

Syncope: The Pediatric Patient

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Overview

- Definition
- Incidence
- Etiology
- Diagnostic evaluation
- Management
- Cases



Definition

- Abrupt, transient, complete loss of consciousness, associated with the inability to maintain postural tone, with rapid and spontaneous recovery
- The presumed mechanism is cerebral hypoperfusion



Yancy et al. ACC/AHA/HRS Guideline for the Evaluation and Management of Patients with Syncope: Executive Summary. 2017

Incidence

- Up to 50% of children experience one syncopal episode by 18y/o
- Bimodal age distribution
 - High incidence between 10-30 and then again > 65 yrs
- Comprises 3% of all pediatric ER visits
- Simple vasovagal/neurally-mediated syncope makes up 90% of syncope in pediatrics



Lewis DA et al. Syncope in the pediatric patient. The cardiologists perspective. *Pediat Clin North Am* 1999.
 Brignole m et al. New concept in the assessment of syncope. *J A Col of Card.* 2012

- ** Common Causes:**
- Vasovagal/neurocardiogenic
 - Breath holding spell
 - Orthostatic hypotension
 - Drug/Toxin exposure

Causes of syncope in children and adolescents

Primary cardiac electrical disturbances
Long QT syndrome*
Brugada syndrome*
Familial catecholaminergic polymorphic ventricular tachycardia*
Short QT syndrome*
Preexcitation syndromes (such as Wolff Parkinson White)*
Bradyarrhythmias (complete atrioventricular block, sinus node dysfunction)*
Structural cardiac abnormalities
Hypertrophic cardiomyopathy*
Coronary artery anomalies*
Arrhythmogenic right ventricular dysplasia/cardiomyopathy*
Valvar aortic stenosis*
Dilated cardiomyopathy*
Pulmonary hypertension*
Acute myocarditis*
Congenital heart disease*
Heat illness*
Anaphylaxis*
Vasovagal (neurocardiogenic) syndrome, including situational syncope (eg, cough, micturition, hair combing, blood draw, intramuscular injection, or emotional stress)†
Breath holding spell†
Orthostatic hypotension due to volume depletion (hemorrhage, dehydration, pregnancy, anorexia nervosa)†
Drug effects or toxic exposure (eg, dionidine, typical antipsychotic agents, carbon monoxide, ethanol intoxication)†
Hypoglycemia*
Conditions that mimic syncope
Seizure
Migraine syndromes
Hysterical faint
Hyperventilation
Intentional strangulation (eg, the "choking game")
Narcolepsy

* Potentially life-threatening causes.
 † Common causes.



UpToDate

Vasovagal

- Also known as neurocardiogenic, reflex, neurally mediated, situational, common fainting
- Most common cause of fainting in children and adolescents
- Typically describe a prodrome



Vasovagal

- Triggered by standing, stress, fear
- Reflex precipitants
 - Carotid Sinus syndrome
 - Swallow syncope
 - Cough syncope
 - Micturition syncope
 - Hair-grooming syncope



Breath Holding Spell

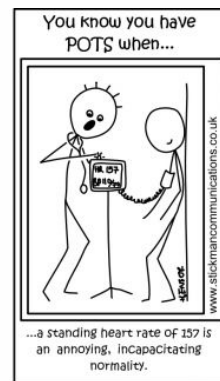
- Occurs between 6-24 months of age
- Triggered by emotional insult
- Cyanotic or pallid
- Resolution by 5 years of age in 85%

Orthostatic Hypotension

- ≥ 20 mmHG drop in systolic BP and/or a ≥ 10 mmHG drop in diastolic BP after 3 minutes of standing
- Causes
 - Volume depletion, pregnancy, anemia, anorexia nervosa, medications, other

Postural Orthostatic Tachycardia Syndrome (POTS)

- Orthostatic intolerance associated with an increase in heart rate from the supine to upright position of >40 BPM or to a heart rate >120 BPM within 10 minutes of standing
- Absence of orthostatic hypotension
- Associated with multiple symptoms



Drugs/Toxins

- Decreased cardiac output (barbiturates, tricyclic antidepressants, and phenothiazines)
- Sudden loss of consciousness (cocaine, alcohol, marijuana, inhalants, and opiates)

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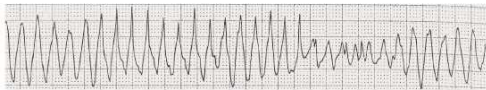
Myogenic arrhythmias
Hysterical faint
Hyperventilation
Intentional strangulation (eg, the "choking game")
Narcolepsy


* Potentially life-threatening causes.
† Common causes.

