Management of Syncope in Heart Failure

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Syncope

• Transient loss of consciousness, with rapid, usually complete, recovery, with or without prodrome

• A common, non-specific, alarming, debilitating, symptom with diverse causes due to various conditions
Syncope – Observations

• Symptom – confusing
• Evaluation - no gold standard
• Diagnosis – suspect
• Natural history - uncertain
• Treatment – complex with several goals
The Challenge

Syncope

- Benign
- Life-threatening

Not the only challenge
Syncope - Outcomes

Cardiac diagnosis doubles the risk of death

Syncope in Heart Failure

- Syncope in 12-16% in FC III-IV CHF
- 1-year sudden death rate: 45% (syncope) vs 12% (no syncope) p<0.00001
- Cardiac cause in 48% but cause of syncope and EP results did not predict risk of death
- Syncope an independent risk factor

In Dilated Cardiomyopathy

- Syncope incurred higher risk of sudden death (5/16 vs. 1/34)\(^1\)
- Syncope associated with greater risk of inducible arrhythmias\(^2\)
- Syncope associated with similar rate of death but greater risk of sudden death\(^3\)

\(^1\)Tchou PJ. JACC 1991;17:196a; \(^2\)Brembilla-Perrot. Am Heart J 1991;121:1124-1131
\(^3\)Fruhwald FM. Cardiology 1996 87:177-180
What Increases Risk of Death?

- Cardiomyopathy
- Heart failure symptoms
- Bundle branch block

- Does syncope increase risk independent of these factors?
Syncope
A Risk Factor for a Poor Outcome?

Does Syncope Predict?

Dilated Cardiomyopathy
primary and secondary prevention ICDs - outcomes

Conclusion: “Patients with DCMP presenting with syncope are a high-risk group, with event rates similar to patients with DCMP presenting with sustained arrhythmias and should be considered for ICD therapy”.

Phang RS. Am J Cardiol 2006;97:416–420
Does Syncope Predict - ESVEM

Mean EF = 0.32
>10 PVCs/hr
Induced VT

Olshansky B. Am Heart J 1999;137:878-86
# Syncope in ESVEM

<table>
<thead>
<tr>
<th>Covariate</th>
<th>Risk ratio (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syncope *</td>
<td>1.27 (0.58, 2.79)</td>
<td>.544</td>
</tr>
<tr>
<td>VT with syncope</td>
<td>1.78 (0.81, 3.89)</td>
<td>.150</td>
</tr>
<tr>
<td>VF</td>
<td>1.38 (0.91, 2.09)</td>
<td>.126</td>
</tr>
<tr>
<td>VT alone</td>
<td>1.00</td>
<td>_</td>
</tr>
<tr>
<td>CAD</td>
<td>0.91 (0.52, 1.61)</td>
<td>.744</td>
</tr>
<tr>
<td>Average PVC/hour (log scale)</td>
<td>1.04 (0.90, 1.19)</td>
<td>.588</td>
</tr>
<tr>
<td>Utah center</td>
<td>0.80 (0.53, 1.22)</td>
<td>.307</td>
</tr>
<tr>
<td>EPS method</td>
<td>0.77 (0.53, 1.11)</td>
<td>.157</td>
</tr>
<tr>
<td>SAS class I</td>
<td>0.48 (0.29, 0.80)</td>
<td>.005</td>
</tr>
<tr>
<td>LVEF</td>
<td>0.97 (0.95, 0.99)</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

Olshansky B. Am Heart J 1999;137:878-86
Syncope Evaluation

*In Heart Failure*

- History
- Physical
- Diagnostic tests
Diagnostic Tests

- Electrocardiogram
- Echocardiogram
- Monitor (external, implantable recorder)
- Treadmill
- Tilt table test (?)
- Electrophysiology test (?)
- T wave alternans (?)
- Signal averaged ECG (?)
EP Testing – Is There a Role?

Bass EB. Am J Cardiol 1988;62:1186-1191
Does EP Testing Predict ICD Shocks in Syncope Patients?

• Inducible VT and EF ≤0.35 predicted appropriate ICD shocks in patients with syncope and structural heart disease.

• -> In these patients VT accounts for syncope.

Syncope and Inducible VT/VF

ICDs Implanted for VT/VF

Link M. J Am Coll Cardiol 1997; 29:370-5
ICD Therapy – Syncope with Induced VT vs. Spontaneous VT

Andrews NP. J Am Coll Cardiol 1999;34:2023-30
77 yo Driver Collapses Drives into the River

- Echo - LV ejection fraction 0.25.
- Cardiac cath: 2 vessel CAD cannot be fixed. No acute ischemia
- Monitor ->

- Do you do an EP study?
49 yo Male - Cardiomyopathy

- Recurrent syncope
- Left ventricular ejection fraction = 0.38
- Left bundle branch block
- Do you do an EP study?
Very Long HV Interval

 HV = 180 ms
Ventricular Tachycardia
Typical Day in the Hospital

- 55 yo male, found on street, dazed possibly passed out
- He has history of exertional dyspnea but no prior cardiac history
- Physical exam – S₃ gallop
- EKG – left bundle branch block
Typical Day in the Hospital

- 55 yo male, found on street, dazed
- EKG – left bundle branch block
- Echo - ejection fraction = 0.35
- Cardiac catheterization – no lesions
- Electrophysiology test – negative
Typical Day in the Hospital

Unexplained syncope – now what?

- 55 yo male, found on street, dazed
- EKG – left bundle branch block
- Echo - ejection fraction = 0.35
- Cardiac catheterization – no lesions
- Electrophysiology test – negative
Role of Programmed Ventricular Stimulation and Implantable Cardioverter Defibrillators in Patients with Idiopathic Dilated Cardiomyopathy and Syncope

EMMANOUIL S. BRILAKIS, WIN K. SHEN, STEPHEN C. HAMMILL, DAVID O. HODGE, ROBERT F. REA, NANCY Y. LEXVOLD, and PAUL A. FRIEDMAN

From the Department of Internal Medicine, Division of Cardiovascular Diseases, Mayo Clinic and Mayo Foundation, Rochester, Minnesota

BRILAKIS, E.S., ET AL.: Role of Programmed Ventricular Stimulation and Implantable Cardioverter Defibrillators in Patients with Idiopathic Dilated Cardiomyopathy and Syncope. The aim of this study was to evaluate the role of programmed ventricular stimulation and ICDs in patients with idiopathic dilated cardiomyopathy and syncope. Between 1990 and 1998, 54 (mean age 67 ± 11 years, 76% men) patients presented with idiopathic dilated cardiomyopathy and syncope. An electrophysiological study was done in 37 of the 54 patients: 10 had inducible sustained monomorphic ventricular tachycardia, 12 had conduction system disease or neurocardiogenic syncope, and 15 had a normal study. Overall, 17 patients received an ICD, 15 patients received pacemaker, and 22 patients received no device. Nine of the 15 patients with a negative electrophysiological study eventually received an ICD: 3 because they were considered high risk and 6 because of recurrent syncope or presyncope. In the 17 patients who received an ICD, incidence of appropriate shocks at 1 and 3 years was 47% and 74%, respectively, in the inducible sustained monomorphic ventricular tachycardia group, and 40% and 40%, respectively, in the group without inducible sustained monomorphic ventricular tachycardia (P = 0.29, log-rank test). In conclusion, programmed ventricular stimulation is not useful in risk stratification of patients with idiopathic dilated cardiomyopathy and syncope and may delay necessary ICD implantation. (PACE 2001; 24:1623–1630)
Cardiomyopathy and Syncope

*An ICD is Indicated!*

- 14 syncope patients, negative EPS vs. 19 cardiac arrest survivors. ICDs placed.
- “Appropriate” shocks: 7/14 syncope (f/u 24 mos) and 8/19 arrest patients (f/u 45 mos)
- Mortality high both groups (28% v. 32%)

- What does syncope have to do with it?
- Does an ICD help?

Knight B. J Am Coll Cardiol. 1999;33:1964-70
Syncope and Cardiomyopathy

*The EP Test is Negative*

- Blinded, matched, case-control analysis of 51 with unexplained syncope, cardiomyopathy and negative EPS (19 ICD vs. 32 “conventional”).
- 14 death/cardiac arrest in 44±20 mos. 2 ICD vs. 12 “conventional”. HR 0.18, 95% CI 0.04,0.85, P=0.04.
- Appropriate ICD shocks in 26% at 2 years.
- ICDs improve outcome of patients with unexplained syncope, ischemic or nonischemic cardiomyopathy and negative EPS

Lindsey B. Heart Rhythm 2005;2:367-373
AVID Substudy and Registry

The Substudy

The Registry

Steinberg  J. J Cardiovasc Electrophysiol 2001;12:996-1001
ICD Indications - Syncope

- **Class I** - Syncope of undetermined origin with clinically relevant, hemodynamically significant sustained VT or VF induced at EP study when drug therapy is ineffective, not tolerated, or not preferred. *(Level of evidence: B)*

- **Class IIb** - Syncope in patients with advanced structural heart disease in which thorough invasive and noninvasive investigation has failed to define a cause. *(Level of evidence: C)*

Gregoratos G. Circulation 2002;106:2145-2161
Class IIa Indication – “ICD can be beneficial for patients with unexplained syncope, significant LV dysfunction and nonischemic dilated cardiomyopathy who are receiving chronic optimal medical therapy. . . (Level of Evidence: C)”
## Syncope Predicts Outcomes in CHF

<table>
<thead>
<tr>
<th></th>
<th>Dead</th>
<th>CV Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR (95% CI)</td>
<td>1.41 (1.13, 1.76)</td>
<td>1.55 (1.19, 2.02)</td>
</tr>
<tr>
<td>p value</td>
<td>0.002</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Syncope did not predict sudden death

Syncope predicts ICD shocks

HR = 2.91 (CI 1.89, 4.47) p = 0.001

16% had syncope after enrollment

Olshansky B. J Am Coll Cardiol. in press. 2008
**Syncope in SCD-HeFT**

*Mortality Independent of Treatment*

<table>
<thead>
<tr>
<th>Syncope - year 1</th>
<th>Amiodarone</th>
<th>Placebo</th>
<th>ICD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>15.1%</td>
<td>17.0%</td>
<td>17.1%</td>
</tr>
<tr>
<td>No</td>
<td>11.2%</td>
<td>12.6%</td>
<td>8.6%</td>
</tr>
<tr>
<td>HR (95% CI)</td>
<td>1.33</td>
<td>1.52</td>
<td>1.72</td>
</tr>
<tr>
<td></td>
<td>(0.91, 1.96)</td>
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<td>(1.16, 2.56)</td>
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</table>

No difference between arms (p=0.64)

Olshansky B. J Am Coll Cardiol. in press. 2008
Presumed Causes for Syncope

458 episodes in 356 patients

- Orthostatic hypotension 65
- Ventricular tachycardia 44
- Drug induced hypotension 38
- Vasomotor 33
- Cardiac arrest (CPR given) 24
- Drug induced arrhythmia 2
- Seizures 7
- Other 159
- Unknown 86

Olshansky B. J Am Coll Cardiol. in press. 2008
Cause of Syncope

356 pts
- 15 excluded (protocol violation or incomplete evaluation)

341 pts
- 4 neurological/psychiatric syncope

337 pts
- Without suspected or diagnosed heart disease n = 146

With suspected or certain heart disease n = 191

Cardiac n = 74 (39%)
Neurally mediated n = 94 (49%)
Unexplained n = 23 (12%)

Cardiac n = 4 (3%)
Neurally mediated n = 105 (72%)
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Alboni P. J Am Coll Cardiol. 2001;37:1921
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Alboni P. J Am Coll Cardiol. 2001;37:1921
Neurocardiogenic Mechanisms of Unexplained Syncope in Idiopathic Dilated Cardiomyopathy

Efthimios G. Livanis, MD\textsuperscript{a}, Anna Kostopoulou, MD\textsuperscript{a,\*,*}, George N. Theodorakis, MD\textsuperscript{a}, Nikolitsa Aggelopoulou, MD\textsuperscript{a}, Stamatis Adamopoulos, MD, PhD\textsuperscript{a}, Dimitrios Degiannis, MD\textsuperscript{b}, and Dimitrios Th. Kremastinos, MD, PhD\textsuperscript{c}

Syncope in patients with advanced heart failure is a sign of poor prognosis. The cause of syncope in patients with dilated cardiomyopathy (DC) is not fully recognized and may remain elusive even after standardized evaluation. The purpose of the present study was to examine the implication of neurally mediated mechanisms in the pathophysiology of syncopal episodes in patients with DC. Twenty-six patients (21 men, 5 women; mean age 59 ± 2 years, range 38 to 79) with DC and left ventricular ejection fractions ≤40% were included in the study. Thirteen patients with unexplained syncope or presyncope and a control group of 13 patients without unexplained syncope underwent head-up tilt tests with clomipramine challenge. The 2 groups were matched with regard to age, gender, and left ventricular ejection fractions, and there were no major differences in terms of medication. Heart rate variability analysis and plethysmography of forearm flow were performed during the tilt tests. Blood samples were also drawn for catecholamine measurements. In the group with histories of unexplained syncope, the head-up tilt test results were positive in 11 patients (84.6%). Sympathetic and parasympathetic heart rate indexes were markedly stimulated, while catecholamine concentrations and blood flow changes indicated sympathetic withdrawal during tilting. In the control group, the head-up tilt test results were negative in 12 patients (92.3%). In conclusion, neurally mediated mechanisms seem to be implicated in the pathophysiology of syncope in patients with DC and should therefore be considered in the differential diagnosis of syncopal episodes of unexplained origin. © 2007 Elsevier Inc. All rights reserved. (Am J Cardiol 2007;99:558–562)
Reasons a Syncope Patient with an ICD May Still Pass Out

- Spontaneous VT treated by the ICD
- Untreated, undetected (e.g., below rate cut-off), recurrent, provoked (by ICD) or nonsustained VT
- Lead or device malfunction or programming issue
- Another arrhythmia (brady or tachy)
- Syncope due to another cause
78 yo Male Recurrent Syncope

- Dilated cardiomyopathy. LVEF = 0.32, LBBB and NYHA FC II. ICD implanted.
- Recurrent syncope despite ICD.
- EP study -> poorly tolerated SVT below programmed ICD detection interval.
- SVT ablation stopped syncope.
Syncope in Heart Failure

Restrictions

• No commercial driving
• If cause is identified and treated – no restriction
• For most restriction from standard driving for 6 months. Justified?
Before the ICD - What to Do?

• With prophylactic ICD use, tendency is to become lax regarding patient evaluation.
• Standard evaluation rules still apply.
• Evaluate potential responsible conditions. An ICD might not be enough.
85 yo Male – A Falling Episode

• He maybe passed out or just tripped on the rug. He is brought in for evaluation
• Procardia/Dyazide
• Px - orthostatic hypotension
• LVEF = 0.30. He has a LBBB
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What if the EF is 0.40?
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What if the EF is 0.40?

What if the EP test shows inducible polymorphic VT?
Elderly Male with “Syncope”

- Evaluated by several internists for AM collapse in his breakfast
- Moderate LV dysfunction. Monitoring negative. He is demented.
- He takes phenobarbital, xanax, acetaminophen with codeine and forgets how much he takes
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ICDs are not always the answer
Syncope in Heart Failure

- Evaluate causes for syncope
- Treat heart failure aggressively
- Treat to
  - prevent sudden and total mortality
  - reduce risk of recurrent syncope
Conclusion

• Syncope in heart failure, not always due to VT, indicates risk of death.
• ICDs reduce risk of arrhythmic death in high-risk syncope patients and have a key role in management.
• Identification of which patient benefits from an ICD can be complex and requires careful clinical assessment.