Syncope

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Syncope:
A Symptom…Not a Diagnosis

- **Self-limited loss of consciousness and postural tone**
- **Relatively rapid onset**
- **Variable warning symptoms**
- **Spontaneous complete recovery**

- **"Syn-kope" means to "cut short"**

The Significance of Syncope

- **The only difference between syncope and sudden death is that in one you wake up.[1]**

[1] Engel GL. Psychologic stress, vasodepressor syncope, and sudden death. *Ann Intern Med* 1978; 89: 403-412.

The Significance of Syncope

- Infrequent, unexplained 38% to 47%
- Explained 53% to 62%
- 500,000 new syncope patients each year [5]
- 170,000 have recurrent syncope [6]
- 70,000 have recurrent, infrequent, unexplained syncope [1-4]

[1] Kapoor W, *Med.* 1990;69:160-175.
2 Silverstein M, et al. *JAMA.* 1982;248:1185-1189.
3 Martin G, et al. *Ann Emerg. Med.* 1984;12:499-504.
4 Kapoor W, et al. *N Eng J Med.* 1983;309:197-204.
5 National Disease and Therapeutic Index, IMS America, Syncope and Collapse #780.2; Jan 1997-Dec 1997.
6 Kapoor W, et al. *Am J Med.* 1987;83:700-708.

Syncope Reported Frequency

- Individuals <18 yrs 15%
- Military Population 17- 46 yrs 20-25%
- Individuals 40-59 yrs* 16-19%
- Individuals >70 yrs* 23%

Brignole M, Alboni P, Benditt DG, et al. Eur Heart J, 2001; 22: 1256-1306.

*during a 10-year period

Causes of Syncope[1]

Cause	Prevalence (Mean) %	Prevalence (Range) %
Reflex-mediated:		
▪Vasovagal	18	8-37
▪Situational	5	1-8
Carotid Sinus	1	0-4
Orthostatic hypotension	8	4-10
Medications	3	1-7
Psychiatric	2	1-7
Neurological	10	3-32
Organic Heart Disease	4	1-8
Cardiac Arrhythmias	14	4-38
Unknown	34	13-41

[1]Kapoor W. In Grubb B, Olshansky B (eds) Syncope: Mechanisms and Management. Armonk NY; Futura Publishing Co, Inc: 1998; 1-13.

The Significance of Syncope

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

[1] Day SC, et al. *Am J of Med* 1982;73:15-23.
[2] Kapoor W. *Medicine* 1990;69:160-175.
[3] Silverstein M, Sager D, Mulley A. *JAMA.* 1982;248:1185-1189.
[4] Martin G, Adams S, Martin H. *Ann Emerg Med.* 1984;13:499-504.

Causes of Syncope-like States

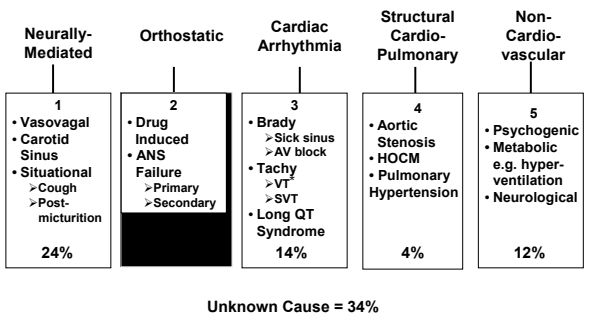
- Migraine*
- Acute hypoxemia*
- Hyperventilation*
- Somatization disorder (psychogenic syncope)
- Acute Intoxication (e.g., alcohol)
- Seizures
- Hypoglycemia
- Sleep disorders

* may cause 'true' syncope

Syncope Diagnostic Objectives

- Distinguish 'True' Syncope from other 'Loss of Consciousness' spells:
  - ✓ Seizures
  - ✓ Psychiatric disturbances
- Establish the cause of syncope with sufficient certainty to:
  - ✓ Assess prognosis confidently
  - ✓ Initiate effective preventive treatment

Syncope: Etiology



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Initial Evaluation (Clinic/Emergency Dept.)