Tachyarrhythmias

- Long QT syndrome
 - Acquired
 - Medications, electrolyte disturbances, eating disorders, neurologic injury
 - Congenital
- Short QT syndrome



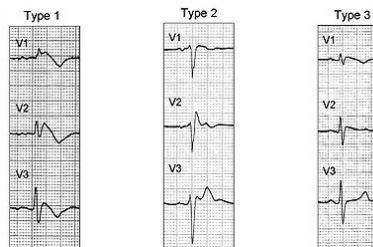


Tachyarrhythmias

- Ventricular tachycardia in structurally normal hearts

- Brugada syndrome

- Associated with fever
- Pseudo-right bundle branch block and persistent ST segment elevation (V1-V3)



- Catecholaminergic Polymorphic Ventricular Tachycardia (CPVT)

- Provoked by exercise testing
- Bidirectional VT

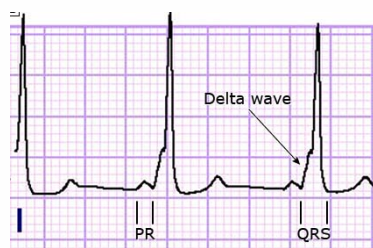


Tachyarrhythmias

- Supraventricular tachycardia

- Unusual presentation of syncope
- Wolff-Parkinson-White (WPW) Syndrome

- Short PR and delta wave on EKG
- Atrial Fibrillation with rapid conduction to ventricles -> syncope
- Electrophysiology (EP) study/ablation is the therapy of choice



Basso et al. Ventricular preexcitation in children and young adults: atrial myocarditis as a possible trigger of sudden death. Circulation. 2001.
<https://www.healio.com/cardiology/learn-the-heart/ecg-review/ecg-topic-reviews-and-criteria/wpw-review>

Bradyarrhythmias

- Sinus Node Dysfunction
- Congenital Atrioventricular (AV) block
- Complete AV block
 - Surgical, Lyme disease, other
- Other: medications, hypervagotonia, hypothyroid



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Other causes of Syncope

- Heat illness
- Anaphylaxis
- Hypoglycemia
 - More gradual onset/offset, not during/after meals

Conditions that Mimic Syncope

- Migraines
- Conversion Disorder
- Hyperventilation
- Narcolepsy
- Seizures ★

Seizures

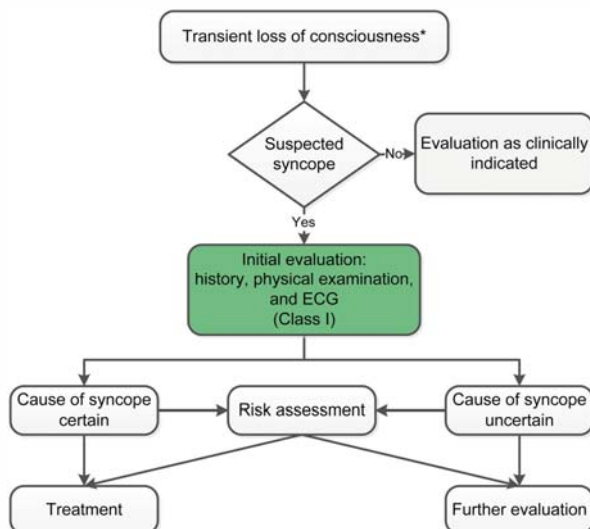
- 12% of patients with syncope will have convulsions

