SYNCOPE
When to Worry

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Syncope

"same as sudden death except that you wake up”

- Transient, abrupt, loss of consciousness, with rapid, usually complete, recovery, with or without a prodrome, caused by cerebral hypoperfusion

- A common, non-specific, alarming, debilitating, symptom with diverse causes and the key in making the diagnosis is in the History and Physical

- Dilemma: Avoid over-testing yet avoid under-diagnosing life-threatening causes

SYNCOPE – Background

• Syncope is common in the general population
• Syncope accounts for 3-5% of Emergency Department (ED) visits and 1-3% of all hospital admissions
• Cardiac syncope doubled the risk of death from any cause

Syncope
Impact on the Medical Community

- Incidence: 500,000/year
- >1,000,000 evaluated annually
- 10% of falls due to syncope
- 10.2 visits/year, 3.2 specialists
- 20-50% of adults experience syncope at least once in a lifetime

Krahn AD Am Heart Journal 1999;137:870
Linzer, J Gen Int Med, 1994;9:181-6
Incidence of Syncope

**SYNCOPE**

**INCIDENCE/AGE**

*Figure 5* Schematic presentation of the distribution of age and cumulative incidence of first episode of syncope in the general population from subjects up to 80 years is shown. The data from subjects 5–60 years come from a study by Ganzeboom et al. The data from subjects < 5 years are based on those of Lombroso et al. and those from subjects aged 60–80 years on the study by Soteriades et al.
Syncope: Etiology

Neurally-Mediated
- Vasovagal
- Carotid Sinus
- Situational
  - Cough
  - Post-micturition
  - Defaecation

66%

Orthostatic
- Drug Induced
- Volume Depletion
- ANS Failure
  - Primary
  - Secondary

10%

Cardiac Arrhythmia
- Brady
  - Sick sinus
  - AV block
- Tachy
  - VT
  - SVT
- Inherited

11%

Structural Cardio-Pulmonary
- Aortic Stenosis
- HOCM
- Pulmonary Hypertension

5%

Non-Syncopal
- Psychogenic
- Metabolic
- Epilepsy
- Intoxications
- TIA
- Falls

6%

Unknown Cause = 2%

Brigole et al. Heart 2007;93:130-136
Syncope: Economic Burden

- Per recent data, the overall cost per hospital admission was estimated to be about $10,600.
- One study found $17,000 of “unnecessary” testing to diagnosis vasovagal syncope.
- Overall cost in US estimated to be in excess of $1 billion.

Costs of Test

- Troponin $156
- EKG $274
- Telemetry $2,325/d
- Head CT $1901
- MRI brain $3947
- Carotid US $1294
- EST $1156
- Echocardiogram $1835
- EEG $978
SYNCOPE

• Broad DDX, cared for by many different Specialties
• A low risk, high stakes symptom
• High frequency of
  • unnecessary admissions
  • Inappropriate investigation
  • Failure to reach a diagnosis
  • Large potential for mis-diagnosis
REGGIE LEWIS

4/29/93 Collapsed while running up the court in a playoff game

Diagnosed with Neuro-cardiogenic syncope and cleared to resume Basketball

7/28/93 Collapsed while shooting and died at the scene of SCD
The Significance of Syncope

- Some causes of syncope are potentially fatal
- Cardiac causes of syncope have the highest mortality rates

Synope in Mild Heart Disease
“Mild Heart Disease”

- CAD
  - +/- Prior MI
  - EF > 35%

- NICM
  - EF >35%

- Mild Conduction Disease
  - RBBB with LAHB/LPHB, or LBBB
TWO GOALS

- Determine the etiology (when possible)
- Risk stratification
What’s the Secret?

- “The secret to being a syncope expert is taking a detailed history”
- 50-85% can be identified by History & Physical alone
Syncope in “Mild” Heart Disease

GREY AREA

BENIGN SYNCOPE

THOSE GETTING AN ICD
Patients with Reflex syncope may also have CAD

Features highly associated with reflex syncope
- Prodrome
- Onset < 35 years of age
- # of prior episodes
- Typical triggers
- Slow recovery after syncope
Extension of the history

- Patients with an elevated BNP or cardiac troponin in the ER are at higher risk of adverse outcomes.
- Sensitivity is very low, but may very important as a POC test in risk stratification.
- Elevated BNP was a powerful predictor of adverse events in the ROSE trial.
  - AUC 79% for adverse CV outcome/death at 1 month.

The majority of these patients had a history of heart disease or CHF on exam.

