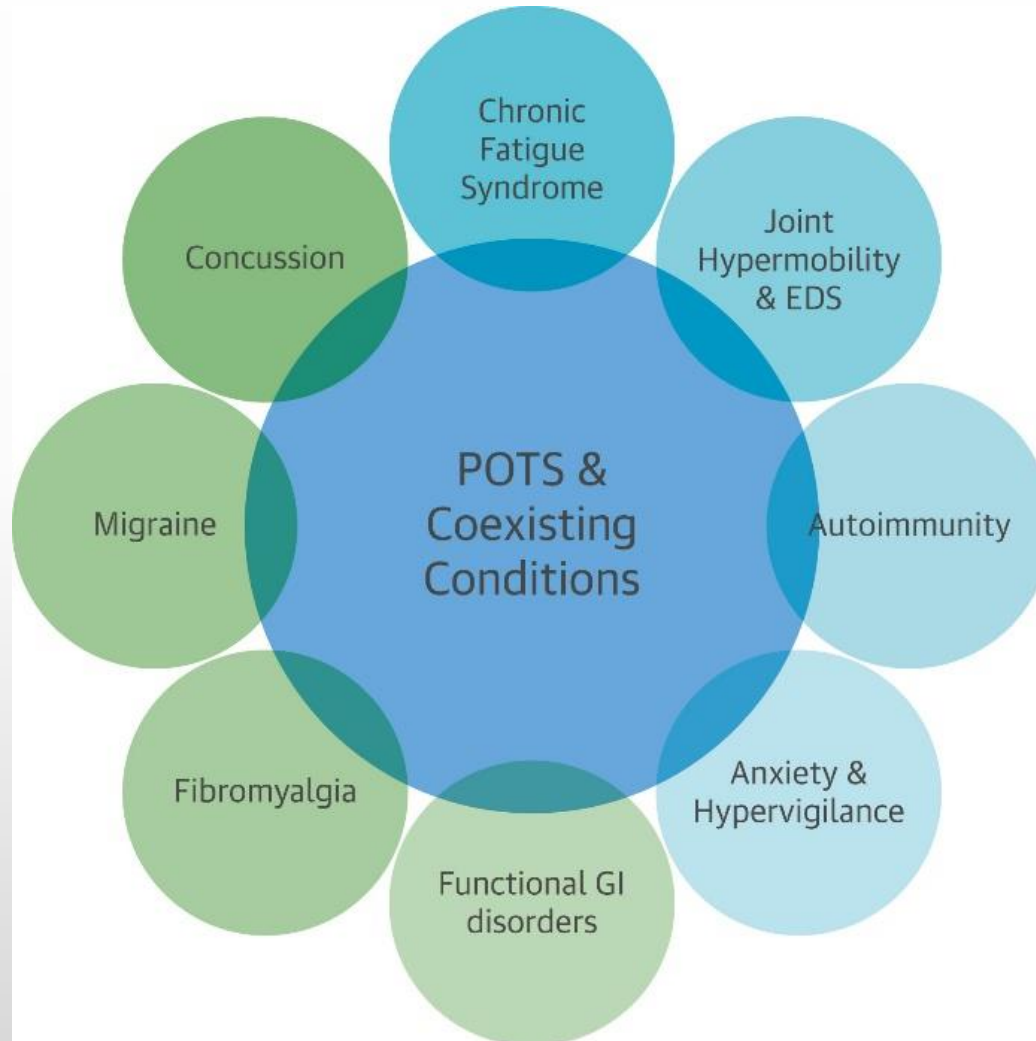
Pathophysiology

- Possible alpha-1 receptor dysfunction
- Heightened β receptor sensitivity
- Impaired venous capacitance
- Autonomic neuropathy affecting lower extremities
- Altered baroreceptor function
- Nitric oxide dysregulation altering release of norepinephrine.
- There are several subtypes that have been proposed that we will not cover.

CENTRAL ILLUSTRATION: Postural Orthostatic Tachycardia Syndrome: Downward Spiral



Comorbidities



POTS workup

H&P

Detailed medication history

- Oral contraceptive
- Mineralocorticoid receptor antagonist
- Diuretics
- Anticholinergic
- Antipsychotic
- Stimulants
- Orthostatic vitals
 - Stand quietly for 3-5 minutes minimum

POTS workup

- Active stand test (tilt table test not usually needed)
 - Patient supine for 10 min then BP and HR assessed.
 - Stand unaided for 10 min BP and HR measure at 1, 3, 5, and 10 min.
 - Perform test in morning since orthostatic tachycardia is more evident in am.
 - See if results meet definition of POTS
- Labs that would address reasons for tachycardia
 - CBC, thyroid, complete metabolic panel
 - EKG and ambulatory BP monitor
 - Don't forget about wearables

Postural Orthostatic Tachycardia Syndrome

- Frequent symptoms that occur with standing
 - Lightheadedness
 - Palpitations
 - Tremulousness
 - Generalized weakness
 - Blurred vision
 - Exercise intolerance
 - Fatigue

Nonpharmacologic POTS treatment

- Increase fluid intake to 3 L daily and sodium intake to 4 g daily
- Compression stockings/abdominal binders
- Avoiding triggers
 - heat, large meals, prolonged recumbency, alcohol, sudden positional changes
- HOB elevation, postural training
- Exercise training

Avoid Situations That Can Exacerbate Symptoms	Liberal Intake of Salt and Water	Sleep With Head of Bed Elevated
 <p>Large/Heavy Meals</p>  <p>Heat Exposure</p>  <p>Alcohol Intake</p>		 <p>Head posts should be elevated 4-6 inches</p>
Use of Compression Garments	Physical Counter Maneuvers	Drinking Water Before Getting Up In The Morning
 <p>Abdominal Binder</p>  <p>Hose</p>	 <p>Leg Crossing Maneuver</p>  <p>Squatting</p>	<p>Drinking a 16 oz glass of water quickly before getting out of bed in the morning or prolonged standing to minimize orthostatic symptoms</p> 
Strategies to Avoid Upright Exercise		
 <p>Seated Rower</p>	 <p>Swimming</p>	 <p>Recumbant Bicycle</p>

Medication Options for POTS Treatment

- **Beta blockers**
 - Control heart rate
 - Low dose propranolol 10-20 mg daily
 - Atenolol 25 mg or metoprolol 25 mg daily are options
- **Ivabradine** (only FDA approved for HF)
 - Used to manage tachycardia by inhibiting “funny” channels in the heart.
- **SSRI**
 - Manage psychological symptoms associated with POTS

Management

- Midodrine (alpha₁-adrenergic agonist)
 - 2.5-10 mg tid
 - First dose while still in bed
 - Last dose late afternoon.
- Fludrocortisone
 - 0.1 up to 0.2 mg daily
 - Expand plasma volume
 - Monitor potassium and magnesium
 - Adjust dose or stop for headache
- Pyridostigmine (cholinergic agonist)
 - Reduces acetylcholine breakdown
 - 30-60 mg tid

Saline infusions

- One liter over one hour
 - Symptom improvement for several hours up to 2 days.
- Reduces HR and minimizes BP fluctuation
- Improve QOL
- Consider during times
 - Stress
 - Oral intolerance
 - Acute illness

Key points to consider

- Diagnosing POTS is challenging
- High index of suspicion should be related to:
 - Age
 - Gender
 - Symptoms
- Treatment
 - May improve symptoms and cause others

Questions?

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