Syncope	Seizures
Light-headedness	Déjà vu
Sweating	Jamais vu
Prolonged standing	Aphasia
Precipitants (i.e. micturition)	Olfactory aura
Chest pain	Epigastric sensation
Palpitations	Tongue biting
Slow heart rate	Post event delirium
Low blood pressure	Focal neurology
	Incontinence

Diagnostic Evaluation

- Conceptually dividing patients into three groups
 1. Benign
 2. Cardiac disease with the potential for sudden death
 3. Other (...seizures)

Diagnostic Evaluation



Diagnostic Evaluation

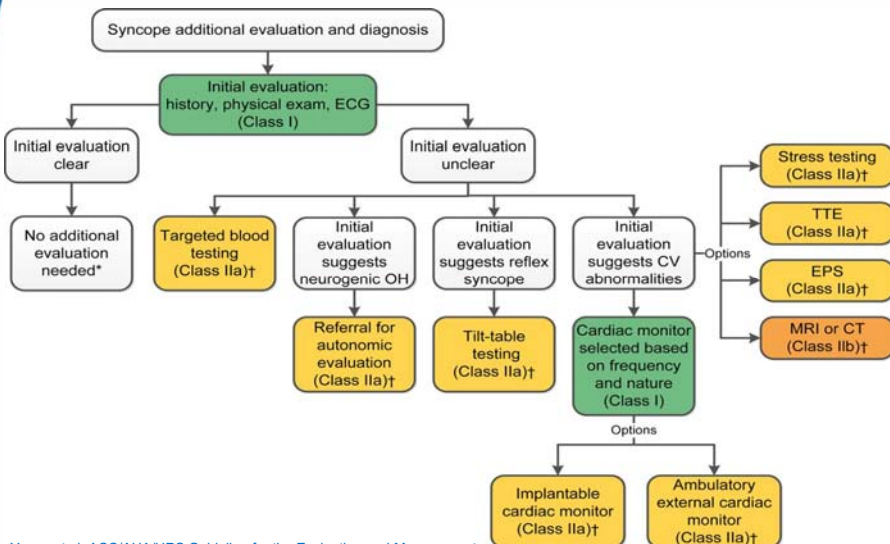
- History
 - Prodrome
 - Situation (supine, with exertion)
 - Palpitations, chest pain
 - “Post-ictal phase”
 - Cardiac, endocrine, neurologic, or psychological disorders
 - Arrhythmias
 - Drug use/sexual activity
 - Family History of inheritable conditions or premature SCD (<50 y/o)

Diagnostic Evaluation

- Physical exam
 - Orthostatics/POTS vitals
 - Cardiac exam
 - Neurologic exam



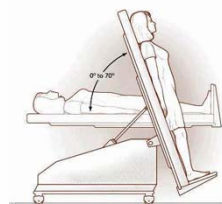
Diagnostic Evaluation



Yancy et al. ACC/AHA/HRS Guideline for the Evaluation and Management of Patients with Syncope: Executive Summary, 2017

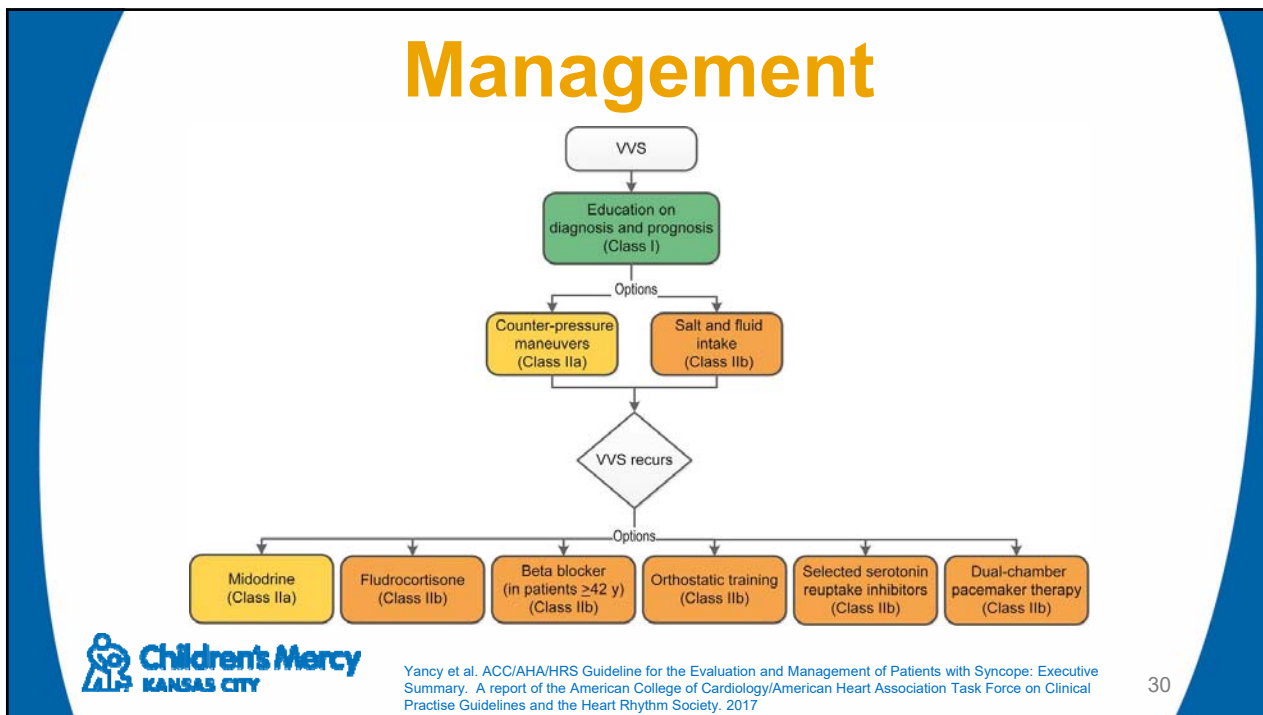
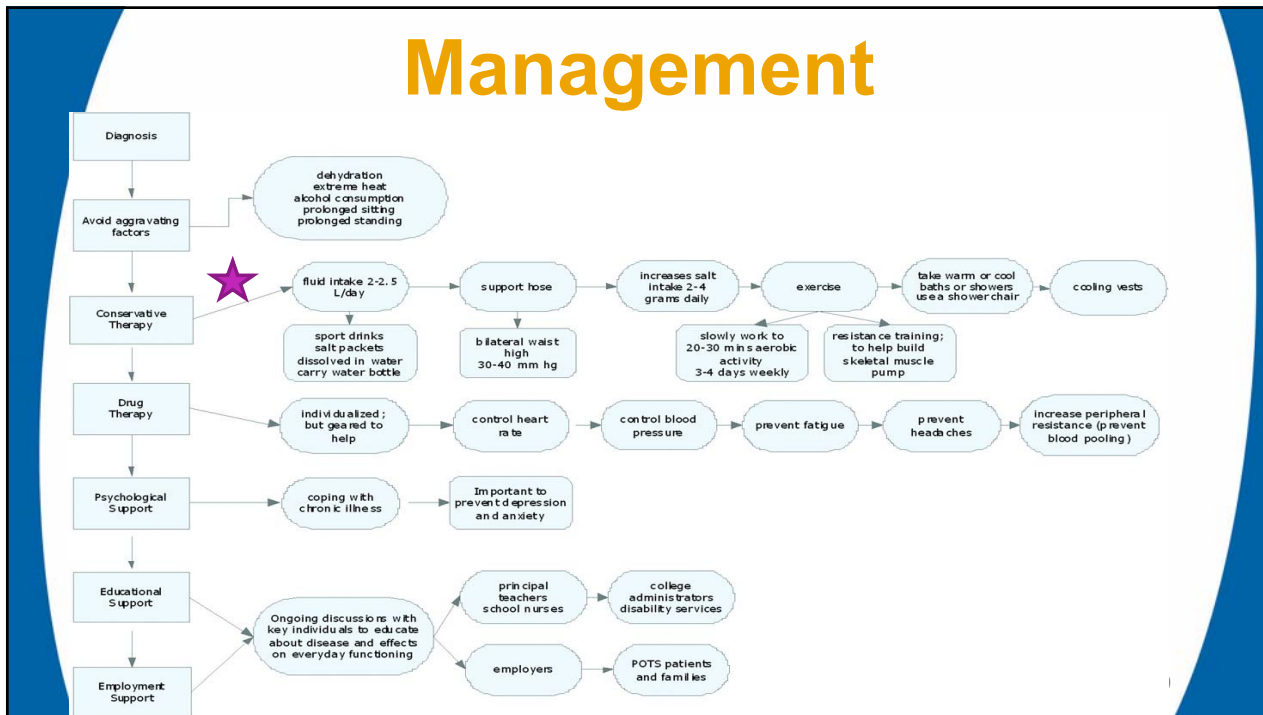
Diagnostic Evaluation

- Studies
 - EKG- done on all patients
 - ECHO-Clinical/FHx, findings on exam, EKG findings
 - Holter- rarely helpful
 - Event monitors- monitoring of events 30 days +
 - Exercise testing- exercise induced syncope
 - Lab testing- not useful
 - EPS- structural heart disease, sudden death
 - Tilt table testing- not done much
 - Implantable loop recorder



New Implantable Loop Recorder





Management

- **Beta Blockers:** These drugs have not been found to be effective in adequately designed and controlled randomized studies. The largest prospective, placebo-controlled, randomized critical trial, Prevention of Syncope Trial (POST) found it is not unreasonable to attempt therapy in older patients and to avoid using it in younger patients.
- **Fludrocortisone:** The POST2 randomized clinical trial comparing fludrocortisone with placebo showed a marginally insignificant 31% risk reduction in adults with moderately frequent symptoms which was significant in patients after a 2-week dose stabilization period.
- **Midodrine:** Five randomized trials of midodrine in adults and children showed a consistent risk reduction of about 43 % in syncope recurrence.
- **Selective Serotonin Reuptake Inhibitors:** Based on a solid biological rationale, there have been several observational studies and three small randomized trials of serotonin transport inhibitors for the prevention of VVS. Results have been mixed and there remains considerable uncertainty about the effectiveness these drugs in preventing syncope.

Management

- Syncope associated with bradycardia, tachycardia, or in the presence of structural heart conditions
 - Current guideline-directed management and therapy is recommended.