Syncope in Mild Ischemic Heart Disease
Syncope with Mild Heart Disease

• Important to distinguish between

  CAD without Prior MI/SCAR

  VS.

  CAD with Prior MI/SCAR
SCAR AND REENTRY
A Mechanism for VT
Syncope and Mild Heart Disease

- Review the Echo closely to identify scar
- Consider MRI, or other imaging to specifically identify scar
- Cornerstone to the evaluation after exclusion of scar:
  Exclude Ischemia
Scar Imaging in CAD

- 195 patients with CAD or highly suspected because of symptoms
- No prior documented MI
- Mean EF 54%

With delayed enhancement by MRI
23% had scar

Kwong RY et al. 2006. Circulation;113: 2733-2743
<table>
<thead>
<tr>
<th>CONUNDRUM</th>
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<tbody>
<tr>
<td><strong>What to do with patients who present with syncope and CAD who do not meet criteria for an AICD?</strong></td>
</tr>
<tr>
<td>• Secondary ICD prevention trials excluded patients with syncope but mean EF of 30%</td>
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<tr>
<td>• AVID</td>
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<tr>
<td>• CIDS</td>
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<tr>
<td>• Syncope was an exclusion criteria in many primary prevention trials</td>
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<tr>
<td>• MUSTT</td>
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<td>• MADIT II</td>
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<td>• SCD HeFT</td>
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EP STUDY IN CAD

- Mostly Pre-primary prevention ICD data
- Syncope and inducible MMVT was associated with a high rate of appropriate ICD therapy
  - Up to 85% at 4 years
- Inducible PMVT/VF only?
  - No survival benefit observed with Negative EPS and inducible VF/PMVT

Link MS et al. JACC 1997;29(2):370-375
Mittal S et al. JACC 2001;38:371-376
Does a Negative EPS help?

- 65 patients with CAD/MI and recurrent syncope with negative initial work-up
- Mean EF of 42% (Relatively preserved EF)
- All negative EPS (Triple ES from 2 sites)
- Followed for 30 months

Recurrent Syncope
17/65 (26%)

- 4 CHB
- 4 SN dysfunction
- 2 Orthostatic hypotension
- 1 SVT
- 1 Reflex syncope
- 1 Seizure
- 4 Unexplained

7 DEATHS
- 2 Sudden
- 3 CHF
- 2 Non-CV

Link MS et al. AJC 1999;83:1334-1337
Is scar by MRI of prognostic importance in CAD?

- Delayed enhancement was the strongest predictor of MACE at 6 months follow-up

Kwong RY et al. 2006. Circulation;113: 2733-2743
Syncope

History and Physical
ECG

Known SHD

Echo
EPS

- Tilt/ILR

+ Treat

No SHD

> 30 days; > 2 Events

Tilt
ILR

< 30 days

Tilt
Holter/ELR
ILR
Syncope in NICM
Syncope and NICM

- EPS?

- Routine EPS in Greece performed in 158 patients with NICM
  - Triples from 2 sites

- Subgroup with EF > 35% (N= 39) ICD only if EPS+

  **Inducible VT/VF**
  - N=10
  - 6 ICD approp. Therapy
  - 1 CHF Death
  - 1 Non-CV Death

  **Non-Inducible**
  - N=29
  - 1 Sudden Death
  - 1 CHF Death

SCAR in NICM

- Does the presence of scar help in risk stratifying patients with NICM and syncope
  - MRI in NICM
  - Received ICD For Primary Prevention
    - N=65

42% of patients

HIGHLY PREDICTIVE OF OUTCOME (OR 8.2)
Even when accounting for EF and NYHA CLASS

Wu K et al. JACC 2008;51:2414-2421
Does extended monitoring have a role?

- ISSUE sub-study (International Study on Syncope of Unknown Etiology)
- Negative EPS
  - 20/35 (57%) Ischemic (Prior MI)
  - 9/35 (26%) Hypertrophic
  - 5/35 (14%) NICM

Implantable Loop Recorder (ILR)

Consider if other testing fails and risk of death is low
A Suggested Approach to Syncope in mild CAD/NICM

1. Consider MRI to Assess for Scar If Echo inconclusive
2. EPS

Initial Evaluation

ILR
Consider ICD
Syncope and Conduction Disease

- RBBB + LAFB/LPFB
- LBBB
- All Patients with conduction disease should have an Echocardiogram (High rate of structural Heart Disease)
  - 50% in most series

Englund A et al. JACC. 1995;v26: 1508-15
Indications for Permanent Pacing in Chronic Bifascicular and Trifascicular Block

- **Class IIa**
  - 1. Syncope not proved to be due to AV block when other likely causes have been excluded, specifically ventricular tachycardia (VT). (Level of evidence: B)
EPS in Bifascicular Block

• Epidemiologic studies showed a high rate of sudden death beyond the incidence of heart block.
• EPS can be helpful in determining etiologies.
• Infra-Hisian block/long HV intervals
• Inducible VT

Rate of VT inducibility was high (20-30%) in small early studies.

McAnulty JH et al. NEJM 1982;307:137-143
Click RL et al. AJC 1987;59:817-823
Ezri M et al. AHJ 1983;106:693.
EPS

Is it useful in this patient population?

- 101 patients with LBBB/BFB (some had syncope)
- All underwent an EPS
- Mean EF of 46%, majority had structural heart disease
- Inducibility with syncope N=41 only (8/41) (VT/VF/PMVT)
- Inducibility without syncope N=60 (10/60)

5 had SCD in 2 years follow up
4/5 occurred in the syncope group

Englund A et al. JACC 1995;v26: 1508-15
The Role of ILR

- ISSUE Study with BBB and negative EPS
  - 52 patients of which 22 (42%) had syncope
  - ILR Detected 19 events, with 3 undetected
    - 12 AV Block (63%)
    - 4 Sinus Arrest (21%)
    - Asystole undefined 1 (5%)
    - NSR 1 (5%)
    - Sinus tachycardia 1 (5%)

Brignole M et al. Circulation 2001;104:2045-50
PRESS Study

• 101 patients with LBBB or BFB and syncope
• All had a negative EPS/Holter/CSM/TTT
• All given a DCPM
• Randomized to DDD 60 or DDI 30

2 year rates
Syncope 13.9%
Synptomatic AVB 9.9%
No VT seen
Do they really need PM’s?

- Does the rate of AVB justify PPM among patients with LBBB/BFB and syncope?

  **SPRITELY STUDY**

- BFB and syncope
- Normal EF or abnormal EF (>35%) + NEG EPS
- Randomized to ILR vs. PPM
An Approach to BFB and LBBB and syncope

- Get an ECHO
- EPS
  - Negative: ILR or PPM is reasonable
  - Positive or severe LV dysfunction then consider ICD or Scar Imaging
TAKE HOME MESSAGES FOR SYNCOPE IN “MILD HEART DISEASE”

- EPS still have a role especially if negative
- Scar imaging may be important in CAD/NICM not meeting criteria for a primary prevention ICD
- ILR’s are a valuable, but still underutilized tool in unexplained syncope and mild heart disease
## Conventional Diagnostic Methods/Yield

<table>
<thead>
<tr>
<th>Test/Procedure</th>
<th>Yield (based on mean time to diagnosis of 5.1 months)</th>
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<tbody>
<tr>
<td><strong>History and Physical</strong></td>
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<tr>
<td>(including carotid sinus massage)</td>
<td>49-85% (^1, 2)</td>
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<tr>
<td><strong>ECG</strong></td>
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<td></td>
<td>2-11% (^2)</td>
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<tr>
<td><strong>Electrophysiology Study without SHD</strong></td>
<td></td>
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<tr>
<td></td>
<td>11% (^3)</td>
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<tr>
<td><strong>Electrophysiology Study with SHD</strong></td>
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<tr>
<td></td>
<td>49% (^3)</td>
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<tr>
<td><strong>Tilt Table Test (without SHD)</strong></td>
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<tr>
<td></td>
<td>11-87% (^4, 5)</td>
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<td><strong>Ambulatory ECG Monitors:</strong></td>
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<tr>
<td>- Holter</td>
<td>2% (^7)</td>
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<tr>
<td>- External Loop Recorder</td>
<td>20% (^7)</td>
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<tr>
<td>(2-3 weeks duration)</td>
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<tr>
<td>- Insertable Loop Recorder</td>
<td>65-88% (^6, 7)</td>
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<tr>
<td>(up to 14 months duration)</td>
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<tr>
<td><strong>Neurological †</strong></td>
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<tr>
<td>(Head CT Scan, Carotid Doppler)</td>
<td>0-4% (^4,5,8,9,10)</td>
</tr>
</tbody>
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\(^5\) Kapoor, *JAMA*, 1992
\(^6\) Krahn, *Circulation*, 1995

† MRI not studied

* Structural Heart Disease
Insanity: doing the same thing over and over again and expecting different results.
Syncope and Driving

“I want to die peacefully in my sleep like my grandfather did, not like the screaming passengers in his car.”

George Burns