Sequoia Heart Symposium 2018:
Syncope

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Disclosures

Gregory Engel, MD

Medtronic – Advisory Board (Payments)


CONGRATULATIONS! YOU'RE PREGNANT!
OH, SORRY! WRONG ROOM!

Syncope: Definition

- Abrupt and self-limited loss of consciousness associated with absence of postural tone
  - Sudden
  - Relatively rapid onset.
  - Variable warning symptoms.
  - Self-limited
  - Spontaneous, rapid and complete recovery.

- Presyncope---prodromal symptom of fainting (typically has the same work up as syncope)

Syncope: Epidemiology

- Common:
  - Annual incidence of 6%
  - 42% lifetime prevalence (assuming 70 years of age)
  - 18.1-39.7 annual episodes per 1000 patients
  - Over 500,000 new syncope patients each year
- Significant burden:
  - 3-5% of ER visits
  - 40% admitted
  - $2.4 billion annual cost

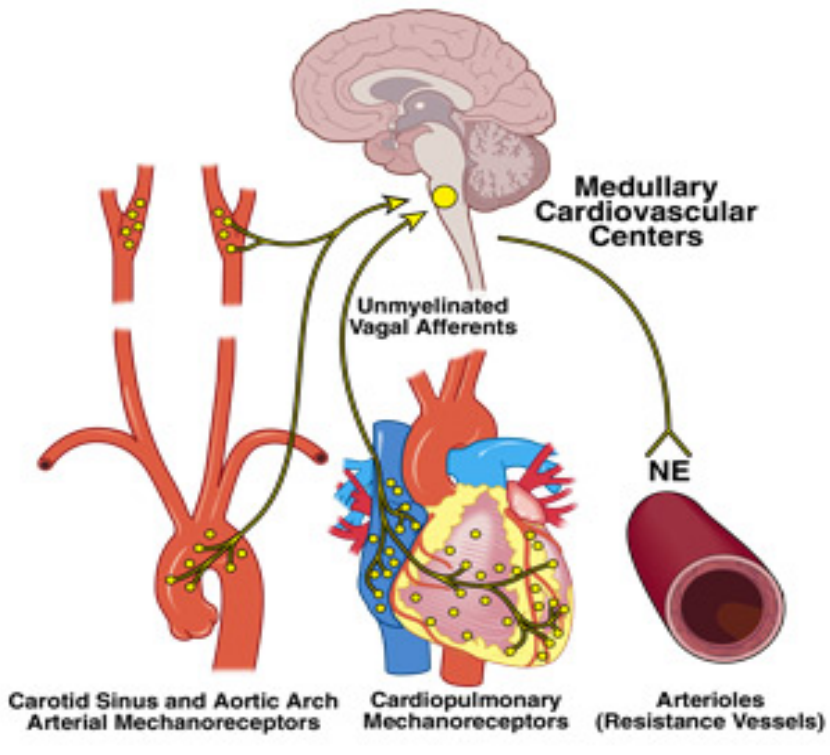
Da Silva. Frontiers in Physiology. 2014:5-471.

Syncope: Epidemiology

- Significant risk:
  - 29% physical injury
  - 4.7% major trauma
- Varies with age:
  - Age 10-30: high prevalence (mostly vasovagal)
  - Over 70: higher incidence (0.6 episodes/100 pts/yr)
  - Over 80: very high incidence (1.1 episodes/100 pts/yr)
  - Elderly:
    - Higher rate of trauma
    - Higher rate of recurrence (over 30%)

Da Silva. Frontiers in Physiology. 2014:5-471.

Syncope: Pathophysiology



- Cerebral hypoperfusion (common to almost all causes of syncope) due to
  - Decreased cardiac output