Cases

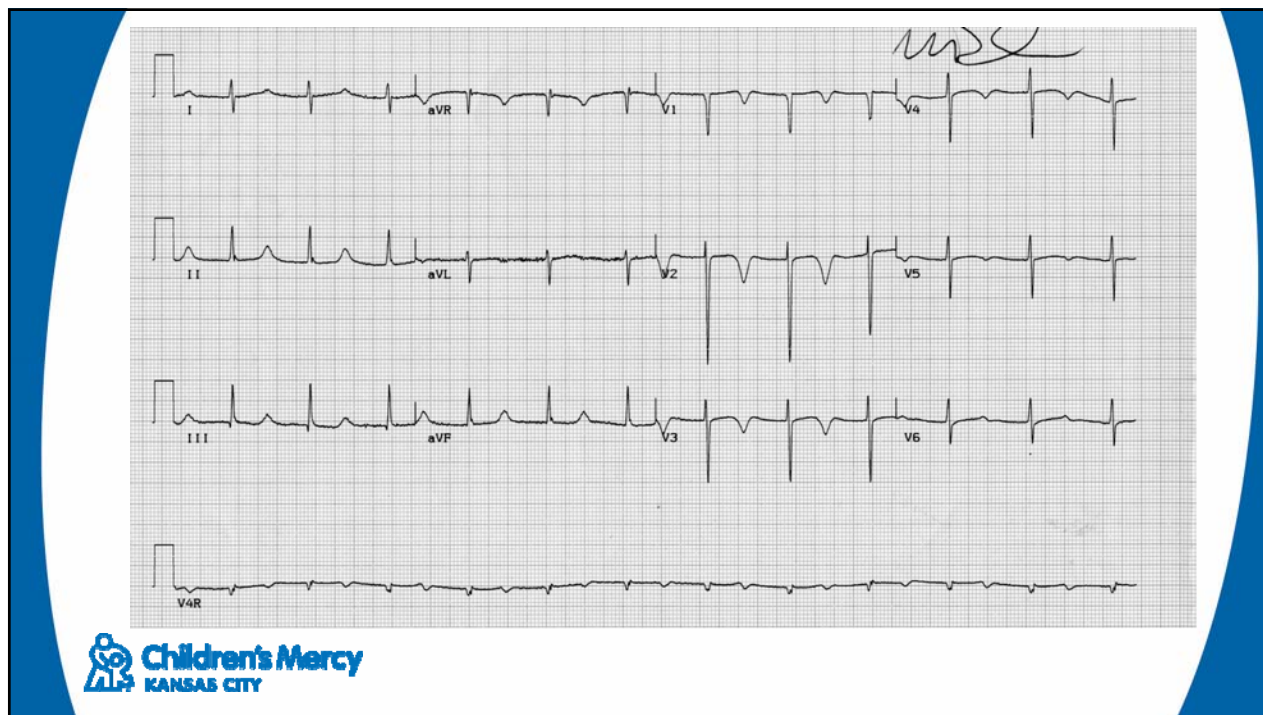


Case 1

- 14 year old male passes out while swimming in a meet at school
- He says he felt “weird before”
- PMHx/Medications- none
- Family history – unknown, adopted



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Long QT Syndrome

- Genetic testing
- Avoid medications that prolong the QTC
 - <https://crediblemeds.org>
- Beta Blocker therapy
- ICD implantation is reasonable in patients with LQTS and suspected arrhythmic syncope on beta-blocker therapy or intolerant to beta-blocker therapy
- Activity restriction

