Objective

1. Know signs, symptoms and electrocardiographic features of AF and VT/VF.
2. Understand the clinical consequences of AF and VT/VF if not prevented or treated.
3. Know how to achieve the most efficacious outcome using pharmacologic therapy for the prevention and/or treatment of AF and VT/VF.

Suggested Reading

2. Falk RH. Atrial Fibrillation. NEJM 2001;344;1067-1078

Atrial Fibrillation

- Irregular beat to beat rate
- No Visible P Waves
- Narrow QRS complex

Atrial Flutter

- Regular beat to beat rate
- Narrow QRS complex
- Evident P waves (flutter waves)
Mechanisms of Atrial Flutter

SA → 80

AV → 300

Rate = 140 - 160 BPM

Regular Ventricular Rate

Classification of Atrial Fibrillation

- 3 P’s of AF:
  - Paroxysmal: terminates spontaneously
  - Persistent: can only be converted with drugs or DC energy
  - Permanent: will not terminate

[Image: Gallagher & Conn, Am J Cardiol 1998;82:18N-28N]

Pathology: What Causes AF

<table>
<thead>
<tr>
<th>Disease</th>
<th>Incidence with AF</th>
<th>Incidence No AF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve</td>
<td>16.7%</td>
<td>6.7%</td>
</tr>
<tr>
<td>↑Thyroid</td>
<td>20.30%</td>
<td>&lt;2%</td>
</tr>
<tr>
<td>MI</td>
<td>22.5%</td>
<td>13%</td>
</tr>
<tr>
<td>HTN with LVH</td>
<td>10.7%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>16.3</td>
<td>10.2</td>
</tr>
<tr>
<td>CHF</td>
<td>20.6%</td>
<td>3.2%</td>
</tr>
<tr>
<td>None</td>
<td>20%</td>
<td></td>
</tr>
</tbody>
</table>


Prevalence & Incidence of Atrial Fibrillation

- Over 2 million people in U.S. currently have atrial fibrillation
- Over 5.5 million cases worldwide
- 720,000 new cases per year worldwide

[Image: Falk RH NEJM 2001;344:1067]

Why Treat AF

Symptoms & Risks

- Decrease symptoms
- Prevent CHF?
- Improve quality of life (Dofetilide)
- Increase survival?

- Decrease stroke
- Improve survival

[Image: Gerstenfeld PACE (abstract) 1999]

AF Symptoms

- Palpitations: 60%
- Chest Pain: 30%
- Fatigue: 20%
- Syncope: 10%
- Anxiety: 5%
- SBO: 3%
- Nausea: 1%
Quality of Life

### Scores by Subscale Category

- **Healthy General Population**
- **Patients with Recent MI**
- **Patients with CHF**
- **Patients with AF**

### Mortality Risk (SOLVD data)

- **Sinus Rhythm**
- **Atrial Fibrillation**

### Heart Failure Risk (SOLVD data)

- **Sinus Rhythm**
- **Atrial Fibrillation**

### Assumption for Therapy

- Patients are better off in NSR
- Reasonable efforts should be used before declaring chronic AF.
- Rhythm vs Rate control studies have questioned this assumption.

### Rhythm Vs. Rate Control Strategy

<table>
<thead>
<tr>
<th>N</th>
<th>F/u (yrs)</th>
<th>AF (days)</th>
<th>AAD</th>
<th>%NSR Rhythm Group</th>
<th>%NSR Rate Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIAF</td>
<td>252</td>
<td>1</td>
<td>7-360</td>
<td>Amio</td>
<td>56%</td>
</tr>
<tr>
<td>STAF</td>
<td>200</td>
<td>3</td>
<td>30-180</td>
<td>NA</td>
<td>23%</td>
</tr>
<tr>
<td>AFFIRM</td>
<td>3657</td>
<td>5</td>
<td>0.25-180</td>
<td>Amio/Sot</td>
<td>60%</td>
</tr>
<tr>
<td>RACE</td>
<td>522</td>
<td>3</td>
<td>1-360</td>
<td>Sot</td>
<td>40%</td>
</tr>
</tbody>
</table>

### Rhythm Vs. Rate Control

- **AFFIRM: Mortality**

- **Hohnloser et al, Lancet 2000;356:1789**
- **Carson et al, PACE 2001;24:561**
- **JACC 2002**
Rhythm Vs. Rate Control

Summary
• Rate control may be considered primary therapy strategy.
• Rhythm control is difficult to maintain with antiarrhythmic agents.
• Antiarrhythmic agents may increase arrhythmic CV events (AFFIRM).
• AF, regardless of strategy, may predict major CV events (STAF).

Conclusion
Less toxic and more effective rhythm control therapies are needed to test NSR benefits.