    or
  - Decreased systemic vascular resistance

Syncope: Pathophysiology

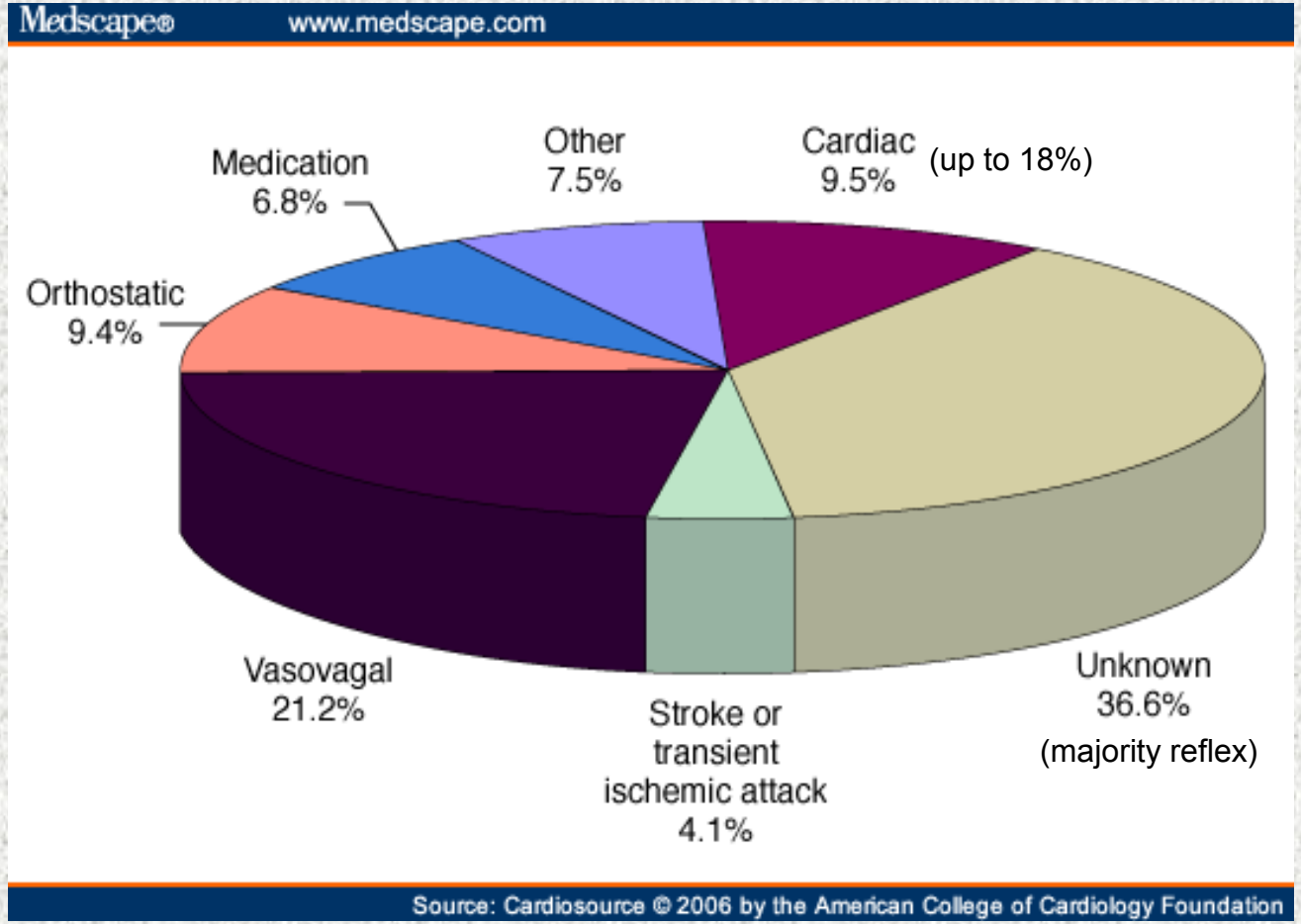
- Cessation of cerebral perfusion for as little as 3-5 seconds can result in syncope

- Modifying factors
  - Cardiac output
  - Systemic and local vascular resistance
  - Blood volume
  - Ability to compensate

Syncope: Etiology

Reflex syncope (neural mediated)	Vasovagal Situational syncope Carotid sinus hypersensitivity
Orthostatic	Autonomic dysfunction Drugs
Cardiac	Structural heart disease Arrhythmias - Brady - Tachy
Neurologic	Cerebrovascular disease Subclavian steal syndrome
Other	Endocrine causes Psychiatric disorders