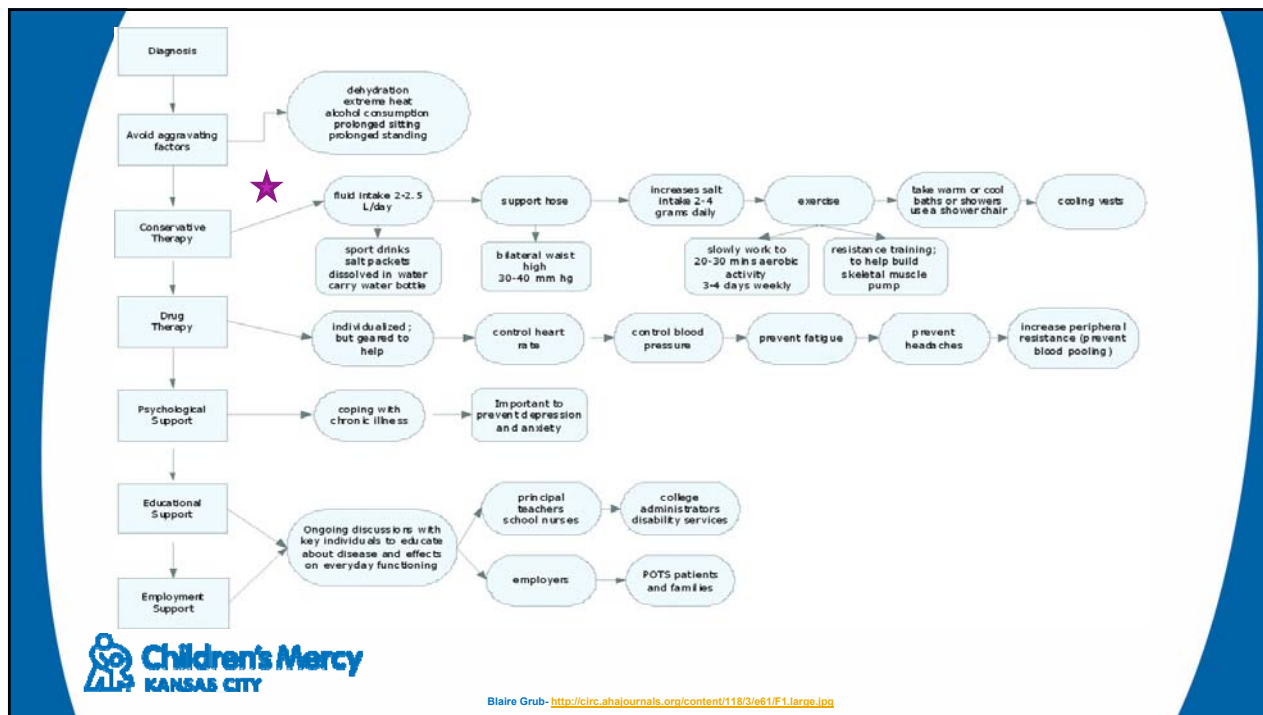
Case 2

- 17y/o male presents with syncope 10x day, now in a wheel chair in your office
- Started a month ago after “mono” like illness
- Now homebound from school

- EKG normal
- POTS vitals

**Positive

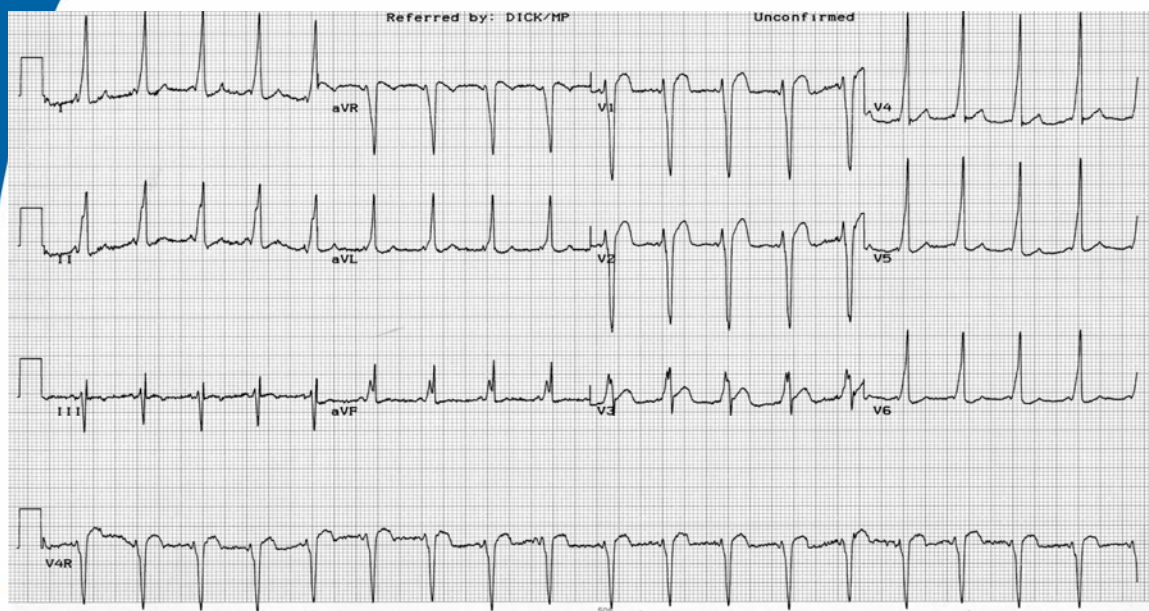
Lying 10 Minutes Systolic BP-POTS : 110
Lying 10 Minutes Diastolic BP-POTS : 52
Lying 10 Minutes HR-POTS : 73 bpm
Standing 1 Minute Systolic BP-POTS : 107
Standing 1 Minute Diastolic BP-POTS : 54
Standing 1 Minute HR-POTS : 97 bpm
Standing 2 Minutes Systolic BP-POTS : 104
Standing 2 Minutes Diastolic BP-POTS : 59
Standing 2 Minutes HR-POTS : 115 bpm
Standing 5 Minutes Systolic BP-POTS : 91
Standing 5 Minutes Diastolic BP-POTS : 48
Standing 5 Minutes HR-POTS : 131 bpm
 ** Had to stop because of symptoms , distraction during vitals prevented syncope “events”



Case 3

- 15y/o female playing basketball, feels lightheaded and dizzy, racing heart, has syncopal event
- PMHx/Meds: None
- Family History: Negative