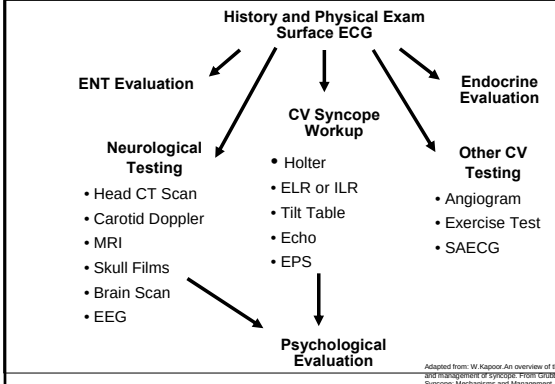
- Detailed history
- Physical examination
- 12-lead ECG
- Echocardiogram (as available)

Syncope Evaluation and Differential Diagnosis

History – What to Look for

- **Complete Description**
  - ✓ **From patient and observers**
- **Type of Onset**
- **Duration of Attacks**
- **Posture**
- **Associated Symptoms**
- **Sequelae**

Unexplained Syncope Diagnosis



Adapted from: W.Kapoor.An overview of the evaluation and management of syncope. From: Grubb B, Olshansky B (eds). Syncope: Mechanisms and Management. Armonk, NY: Futura Publishing Co., Inc.1998.

Syncope Basic Diagnostic Steps

- **Detailed History & Physical**
  - ✓ **Document details of events**
  - ✓ **Assess frequency, severity**
  - ✓ **Obtain careful family history**
- **Heart disease present?**
  - ✓ **Physical exam**
  - ✓ **ECG: long QT, WPW, conduction system disease**
  - ✓ **Echo: LV function, valve status, HOCM**
- **Follow a diagnostic plan...**

Conventional Diagnostic Methods/Yield

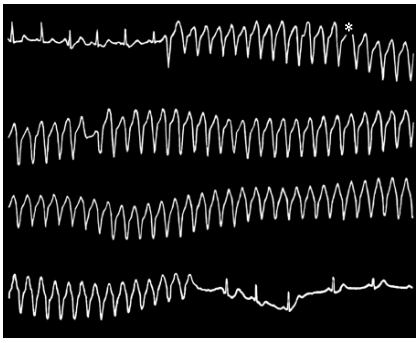
Test/Procedure	Yield (based on mean time to diagnosis of 5.1 months[7])
History and Physical (including carotid sinus massage)	49-85% [1, 2]
ECG	2-11% [2]
Electrophysiology Study without SHD*	11% [3]
Electrophysiology Study with SHD	49% [3]
Tilt Table Test (without SHD)	11-87% [4, 5]
Ambulatory ECG Monitors:	
• Holter	2% [7]
• External Loop Recorder (2-3 weeks duration)	20% [7]
• Insertable Loop Recorder (up to 14 months duration)	65-88% [6, 7]
Neurological † (Head CT Scan, Carotid Doppler)	0-4% [4,5,6,9,10]

† Kapoor, et al *N Eng J Med*, 1983.
[1] Kapoor, *Am J Med*, 1991.
[2] Linzer, et al. *Ann Int. Med*, 1997.
[3] Kapoor, *JAMA*, 1992
[4] Krahn, *Circulation*, 1995
[7] Krahn, *Cardiology Clinics*, 1997.
[9] Day S, et al. Am J Med. 1982; 73: 15-23.
[10] Stetson P, et al. PACE. 1999; 22 (part II): 782.
* Structural Heart Disease
† MRI not studied

12-Lead ECG

- **Normal or Abnormal?**
  - ✓ **Acute MI**
  - ✓ **Severe Sinus Bradycardia/pause**
  - ✓ **AV Block**
  - ✓ **Tachyarrhythmia (SVT, VT)**
  - ✓ **Preexcitation (WPW), Long QT, Brugada**
- **Short sampling window (approx. 12 sec)**

Value of Event Recorder in Syncope



***Asterisk denotes event marker**

Linzer M. Am J Cardiol. 1990;66:214-219.

Ambulatory ECG

Method	Comments
Holter (24-48 hours)	**Useful for infrequent events**
Event Recorder	▪ **Useful for infrequent events** ▪ **Limited value in sudden LOC**
Loop Recorder	▪ **Useful for infrequent events** ▪ **Implantable type more convenient (ILR)**
Wireless (internet) Event Monitoring	**In development**

Carotid Sinus Massage

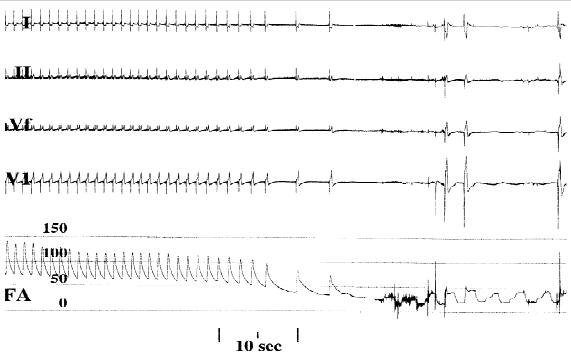
- **Site:**
  - ✓ **Carotid arterial pulse just below thyroid cartilage**
- **Method:**
  - ✓ **Right followed by left, pause between**
  - ✓ **Massage, NOT occlusion**
  - ✓ **Duration: 5-10 sec**
  - ✓ **Posture – supine & erect**

Carotid Sinus Massage

- **Outcome:**
  - ✓ **3 sec asystole and/or 50 mmHg fall in systolic blood pressure with reproduction of symptoms =**

  Carotid Sinus Syndrome (CSS)
- **Contraindications**
  - ✓ **Carotid bruit, known significant carotid arterial disease, previous CVA, MI last 3 months**
- **Risks**
  - ✓ **1 in 5000 massages complicated by TIA**

Head-Up Tilt Test (HUT)



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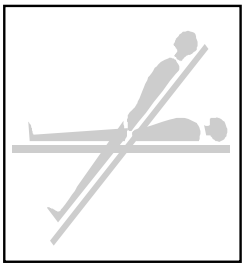
Head-up Tilt Test (HUT)

- **Unmasks VVS susceptibility**
- **Reproduces symptoms**
- **Patient learns VVS warning symptoms**
- **Physician is better able to give prognostic / treatment advice**



Electroencephalogram

- **Not a first line of testing**
- **Syncope from Seizures**
- **Abnormal in the interval between two attacks – Epilepsy**
- **Normal – Syncope**

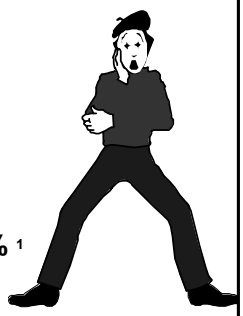
Conventional EP Testing in Syncope

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

Brignole M, Alboni P, Benditt DG, et al. Eur Heart Journal 2001; 22: 1256-1306.

Diagnostic Limitations

- Difficult to correlate spontaneous events and laboratory findings
- Often must settle for an attributable cause
- Unknowns remain 20-30% [1]



[1]Kapoor W. In Grubb B, Olshansky B (eds) Syncope: Mechanisms and Management. Armonk NY; Futura Publishing Co, Inc: 1998; 1-13.

EP Testing in Syncope: Useful Diagnostic Observations

- Inducible monomorphic VT
- SNRT > 3000 ms or CSRT > 600 ms
- Inducible SVT with hypotension
- HV interval ≥ 100 ms (especially in absence of inducible VT)
- Pacing induced infra-nodal block

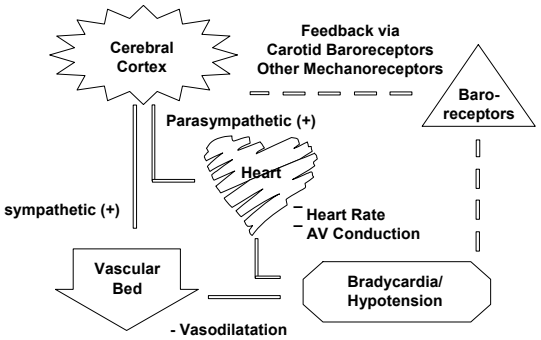
Section IV:

Specific Conditions

Neurally-Mediated Reflex Syncope (NMS)

- Vasovagal syncope (VVS)
- Carotid sinus syndrome (CSS)
- Situational syncope
  - ✓ post-micturition
  - ✓ cough
  - ✓ swallow
  - ✓ defecation
  - ✓ blood drawing
  - ✓ etc.

NMS – Basic Pathophysiology



Benditt DG, Lurie KG, Adler SW, et al. Pathophysiology of vasovagal syncope. In: Neurally mediated syncope: Pathophysiology, investigations and treatment. Blanc JJ, Benditt D, Sutton R. Bakken Research Center Series, v. 10. Armonk, NY: Futura, 1996

NM Reflex Syncope: Pathophysiology

- Multiple triggers
- Variable contribution of vasodilatation and bradycardia

Vasovagal Syncope (VVS): Clinical Pathophysiology

- Neurally Mediated Physiologic Reflex Mechanism with two Components:
  - ✓ Cardioinhibitory ↓ (HR)
  - ✓ Vasodepressor ↓ (BP)
- Both components are usually present

Prevalence of VVS

- Prevalence is poorly known
  - ✓ Various studies report 8% to 37% (mean 18%) of cases of syncope (Linzer 1997)
- In general:
  - ✓ VVS patients younger than CSS patients
  - ✓ Ages range from adolescence to elderly (median 43 years)
  - ✓ Pallor, nausea, sweating, palpitations are common
  - ✓ Amnesia for warning symptoms in older patients

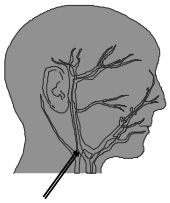
Carotid Sinus Syndrome (CSS)

- Syncope clearly associated with carotid sinus stimulation is rare (≤1% of syncope)
- CSS may be an important cause of unexplained syncope / falls in older individuals

Management Strategies for VVS

- Optimal management strategies for VVS are a source of debate
  - ✓ Patient education, reassurance, instruction
  - ✓ Fluids, salt, diet
  - ✓ Tilt Training
  - ✓ Support hose
- Drug therapies
- Pacing
  - ✓ Class II indication for VVS patients with positive HUT and cardioinhibitory or mixed reflex

Etiology of CSS



Carotid Sinus

- Sensory nerve endings in the carotid sinus walls respond to deformation
- "Deafferentation" of neck muscles may contribute
- Increased afferent signals to brain stem
- Reflex increase in efferent vagal activity and diminution of sympathetic tone results in bradycardia and vasodilation

CSS and Falls in the Elderly

- 30% of people >65 yrs of age fall each year[1]
  - ✓ Total is 9,000,000 people in USA
  - ✓ Approximately 10% of falls in elderly persons are due to syncope[2]
- 50% of fallers have documented recurrence[3]
- Prevalence of CSS among frequent and unexplained fallers unknown but…
  - ✓ CSH present in 23% of >50 yrs fallers presenting at ER [3]

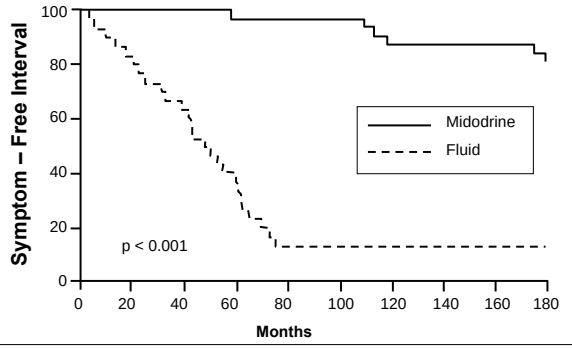
[1]Falling in the Elderly: U.S. Prevalence Data. *Journal of the American Geriatric Society,* 1995.
[2] Campbell et al. Age and Aging 1981;10:264-270.
[3]Richardson DA, Bexton RS, et al. Prevalence of cardioinhibitory carotid sinus hypersensitivity in patients 50 years or over presenting to the Accident and Emergency Department with "unexplained" or "recurrent" falls. *PACE* 1997

VVS: Pharmacologic Rx

- Salt /Volume
  - ✓ Salt tablets, 'sport' drinks, fludrocortisone
- Beta-adrenergic blockers
  - ✓ 1 positive controlled trial (atenolol),
  - ✓ 1 on-going RCT (POST)
- Disopyramide
- SSRIs
  - ✓ 1 controlled trial
- Vasoconstrictors (e.g., midodrine)
  - ✓ 1 negative controlled trial (etilephrine)

Treatment Options

Midodrine for Neurocardiogenic Syncope



Journal of Cardiovascular Electrophysiology Vol. 12, No. 8, Perez-Lugones, et al.

VVS: Tilt-Training

- Objectives
  - ✓ Enhance Orthostatic Tolerance
  - ✓ Diminish Excessive Autonomic Reflex Activity
  - ✓ Reduce Syncope Susceptibility / Recurrences
- Technique
  - ✓ Prescribed Periods of Upright Posture
  - ✓ Progressive Increased Duration

VVS Pacing Trials Conclusions

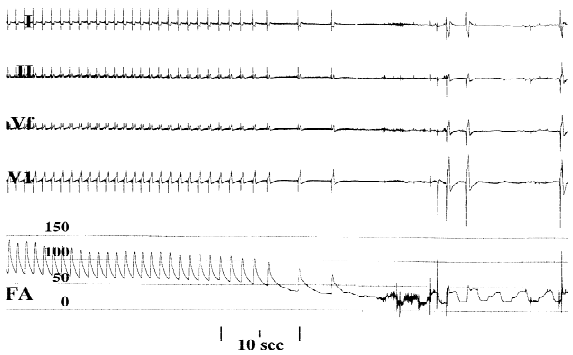
- DDD pacing reduces the risk of syncope in patients with recurrent, refractory, highly-symptomatic, cardioinhibitory vasovagal syncope.

Status of Pacing in VVS

- Perception of pacing for VVS changing:
  - ✓ VVS with +HUT and cardioinhibitory response a Class IIb indication[1]
- Recent clinical studies demonstrated benefits of pacing in select VVS patients:
  - ✓ VPS I
  - ✓ VASIS
  - ✓ SYDIT
  - ✓ VPS II –Phase I
  - ✓ ROME VVS Trial

[1]Gregoratos G, et al. ACC/AHA Guidelines for Implantation of Cardiac Pacemakers and Antiarrhythmic Devices. *Circulation*. 1998; 97: 1325-1335.

Head-Up Tilt Test (HUT)



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Principal Causes of Orthostatic Syncope

- Drug-induced (very common)
  - ✓ diuretics
  - ✓ vasodilators
- Primary autonomic failure
  - ✓ multiple system atrophy
  - ✓ Parkinsonism
- Secondary autonomic failure
  - ✓ diabetes
  - ✓ alcohol
  - ✓ amyloid
- Alcohol
  - ✓ orthostatic intolerance apart from neuropathy

Principal Causes of Syncope due to Structural Cardiovascular Disease

- Acute MI / Ischemia
  - ✓ Acquired coronary artery disease
  - ✓ Congenital coronary artery anomalies
- HOCM
- Acute aortic dissection
- Pericardial disease / tamponade
- Pulmonary embolus / pulmonary hypertension
- Valvular abnormalities
  - ✓ Aortic stenosis, Atrial myxoma

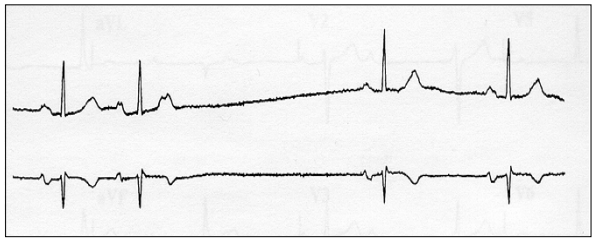
Syncope Due to Arrhythmia or Structural CV Disease: General Rules

- Often life-threatening and/or exposes patient to high risk of injury
- May be warning of critical CV disease
  - ✓ Aortic stenosis, Myocardial ischemia, Pulmonary hypertension
- Assess culprit arrhythmia / structural abnormality aggressively
- Initiate treatment promptly

Syncope Due to Cardiac Arrhythmias

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

AECG: 74 yr Male, Syncope



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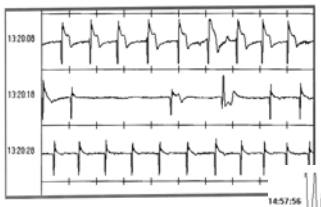
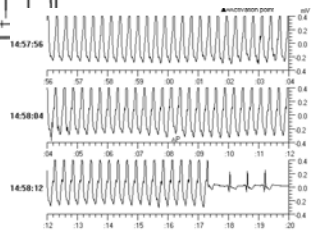


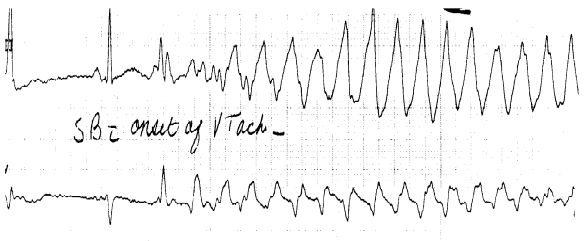
28 yo man in the ER multiple times after falls resulting in trauma
VT: ablated and medicated



83 yo woman
Bradycardia: Pacemaker implanted

Reveal ® ILR recordings; Medtronic data on file.

Syncope: Torsades



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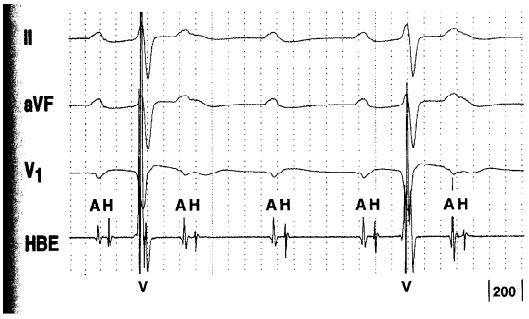
Infra-His Block



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Drug-Induced QT Prolongation

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

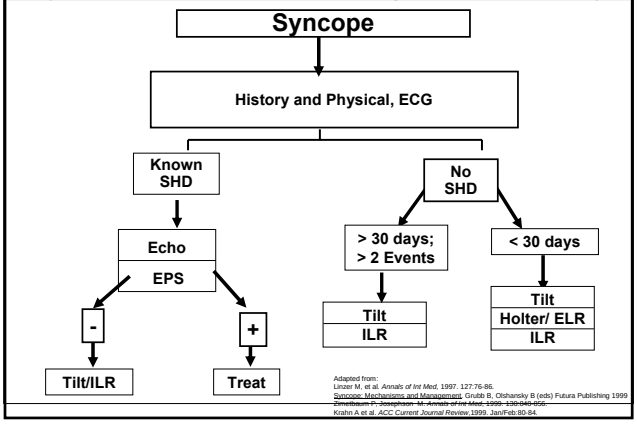
Treatment of Syncope Due to Tachyarrhythmia

- Atrial Tachyarrhythmias;
  - ✓ AVRT due to accessory pathway – ablate pathway
  - ✓ AVNRT – ablate AV nodal slow pathway
  - ✓ Atrial fib^{O}– Pacing, linear / focal ablation, ICD selected pts
  - ✓ Atrial flutter – Ablation of reentrant circuit
- Ventricular Tachyarrhythmias;
  - ✓ Ventricular tachycardia – ICD or ablation where appropriate
  - ✓ Torsades de Pointes – withdraw offending Rx or ICD (long-QT/Brugada)
- Drug therapy may be an alternative in many cases

Treatment of Syncope Due to Bradyarrhythmia

- Class I indication for pacing using dual-chamber system wherever adequate atrial rhythm is available
- Ventricular pacing in atrial fibrillation with slow ventricular response

Typical Cardiovascular Diagnostic Pathway



Adapted from:
Linzer M, et al. *Annals of Int Med*, 1997. 127:76-86.
Syncope: Mechanisms and Management, Grubb B, Olshansky B (eds) Futura Publishing 1999.
Zimetbaum P, Josephson M. *Annals of Int Med*. 1999. 130:940-956.
Krahn A et al. *ACC Current Journal Review*,1999. Jan/Feb:80-84.

- **“I want to die like my father, peacefully in his sleep; not screaming like the passengers in his car”**

George Burns

The End