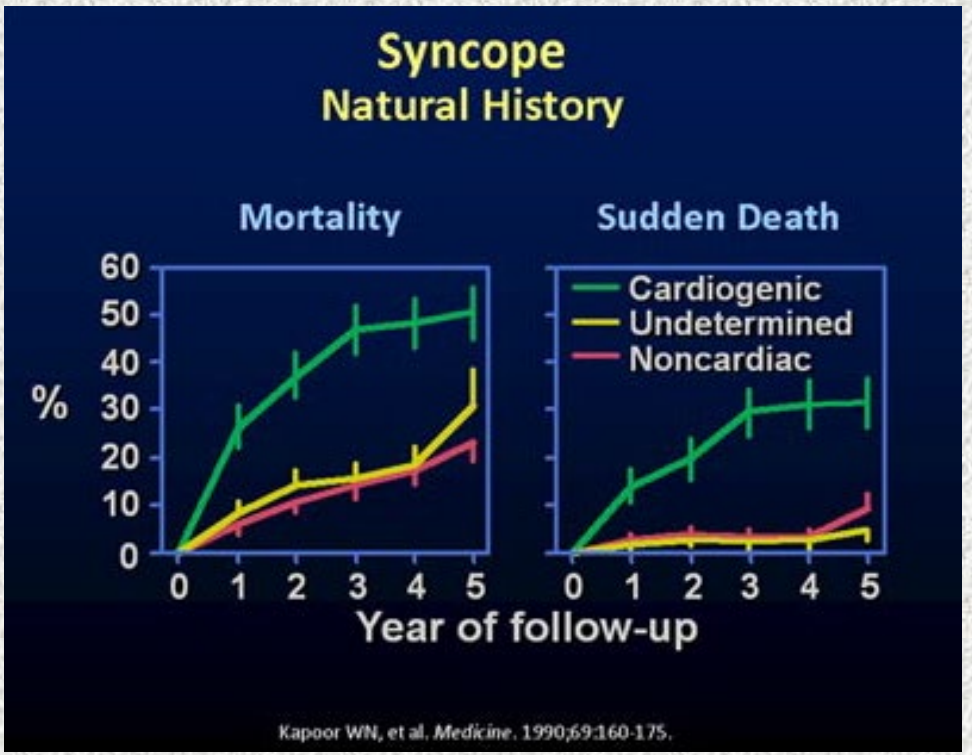
Causes of Syncope



NEJM 2000; 343:1856-62

Syncope: Morbidity and Mortality

- Most cases benign.
- Cardiac origin has the highest morbidity and mortality:
  - 1 year mortality of 18-33%
- Unknown origin:
  - 1 year mortality of 6-12%.



- If normal ECG and no heart disease, mortality reduced to 3%.

Kapoor W. *Medicine* 1990;69:160-175. Kapoor 2002. Unger et al. 2010

The Significance of Syncope

The only difference between syncope and sudden death is that in one you wake up.

WHEN A PERSON COLLAPSES but quickly recovers, it is called fainting or syncope. When he dies within the next few minutes, it is called sudden or instantaneous death.

Engel, George L. *Ann Intern Med* 1978; 89: 403-412.

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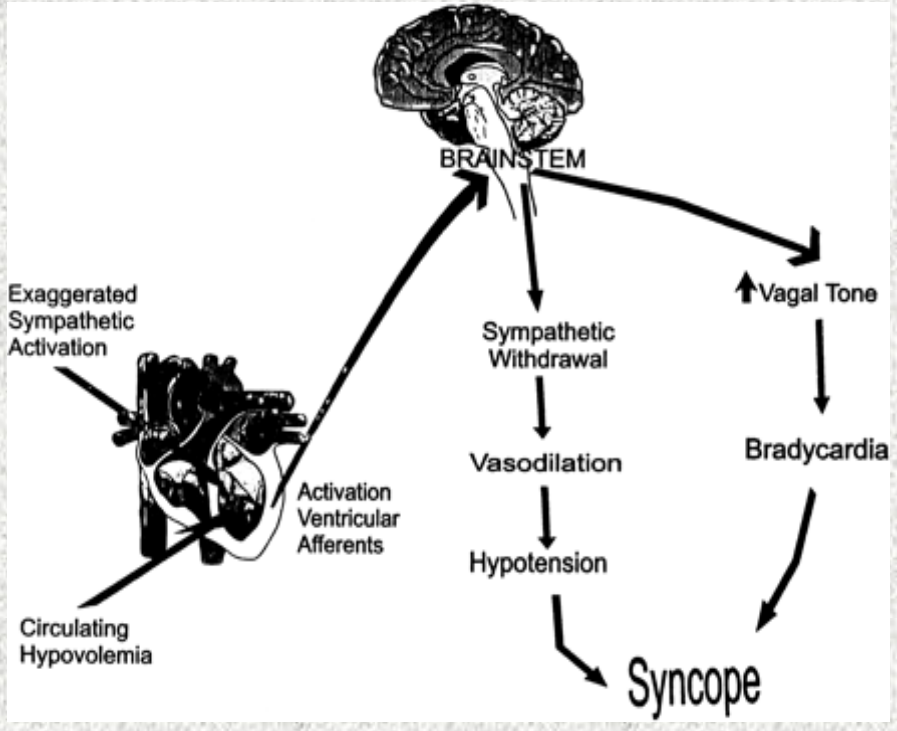
Vasovagal Syncope

- Most common cause of syncope in young adults (prevalence ~ 8-18%)
- Age range: teens to elderly; mean 43 years
- Amnesia for warning symptoms in older patients
- Precipitating event is often identifiable
  - Stress, trauma, pain, sight of blood, prolonged standing, heat exposure

Vasovagal Syncope: Mechanism

- Abnormal autonomic reflex
- Normal increased sympathetic tone replaced by increased vagal tone
- Variable contribution of vasodilation and bradycardia.



Vasovagal Syncope: Mechanism

3 PHASES:

- -1-Prodrome (~1-2 min)
    - Diaphoresis, nausea, epigastric discomfort, weakness, dizziness, palpitations
- -2-Loss of consciousness (~5-20 sec)
- -3-Postsyncopal phase
    - Nausea, dizziness, general sense of poor health
    - If present, confusion which lasts no more than 30 seconds

Vasovagal Syncope: Management

- Optimal management - debated
  - Patient education, reassurance
  - Fluids: sports drinks, salt
  - Tilt training
  - Support hose
- Medications . . .
- Pacing . . .

Vasovagal Syncope: Medications

Limited studies for all

- Beta-adrenergic blockers
  - Use if history of hypertension
- SSRIs
  - Use if history of depression
- Mineralocorticoid: fludrocortisone
- Vasoconstrictors: midodrine
  - Use midodrine if significant hypotension

Pacing for Vasovagal Syncope

Pacing:

- Studies with some positive results and others not statistically significant
- Dual chamber pacer with rate drop response reduced likelihood of syncope
- Pacing superior to beta blocker for recurrent, refractory, highly symptomatic patients

Connolly S, et al. *J Am Coll Cardiol* 1999; 33: 16-20.

Sutton, R, et al. *Circulation*. 2000; 102:294-299.

Ammirati, et al. *Circulation*. 2001; 104:52-57.

Kenny RA, *J Am Coll Cardiol 2001*; 38:1491-1496.

Pacing for Vasovagal Syncope

- Pacemaker
  - Class I Indication:
    - None
  - Class IIa Indication:
    - Syncope without clear provocative events and a cardioinhibitory response greater than 3 seconds
  - Class IIb Indication:
    - Significantly symptomatic neurocardiogenic syncope associated with documented bradycardia (tilt table testing)

Situational Syncope

- “Situational:”
  - Coughing
  - Micturition
  - Defecation
  - Swallowing
- Circumstances are diagnostic
- Induced by baroreceptor and mechanoreceptors causing vagal stimulation

Carotid Sinus Syncope

- Syncope related to head turning, shaving, wearing a tight collar
- Pathophysiology
  - Carotid sinus pressure causes a reflex decrease in heart rate and blood pressure
- Carotid sinus massage:
  - Rarely done
  - 1/5000 massages complicated by TIA
  - Avoid if carotid bruit, known carotid disease, recent CVA/TIA

Pacing for Carotid Sinus Syncope

- Pacemaker
  - Class I Indication:
    - Recurrent syncope caused by carotid sinus stimulation that induces asystole greater than 3 seconds

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Orthostatic Syncope

- Normal: Gravity causes blood to pool when standing – increased sympathetic tone counteracts this.
- Abnormal: Inadequate sympathetic response

- Orthostatic blood pressure:
  - Drop in BP: 20 systolic or 10 diastolic within 3 minutes of standing
  - Present in 40% of patients over 70 years old

Orthostatic Hypotension: Etiology

- Volume loss
  - Assoc. with tachycardia
- Medications
  - Common in elderly patients
  - Diuretics, vasodilators
- Adrenal insufficiency
- Primary autonomic disease
  - Idiopathic
  - Parkinsons disease
  - Multisystem atrophy (Shy-Dragger)
- Secondary autonomic disease
  - Neuropathic (diabetes, amyloid, alcohol)
  - CNS (CVA, multiple sclerosis, tumors, spinal cord)

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Cardiac Syncope

- Types:
  - Structural
  - Arrhythmia
- Inadequate cardiac output for demand
- Might mortality especially in the elderly

Syncope: Cardiac

- Structural:
  - Aortic Stenosis
  - Mitral stenosis
  - Hypertrophic cardiomyopathy
  - Anomalous origin of left coronary artery
  - Myocarditis
  - Atrial myoxomas
  - Cardiac tamponade
  - Aortic dissection
- Other:
  - Long QT syndrome
  - WPW

Syncope: Cardiac Arrhythmias

- Bradyarrhythmias
  - Sinus arrest, exit block
  - High grade or acute complete AV block
- Tachyarrhythmias
  - Atrial fibrillation / flutter with rapid ventricular rate
  - Paroxysmal SVT or VT
  - WPW (with supraventricular arrhythmia)
  - Torsades de pointes

QT Prolongation: Drug Induced

- Antiarrhythmics
  - *Class IA ...*Quinidine, Procainamide, Disopyramide
  - *Class III…*Sotalol, Ibutilide, Dofetilide, Amiodarone
- Psychoactive Agents
  - Phenothiazines, Amitriptyline, Imipramine, Ziprasidone
- Antibiotics
  - Erythromycin, Pentamidine, Fluconazole
- Nonsedating antihistamines
  - (Terfenadine), Astemizole
- Others
  - (Cisapride), Droperidol

Treatment of Syncope Due to Bradyarrhythmia

- Pacemaker
  - Class I Indication:
    - Symptomatic bradycardia or sinus pauses
    - Symptomatic high grade AV block
  - Class IIa Indication:
    - Unexplained syncope with significant sinus node dysfunction
    - Unexplained syncope with bifascicular block

Treatment of Syncope Due to Tachyarrhythmia

- Atrial Tachyarrhythmias;
  - Ablation
  - Medications
  - Medications + medications (tachy-brady)

- Ventricular Tachyarrhythmias;
  - Ventricular tachycardia
    - ICD
    - +/- Ablation
  - Torsades de Pointes
    - Withdraw offending drug
    - ICD (long-QT/Brugada)

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Neurologic Syncope

- “Drop attacks”
  - Rare cause of syncope
  - Due to vertebrobasilar insufficiency – TIA of basilar migraine
  - Usually have vertigo, ataxia, dysarthia, diplopia
- Other:
  - Subclavian steal – occurs with arm movement

Syncope: Seizures

- More likely:
  - Confusion after
  - Amnesia
  - Unusual posture or limb movement
  - Déjà vu or jamais vu
  - Tongue cut ++
- Less likely:
  - Lightheaded
  - Sweating before
  - Associated with prolonged standing or sitting

Syncope: Etiology

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Syncope: Other etiologies

- TRANSIENT
  - TIA (vertebrobasilar)/ CVA
  - Subdural hematoma
  - Subarachnoid hemorrhage
  - CNS mass effect (tumor)
  - Basilar artery migraine
  - Hypoglycemia

Syncope: Other etiologies

- PULMONARY
  - Pulmonary embolism
  - Acute hypoxemia
  - Pulmonary HTN
  - COPD exacerbation
  - CO poisoning

Syncope: Other etiologies

- UNUSUAL CAUSES
  - Anxiety, Panic disorder
  - Major depressive disorder
  - Hyperventilation syndrome
  - Migraine
  - Sleep disorder
  - Somatization disorder (psychogenic syncope)

Evaluation of Syncope

Syncope: Initial Evaluation

- History
- Orthostatic vital signs
- Routine blood work
  - Hemoglobin, Glucose, Metabolic Panel, UA
- ECG

Clues to the Etiology of Syncope

- Abrupt onset -- cardiac syncope
- With exertion -- aortic stenosis, hypertrophic cardiomyopathy, arrhythmias
- Blood pressure/pulse differential -- aortic dissection, subclavian steal syndrome
- Post-syncopal disorientation; incontinence -- seizure

Clues to the Etiology of Syncope

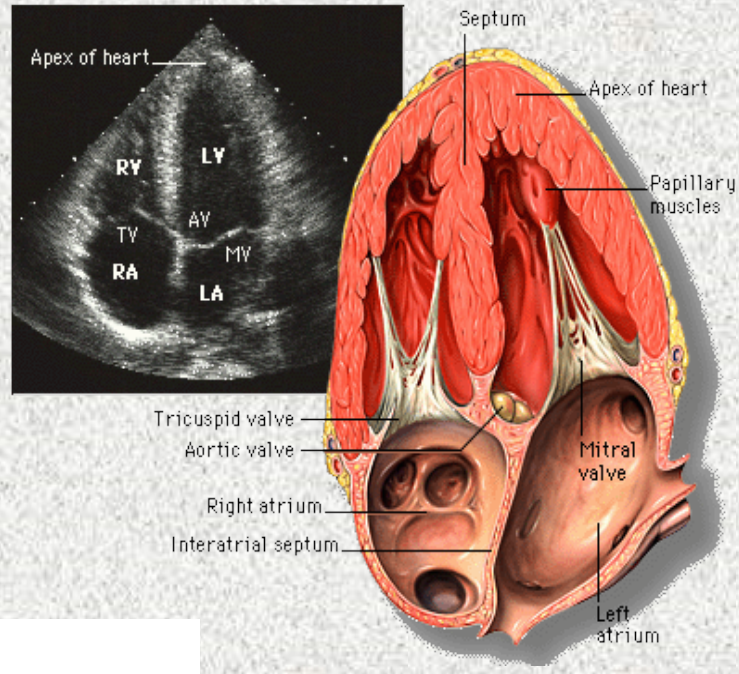
- Cough, micturition, defecation, swallowing -- situational syncope
- Syncope with shaving -- carotid sinus syncope
- Syncope with change of position – orthostatic
- Nausea, diaphoresis (prodromal) -- neurally mediated reflex (vasovagal)

Syncope: ECG

- ~50% of syncope patients with abnormal ECG
  - Identifies probable cause in 5%
  - Useful in directing further evaluation:
    - Heart block, bundle branch block
    - Q-waves
    - Long QT
    - WPW
- Normal ECG with normal H&P indicates extremely low risk for sudden death.

Evaluation of Syncope

- Echo



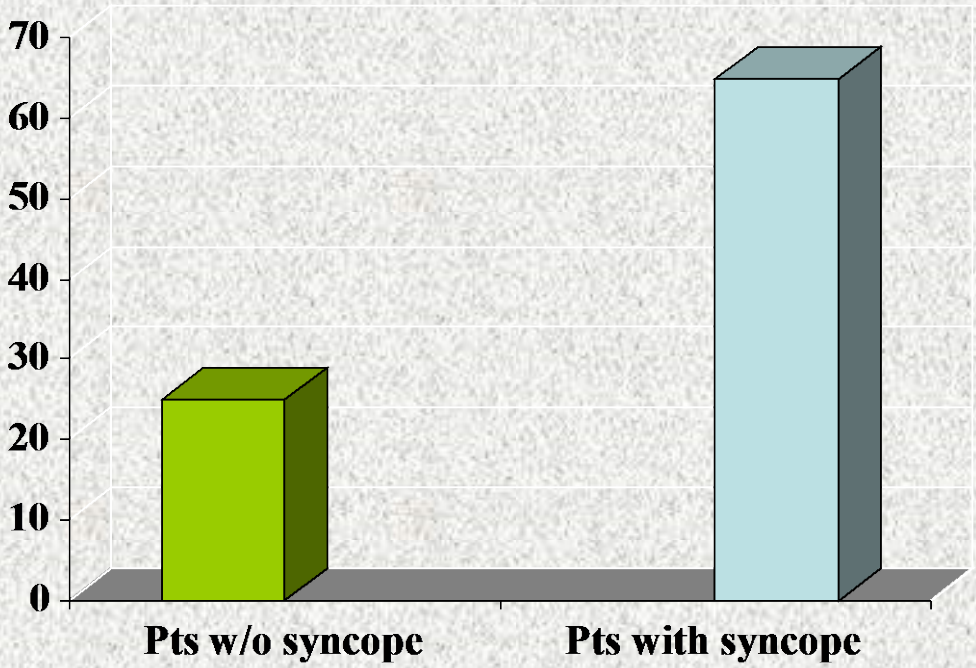
- Stress test

Predictive value of LVEF

- Risk for sudden death is dependent mostly on LV ejection fraction

Prognostic value of syncope in patients with CHF

Mortality at one year



- Prognostic value similar regardless of cardiac vs noncardiac etiology

Middlkauf et al;JACC,1993

Evaluation of Syncope

- EP Study
- Tilt table test

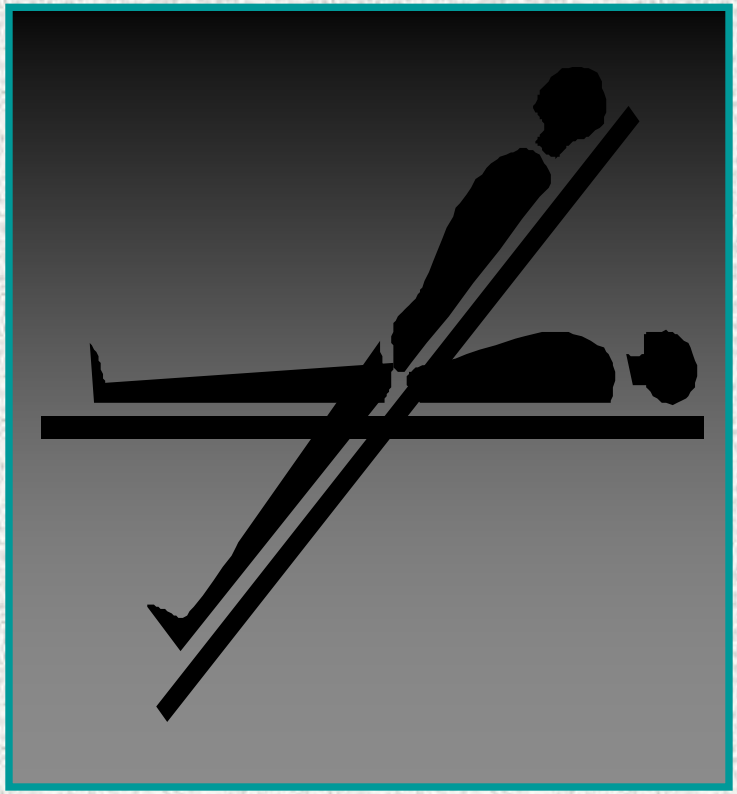
Conventional EP Testing in Syncope

- Limited utility in syncope evaluation
- More useful in patients with structural heart disease
  - Heart disease……..50-80%
  - No Heart disease…18-50%
- Relatively ineffective for assessing bradyarrhythmias

Brignole et al. Eur Heart Journal 2001; 22: 1256.

Head-up Tilt Test (HUT)

- Possibly unmasks VVS susceptibility
- Reproduces symptoms



ISSUE Study

International Study of Syncope of Uncertain Etiology

- Objectives:
  - Understand the mechanism of syncope in tilt-positive and tilt-negative (isolated) patients
  - All patients receive an implantable loop recorder (ILR)
- Inclusion Criteria:
  - Patients with three or more syncopal episodes in the last 2 years

Moya A. *Circulation.* 2001; 104:1261-1267

ISSUE Study Results

Results	Tilt-Negative Syncope (Isolated) n=82	Tilt-Positive Syncope n=29
Recurrent Event Occurrence (#)	34% (28)	34% (10)
Mean Time to Recurrent Event (range)	105 days (47-226)	59 (22-98)
ILR ECG Documented (#)	29% (24)	28% (8)
–**Tachyarrhythmia**	2% (2)	
–**Bradycardia**	16% (13)	21% (6)
–Sinus Brady	2% (2)	3% (1)
–Sinus Arrest	12% (10)	17% (5)
–AV Block	1% (1)	
Total Arrhythmic	18% (15)	21% (6)
Normal Sinus Rhythm	11% (9)	7% (2)

Moya A. *Circulation.* 2001; 104:1261-1267

ISSUE Study

- Conclusions:
  - Homogeneous findings from tilt-negative and tilt-positive syncope patients were observed (clinical characteristics and outcomes).
  - Most frequent finding was asystole secondary to progressive sinus bradycardia, suggesting a neuromediated origin
  - Tilt-negative patients had as many arrhythmias (18%) as tilt-positive patients (21%)
  - HUT outcome was not predictive of vasodepressor vs. cardioinhibitory response

Moya A. *Circulation.* 2001; 104:1261-1267

Evaluation of Syncope

- Holter

- Event recorder

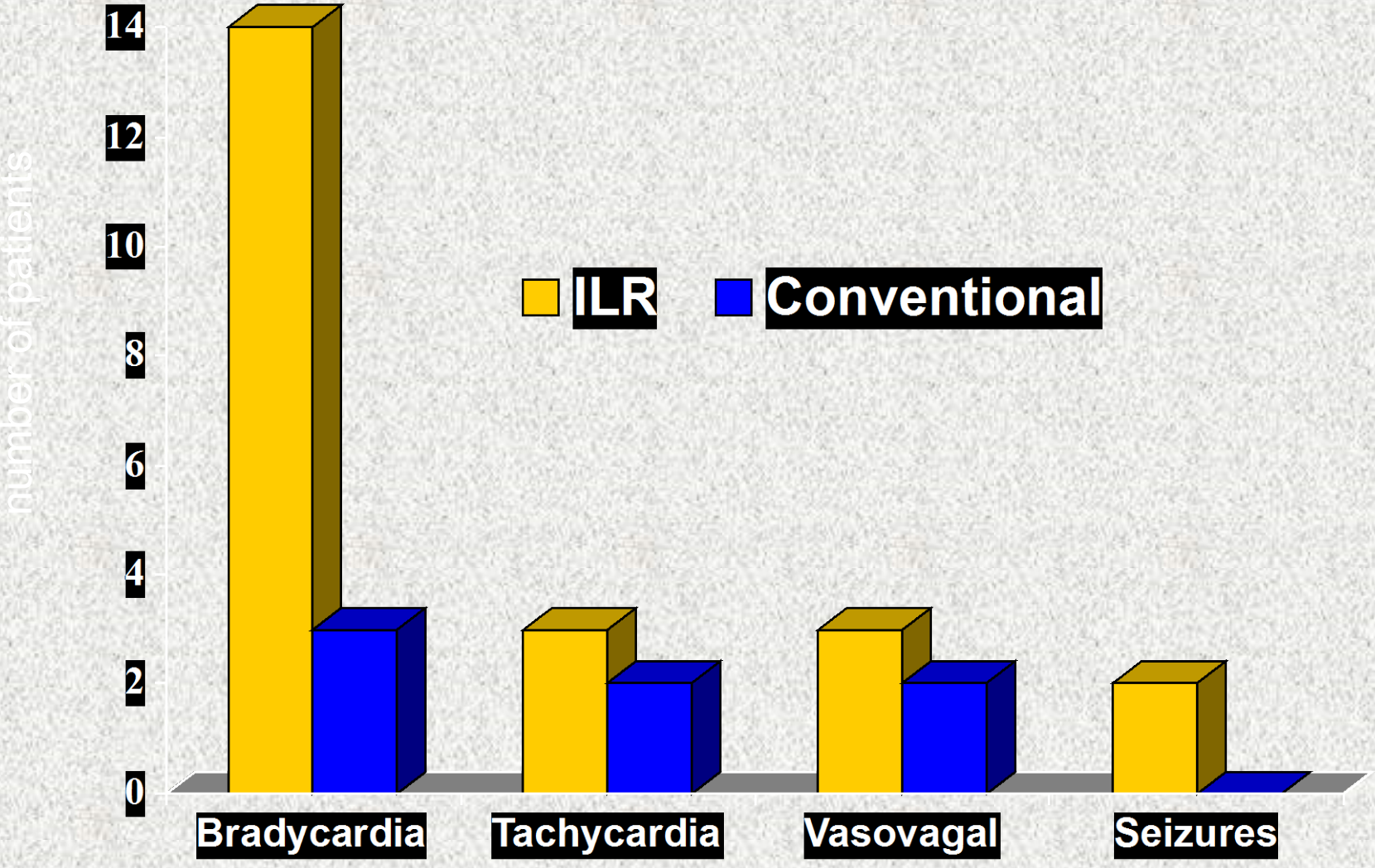
- Extended Holter (patch monitor)

Evaluation of Syncope

- Implantable loop recorders

RAST

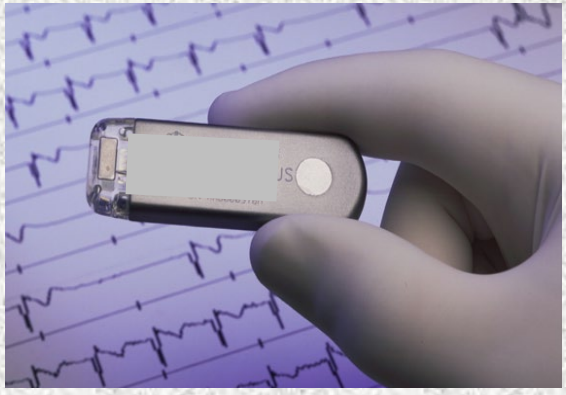
Randomized Trial for Unexplained Syncope



Krahn A, Klein GJ, Skanes Y. *Circulation* 2001; 104:46-51.

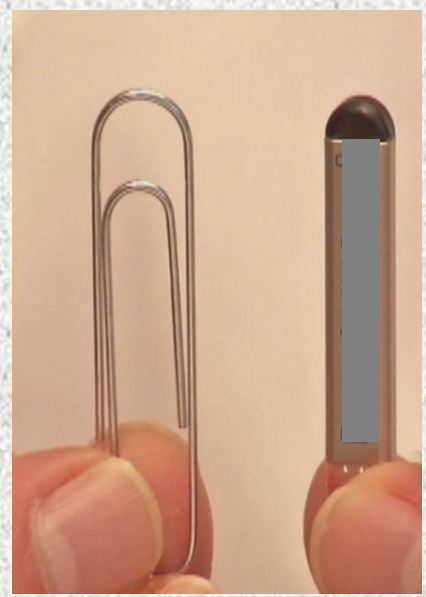
Implantable Loop Recorders

Then:



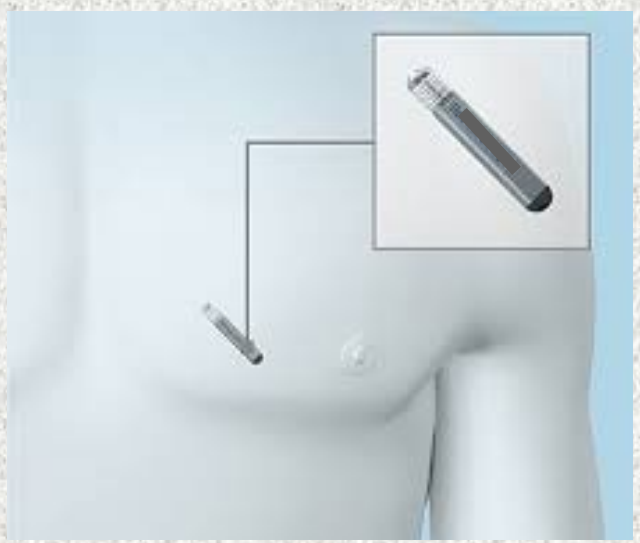
Now:

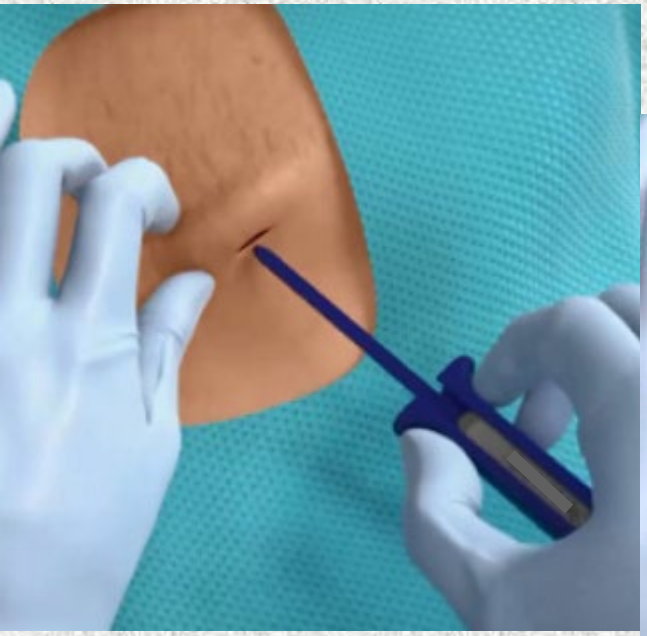
- Reveal LINQ
- Wireless remote monitoring
- 3 year battery life
- MRI safe
- 44.8 mm x 7.2 mm x 4.0 mm



Medtronic Reveal LINQ Insertable Cardiac Monitoring System Product Specifications

Implant






Wireless
Cellular

Syncope: Summary

- Vasovagal most common
- Cardiac origin is highest risk
- Initial work-up:
  - History is key
  - Labs, vitals
- Cardiac work-up:
  - ECG
  - Echo
  - Monitoring

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