Approach to Therapy –AF

Chronic AF
• Rate Control
• Anti-coagulation

Paroxysmal/Persistent
• Rate Control
• Anti-coagulation (>24-48hr)

Termination
• Spontaneous
• Pacing (flutter)
• Pharmacologic
• DC cardioversion

Prevention
• Watchful waiting
• Pharmacologic
• Pacing therapies
• Catheter ablation
• Surgical ablation

Treatment Pathways for AF/AFL

AF
• DC Cardioversion
• RX Cardioversion
  o RX Prevention
  o Rate Control
  o Stroke Prevention
  o Pacing Prevention
  o Surgical/Ablation Cure

AFL
• Pacing Cardioversion
• DC Cardioversion
• RX Cardioversion
  o Ablation Cure
  o RX Prevention
  o Rate Control
  o Stroke Prevention
  o Pacing Prevention

Pharmacology Tool Box

<table>
<thead>
<tr>
<th>Drug</th>
<th>Cardioversion</th>
<th>Maintenance</th>
<th>Rate Control</th>
<th>Anticoagulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinidine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procainamide</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flecainide</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propafenone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amiodarone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ibutilide</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dofetilide</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quinidine</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Procainamide</td>
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<tr>
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</tr>
<tr>
<td>Amiodarone</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Ibutilide</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dofetilide</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Antiarrhythmic Pharmacology

<table>
<thead>
<tr>
<th>Class</th>
<th>Drug</th>
<th>Prevalence of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>Quinidine</td>
<td>Moderate/low</td>
</tr>
<tr>
<td>IA</td>
<td>Procainamide</td>
<td>low</td>
</tr>
<tr>
<td>IA</td>
<td>Disopyridine</td>
<td>very low</td>
</tr>
<tr>
<td>IC</td>
<td>Flecainide</td>
<td>moderate</td>
</tr>
<tr>
<td>IC</td>
<td>Propafenone</td>
<td>moderate</td>
</tr>
<tr>
<td>III</td>
<td>Amiodarone</td>
<td>high</td>
</tr>
<tr>
<td>III</td>
<td>Sotalol</td>
<td>high</td>
</tr>
<tr>
<td>III</td>
<td>Ibutilide</td>
<td>low</td>
</tr>
<tr>
<td>III</td>
<td>Dofetilide</td>
<td>New</td>
</tr>
<tr>
<td>III</td>
<td>Azimilide</td>
<td>Investigational</td>
</tr>
</tbody>
</table>

Antiarrhythmic Efficacy: Acute Termination

<table>
<thead>
<tr>
<th>Drug IV or oral delivery</th>
<th>Acute onset (&lt;7 days)</th>
<th>Persistent AF (&gt;7 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flecainide</td>
<td>70-90%</td>
<td>?</td>
</tr>
<tr>
<td>Propafenone</td>
<td>50-90%</td>
<td>30%</td>
</tr>
<tr>
<td>Procainamide</td>
<td>60-70%</td>
<td>5%</td>
</tr>
<tr>
<td>Amiodarone</td>
<td>50-90%</td>
<td>40-70%</td>
</tr>
<tr>
<td>Sotalol</td>
<td>= placebo</td>
<td></td>
</tr>
<tr>
<td>Ibutilide</td>
<td>46%?</td>
<td>15%</td>
</tr>
<tr>
<td>Dofetilide</td>
<td>67%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Placebo = 20-50% for lone AF = <20% for OHD

**Doefetilide: Conversion to SR**

- Probability of Remaining in AF
  - Log-rank p=0.002

- Number at risk:
  - Doefetilide: 59, 4, 1, 0
  - Placebo: 56, 17, 12, 2

**Relative Efficacy: Maintain NSR**

- % NSR (6-12 Month)

**Conversion & Prevention: Drug Selection**

- Class I Agents
  - Avoid - Increased proarrhythmia if:
    - Structural heart disease
    - Ischemic heart disease
    - Systolic and diastolic dysfunction
    - QRS > 120 ms
    - QTc > 480 ms

**Mortality: Quinidine prophylaxis**

- Meta Analysis

**Relative Efficacy: Maintain NSR**

- % NSR (6-12 Month)

**Conversion & Prevention: Drug Selection**

- Drug Selection
  - Efficacy
  - Structural heart disease
  - QRS or QT interval
  - Systolic function
  - Comorbidities / life expectancy

**Mortality: Quinidine prophylaxis**

- Meta Analysis

- Odds Ratio

**Class I Agents**

- Avoid - Increased proarrhythmia if:
  - Structural heart disease
  - Ischemic heart disease
  - Systolic and diastolic dysfunction
  - QRS > 120 ms
  - QTc > 480 ms

**Conversion & Prevention: Drug Selection**

- Drug Selection
  - Efficacy
  - Structural heart disease
  - QRS or QT interval
  - Systolic function
  - Comorbidities / life expectancy

**Mortality: Quinidine prophylaxis**

- Meta Analysis

- Odds Ratio

**Class I Agents**

- Avoid - Increased proarrhythmia if:
  - Structural heart disease
  - Ischemic heart disease
  - Systolic and diastolic dysfunction
  - QRS > 120 ms
  - QTc > 480 ms
**Conversion & Prevention: Mortality with Class I Agents**

Flaker, J Am Coll Cardiol 1992;20:527-32

- Class III Agents: Sotalol and Ibutilide
- Avoid - Increased proarrhythmia if:
  - HR < 50 bpm
  - QTc interval > 480 ms
  - K+ < 3.6 mmol
  - Mg < 1.0 mmol
  - LV dysfunction: EF < 30%

**Conversion & Prevention: Drug Selection**

**Class III Proarrhythmia**

**Conversion & Prevention: Drug Selection**

**Class III Agents: Amiodarone**

Avoid if:
- HR < 50 bpm
- Life expectancy > 10 years
- Liver disease
- Pulmonary disease

**Pharmacologic Conversion**

- Propafenone or ibutilide
  - No
  - Yes
- Flecainide
  - No
  - Yes
- Sotalol or Dofetilide
  - No
  - Yes
- DC CV
  - No
  - Yes
- Amiodarone
  - No
  - Yes

**Pharmacologic Prevention:**

- Propafenone
  - No
  - Yes
- Flecainide
  - No
  - Yes
- Sotalol or Dofetilide
  - No
  - Yes
- Amiodarone
  - No
  - Yes
  - Proarrhythmia Risks
  - No
  - Yes
- EF < 40%
  - No
  - Yes
- Life expectancy
  - No
  - Yes
  - > 10 yr
  - < 10 yr
### Pharmacologic Considerations

**Quinidine**
- TDP risk (not dose related)
- Discontinue if QTc > 500 ms
- Dig interaction
- Inexpensive

**Propafenone**
- Beta blocker
- Poorly metabolized (7%) pts.
- CNS adverse effects
- Dig interaction

**Flecainide**
- Discontinue if QRS > 120 ms
- CNS adverse effects
- Very proarrhythmic

**Sotalol**
- Beta blocker
- TDP risk (dose related)
- Discontinue if QTc > 500 ms
- Renal elimination must adjust dose

**Amiodarone**
- Very low proarrhythmia
- Improve CHF symptoms
- Most effective agent
- Cumulative dose end organ damage
- Very long half-life and many Rx interactions

### Pharmacologic Dosing

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosing</th>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinidine</td>
<td>324 Tid up to 684 TID</td>
<td>Blood level: 2.5-5.5 ug/mL QTc &gt; 500 decrease dose</td>
</tr>
<tr>
<td>Procainamide</td>
<td>500-1500mg Tid to QID</td>
<td>Blood level: 4-6 ug/mL, NAPA + PA &lt; 25 ug/mL QTc &gt; 500 decrease dose Adjust for renal failure</td>
</tr>
<tr>
<td>Flecainide</td>
<td>100-200 mg BID</td>
<td>QRS &gt; 140 decrease dose Adjust for renal failure</td>
</tr>
<tr>
<td>Propafenone</td>
<td>150-300 mg bid to TID</td>
<td>QRS &gt; 140 decrease dose</td>
</tr>
<tr>
<td>Amiodarone</td>
<td>200 mg</td>
<td>No dosing modifications</td>
</tr>
<tr>
<td>Sotalol</td>
<td>80 – 160 mg BID</td>
<td>QTc &gt; 500ms decrease dose Adjust for renal failure</td>
</tr>
<tr>
<td>Ibutilide</td>
<td>1 mg in 10 min</td>
<td>Stop infusion if QTc&gt;550 ms</td>
</tr>
<tr>
<td>Dofetilide</td>
<td>500 ug bid</td>
<td>QTc &gt; 500ms decrease dose Adjust for renal failure</td>
</tr>
</tbody>
</table>

### Pharmacologic Therapy: In hospital initiation?

- Dofetilide – Required by labeling
- Sotalol therapy (Prystowsky EN. Clin Cardiol 1994;17:7-10)
  - Structural heart disease
  - Sinus node dysfunction
  - AV conduction delay
  - Long QT
  - Electrolyte imbalance
  - IV therapy

### Rapid AF: Rate Control

- Beta Blockers
- Diltiazem or verapamil
- Digoxin

### Rate Control Efficacy

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Digoxin</td>
<td>Diltiazem</td>
<td>Atenolol</td>
<td>Dibeta</td>
<td>Dig+atn</td>
<td></td>
</tr>
<tr>
<td>Ventricular Rate, bpm</td>
<td>180</td>
<td>160</td>
<td>140</td>
<td>120</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>Time, min</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

### Acute Rate Control

**Hypotension (SBP < 95 mmHg)**

- **Hyperactive airway disease**
  - No
  - Yes

- **Pulmonary congestion**
  - No
  - Yes

- **Diltiazem or verapamil**
  - Beta Blocker

- **Moderate to severe symptoms**
  - Oral therapy
  - IV therapy

### Chronic Rate Control

**Systolic Dysfunction (EF < 40%)**

- **Hyperactive airway disease**
  - No
  - Yes

- **Pulmonary congestion**
  - No
  - Yes

- **Diltiazem or verapamil**
  - Beta Blocker

### Anticoagulation

**When to Consider**

- AF > 48 hrs
- Chronic AF
- Multiple sustained AF events > 2 hours

**When to Stop**

- 3 Weeks following cardioversion & NSR?
- No episodes for > 6 months?

### Anticoagulation Guideline

- **No Structural Heart Disease**
  - <65 y/o ⇒ ASA
  - >65 y/o ⇒ Warfarin

- **Structural Heart Disease** ⇒ Warfarin

- **Previous Thromboembolic Event** ⇒ Warfarin

### Pharmacologic Summary

- **Acute Conversion:** Class I & ibutilide
- **Conversion of refractory patients:** oral amiodarone
- **Maintenance of NSR:**
  - Class 1C agents only in healthy hearts
  - Sotalol for healthy hearts or > 10 yr life expectancy
  - Amiodarone for <10 yr life expectancy or refractory patients.
- **Rate control:**
  - Beta and Ca+ blockers equally effective
  - Avoid Ca+ when EF < 40%
- **Anticoagulation:** Risk factor dependent and AF frequency
Non Pharmacologic Therapies

- Catheter Ablation
- Surgical Ablation

AF Mechanisms: Triggers

Case Studies: Patient Assessment

- Symptom history
  - Frequency consider cardioversion
  - Assess for prophylaxis
  - Anticoagulation
- ECG
  - Ventricular response
  - QRS and QT interval
- Hemodynamic stability
- Echocardiogram
  - Structural heart disease
  - LV ejection fraction
- Thyroid Function
- Drug history

Case I

AL is a 61 year old female with valvular heart disease (secondary to rheumatic fever) who presents to the clinic with chief complaints of shortness of breath on exertion and palpitations. She states that these symptoms presented when walking her dog last evening. Upon rest she notes that she is no longer short of breath but still feels heart palpitations. AL was noted to be in no apparent distress during the physical exam.

Vitals: BP 113/76 mmHg, Pulse 133 beats/min irregular, Resp 16/min and afebrile

PMH: Mild/moderate mitral valve regurgitation
Dilated cardiomyopathy
Congestive heart failure (NYHA class II)

ECG: Atrial fibrillation, rate 95-145 beats/min, all intervals within normal limits.

Medications
furosemide 40 mg Bid
captopril 25 mg BID

Patient Assessment
Design a therapeutic plan.
- Explain any additional information needed prior to designing a therapeutic plan.
- What should be done to treat the patient’s symptoms.

Case I

AL is asymptomatic and resting comfortably. AL, however remains in AF.

- Explain the pros and cons of rate control management versus cardioversion and maintaining normal sinus rhythm.
- It was decided to try pharmacologic CV. What would be the most appropriate therapy?
- What should be done to maintain NSR
- Should anticoagulation be prescribed?
Case I: Follow up

AL is successfully treated and is discharged home. Over the next year AL has had seven hospital admission for symptomatic atrial fibrillation. A echocardiogram two months ago documented an ejection fraction of 32%. She presents today with palpitations, severe shortness of breath and dizziness which is unrelieved by rest. On ECG she is noted to be in atrial fibrillation with a systolic pressure of 85 mmHg. It was decided to electively use DCC, which placed AL into sinus rhythm. On exam after cardioversion, AL was noted to be in less distress and more comfortable.

Medications on Admission:
- digoxin 0.125 mg QD
- metoprolol 50 mg QD
- Warfarin 5 mg QD
- captopril 25 mg TID
- sotalol 120 mg BID, also failed quinidin.

Case I: Follow up

What is your assessment of this patient’s problems compared to last visit.

What will be your therapeutic goal and which therapy will be used to achieve this goal

State expected outcomes from therapy.

Types of Ventricular Arrhythmias

- origin of arrhythmia is within the ventricle

Premature Ventricular Contractions

- An early Irregular beat
- Wide QRS complex
- No P waves

Ventricular Tachycardia

- