Clinical evaluation of the patient with syncope (or pre-syncope)

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Definition

- Sudden loss of consciousness
- Loss of postural tone
- Rapid complete recovery

Differentiate from Sudden Cardiac Death:
- Resuscitation
- Cardioversion

Same work-up as pre-syncope
Epidemiology

- About 3% of Framingham population had it in 26Y FU
- About 70% of the population have it in a life time
- Of patients visiting ER with syncope: (Alboni et al JACC 2001;37:1921)
  - Cardiac (often arrhythmia) 23%
  - Neurally mediated 58%
  - Neuro-psychiatric 1%
  - Unexplained 18%
- Of patients with cardiac syncope, 24% subsequently develop Sudden Death (Kapoor, Medicine (Baltimore) 1990;69:160)
Approach

- Accurate diagnosis of etiology is possible from history, examination, basic lab & ECG in 2/3 of patients.

- Of those who require detailed work-up:
  - Clinically targeted: Dx. Reached by work-up in 73%
  - Not targeted: Dx. Reached by work-up in 25%
    - (Sarasin et al Am J Med 2001;111:177)

- Work-up depends on duration of symptoms, frequency of attacks, known pre-existing disease, and age of the patient.
Common causes of syncope

**Cardiovascular disease**

- **Arrhythmic causes**
  - AV block with bradycardia (structural changes, drugs)
  - Sinus pauses/bradycardia (vagal causes, sick sinus syndrome, negative chronotropic drugs such as beta blockers and calcium channel blockers)
  - Ventricular tachycardia due to structural heart disease
- **Nonarrhythmic causes**
  - Hypertrophic cardiomyopathy
  - Aortic stenosis
Noncardiovascular

Reflex mechanisms
  Vasovagal and vasodepressor syncope (neurocardiogenic syncope)
  Micturition
  Deglutition
  Cough
Orthostatic hypotension
  Dysautonomias
  Fluid depletion
  Illness, bedrest, deconditioning
  Drugs – antidepressants, sympathetic blockers
Psychogenic
  Hysterical
  Panic disorder
  Anxiety disorder
Undiagnosed seizures
Improperly diagnosed syncope – confusional states, eg, due to hypoglycemia, stroke
Drug-induced loss of consciousness (consider alcohol, illicit drugs)
Uncommon causes of syncope

Cardiovascular disease

Arrhythmic causes
- Supraventricular tachycardia
- Long QT interval syndrome
- Idiopathic ventricular tachycardia
- Myocardial infarction causing bradycardias and tachycardias
- Right ventricular dysplasia

Nonarrhythmic causes
- Pulmonary embolus
- Pulmonary hypertension
- Dissecting aortic aneurysm
- Subclavian steal
- Atrial myxoma
- Cardiac tamponade
Noncardiovascular disease

Reflexes
  Defecation
  Glossopharyngeal
  Postprandial
  Carotid sinus hypersensitivity

Hyperventilation
Migraine
Carcinoid syndrome
Systemic mastocytosis
Metabolic
  Hypoglycemia
  Hypoxia
Multivessel obstructive cerebrovascular disease
The history

- Age
- Number of episodes
- Associated symptoms
- Prodrome
- Warning
- Preceding events
- Body position
- Duration of episode
- Recovery
- Witness
- Exertional syncope
- Pre-existing conditions
- Injury
- Medications
- Recreational drugs
- R/O seizure or vertigo
- **AGE:**
  - Young: NCS, Functional, HOCM, Long QT.
  - Old:
    - Do not diagnose functional
    - Keep NCS to the end
    - SHD & CNS dis. Common
    - Carotid sinus syncope
    - Orthostatic hypotension
- **PRECEDING EVENTS:**
  - Prodrome: NCS
  - Aura: Seizure
  - Nothing: Arrhythmia
  - Situational:
    - Micturition
    - Deglutition
    - Neck compression
    - ETC
- **FREQUENCY:**
  - Seriousness
  - Probability of recurrence
  - Need for hospitalization
- **BODY POSITION**
  - During standing: NCS
  - At standing: Orthostatic HT
  - Supine: Arrhythmia
  - Exertional
    - Obstructive cardiac
    - VT
    - HCM
    - NCS
**ASSOCIATED SYMPTOMS**
- Dyspnea: PE, Hemorrhage
- Angina: SHD
- Neurologic: CNS
- Nausea: NCS
- Incontinence: Seizures

**WITNESS:**
- Confirm loss of consciousness
- Pale or suffused?
- Tonic, clonic, or flaccid?
- Count pulse?

**DURATION:**
- Long: Seizures AS
- Brief: NCS Arrhythmia

**INJURIES:**
- PRESENCE
- LOCATION
  - HEAD
  - TONGUE BITES
  - TRUNCK
  - LIMBS

**SLOW RECOVERY:**
- Seizures
- NCS
Syncope versus Seizure: A continuing source of error

- CUT TONGUE 2
- CONFUSION AFTER 1
- LIMB JERKING 1
- PRODROMAL DÉJÀ VU 1
- HEAD TURNING 1
- LIGHT HEADEDNESS -2
- ON LONG STANDING -2
- PRECEDING SWEATING -2

SCORE > 1: SEIZURE
SCORE < 1: SYNCOPE

Sheldon et al. JACC 2002;40:142
Examination

- Pallor:
  - Anxiety-type
  - Heart-type
  - Anemia-type

- Disturbed vital signs:
  - Postural BP drop
  - Rhythm disturbances
  - Hyperventilation: functional, or pulmonary embolism

- Cardiomegaly

- Cardiac auscultation: AS. PS. PHT. MYXOMA.

- Vaso-active maneuvers

- Neurologic findings: Lateralization

- Carotid sinus massage:

  • TECHNIQUE
  • INTERPRETATION
  • COMPLICATIONS
The ECG

- Stigma of Brady-arrhythmia:
  - 2nd. & 3rd degree AV block
  - First degree AV block in certain situations
  - Tri-fasicular block
  - RBBB+LPHB

- Stigma of Tachy-arrhythmia
  - Long QT
  - Rare: ARVD, Brugada, ….

- No proof of causal relationship
- Commonly Normal
BRUGADA SYNDROME
Ambulatory ECG

- Commonly performed, commonly useless.
- Limitations:
  - Symptoms
  - Artifacts

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Arrhythmia</th>
<th>Diagnostic</th>
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<tbody>
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<td>Diagnostic</td>
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<tr>
<td>No symptoms</td>
<td>Arrhythmia</td>
<td>Variable</td>
</tr>
<tr>
<td>No symptoms</td>
<td>No arrhythmia</td>
<td>No value</td>
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</tbody>
</table>
When is arrhythmia significant even without symptoms?

- **Tachy-arrhythmia:**
  - Any VT
  - Rapid SVT
  - AF

- **Brady-arrhythmia:**
  - Pause ≥ 4 sec.
  - Mobitz II
  - High-grade & 3rd degree AV block
  - Sinus bradycardia < 30 bpm unless during sleep.
  - Some Wenckebach cycles.

**ASYMPTOMATIC WENCKBACH ON HOLTER**
- Night vs Day, Athlete, Vagotonia.
- Sinus Bradycardia vs Sinus Tachycardia
- Long cycles vs. Short cycles
- Narrow QRS vs. Wide QRS
V T? Think again

BASELINE SHIFT
KNOWN MUSCLE ACTIVITY
TRACABLE QRS COMPLEX
NO PRECEDING ECTOPY
Event recorders

- Require patient activity
- Most use TTT
- No much added diagnostic value in syncope, mainly in palpitation.
Implantable loop recorder (ILR)

- Up to 2 years of recording.
- Activated by Algorithm or Manual
- Diagnostic yield: Of 206 yet-unexplained pts:
  - Symptom recurrence 69%
  - Brady-arrhythmia 17%
  - Tachy-arrhythmia 6%
  - Neurally mediated 11%
  - No diagnosis 31%

  Krahn et al. Pacing Clin Electrophysiol 2002;25:37

- Efficacy (compared to EPS): Of 60 pts (66 y) randomized to ILR or EPS:
  - Diagnosed by ILR 55%
  - Diagnosed by EPS 19%

  Krahn et al. Circulation 2001;104:46
Cardiac testing

STANDARD
Echocardiography: SHD
Exercise testing:
  CAD
  Exercise-induced arrhythmia
  QT does not shorten
  Post-exercise bradycardia
  Exercise-induced NCS

ADVANCED
SAEGK: Predicts inducible SMVT
  With SHD, Sensitivity 80%, specificity 90%
  More powerful with EF < 40%
  Not useful in:
    NSVT without SHD
    IVCD

Kuchar et al. Am J Cardiol 1986;58:949

EPS: SHD + ? Etiology

ACC/AHA/NASPE Guidelines.
JACC 1995;26:555
Neurologic testing

- EEG (Hyperventilation, Sleep-deprived, Nasopharyngeal)
- Brain CT / MRI
- Carotid Duplex

Some test is done in over half pts with syncope
Rarely useful, except in very well-selected cases

Pires et al. Arch Int Med 2001;161:1889
Head-up tilt

Young pts. No SHD

Relevant issues:

- Type of response
- Sensitivity-specificity in different populations
- Tilt degree and time
- Use and type of provocation
- Reproducibility

Oribe et al. Pacing Clin Electrophysiol 1997; 20:874

Efficacy compared to ATP infusion

Flammang et al. Circulation 1999;99:2427
A  Classic neurocardiogenic (vasovagal) response

B  Dysautonomic response

C  POTS response

**Legend:**
- **Heart rate**
- **Blood pressure**
Approach to Recent Onset Syncope with Fewer Than Three Episodes

- Initial history (patient, observers)
  - Events prior to syncope, prodrome?
  - Condition following syncope
  - Past medical history (cardiac, neurologic)
  - Medications

- Orthostatic vital sign change? → Volume resuscitation
  - Abnormal cardiac exam? → Echocardiogram
  - Focal neurologic findings? → Head CT
  - Vasovagal prodrome? → Tilt table test (TTT)

- Continuous telemetry during initial evaluation

- ECG-conduction abnormalities, previous MI, acute ischemic changes?

- Laboratory results - H/H, glucose, toxicology
Significant abnormalities, serious injury, and/or age >40 years?

Yes → Admission for further evaluation
  Telemetry monitoring

No → Outpatient evaluation

Probable cause identified?

Yes → Appropriate therapy

No → Neurologic abnormality?

Yes → Neurology consult
  Head CT

No → Cardiac disease?

Yes → Cardiac consult
  Holter recording
  Echocardiogram
  EPS

No → Structural heart disease?

Yes → Cardiac consult
  EPS, Holter recording

No → Evaluation of LVEF
<6M duration

Probable cause identified by initial history, physical, and ECG evaluation

Yes

Appropriate therapy

No

Structural heart disease, abnormal ECG (conduction abnormalities, arrhythmias, or evidence for previous MI) or serious injury resulting from syncope

Yes

Hospitalization

No

Outpatient evaluation

EP consultation
Probable EPS

Yes

Etiology identified

ICD, pacemaker, or other appropriate therapy

No

Tilt table testing (TTT)

No

Consider repeat TTT

Reoccurrence

Yes

Event monitor

+
Probable cause not identified by initial history, physical, and ECG evaluation

Tilt table test

- Appropriate therapy
- Outpatient EP evaluation

- Structural heart disease, abnormal ECG, or serious injury occurring?

- Recurrence?

- Event recorder
- Appropriate therapy

>6M duration
COST-EFFECTIVENESS OF DIAGNOSTIC PROCEDURES

<table>
<thead>
<tr>
<th>Test</th>
<th>Cost (LE)</th>
<th>Dx. Yield %*</th>
<th>Cost per Dx. (LE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hx. Ex. ECG</td>
<td>100</td>
<td>50%</td>
<td>50</td>
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<tr>
<td>External loop recorder</td>
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<td>38%</td>
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<tr>
<td>Holter (24H)</td>
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<tr>
<td>HUT</td>
<td>300</td>
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<tr>
<td>Implanted LR</td>
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<td>88%</td>
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<tr>
<td>EPS (SHD)</td>
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<td>Echo (Hx.Ex. -ve)</td>
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<td>6,667</td>
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<tr>
<td>EPS (No SHD)</td>
<td>3,000</td>
<td>5%</td>
<td>60,000</td>
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