- Orthostatic Vitals
 - Normal
- EKG



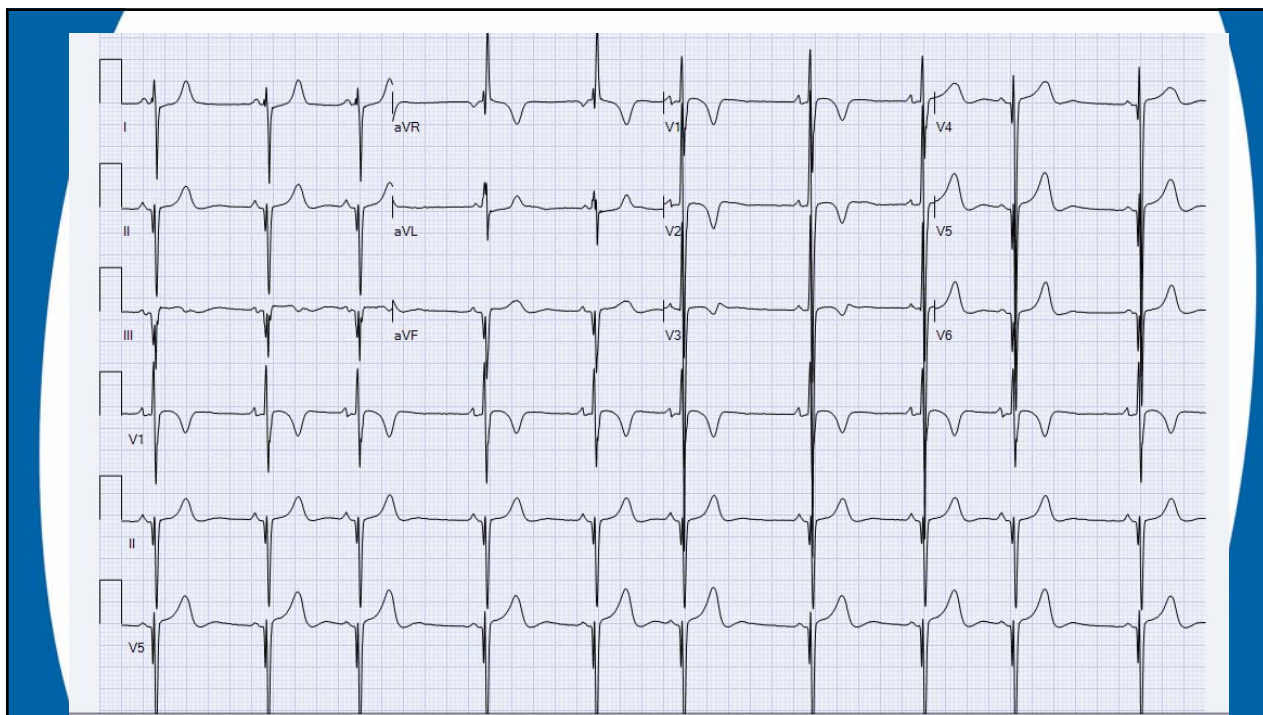
WPW Syndrome

- Short PR and delta wave on EKG
- Atrial Fibrillation with rapid conduction to ventricles -> syncope
- Three options:
 - Clinically monitor (not in this case)
 - Medications
 - Electrophysiology study with possible ablation is the therapy of choice ****

Case 4

- 10 y/o presents after syncopal event at school
- Got up from his desk and felt presyncopal, fell and hit his head, took some time to recover
- PMHx/Meds: None
- FHx: Dad died at age 35, possible HCM

- Orthostatic Vitals
 - Normal
- EKG



Hypertrophic Cardiomyopathy

- ECG is abnormal 90-95% of the time:
 - Left ventricular hypertrophy
 - ST-T changes including T-wave inversions
 - Left atrial enlargement
 - Abnormally deep Q waves
- Syncope may result from left sided obstruction, ventricular arrhythmia, other



Take Home Message

- Get a good history and perform a good physical
- EKG crucial to r/o malignant causes
- Other tests are of variable utility depending upon screening findings



Thank You!

Questions



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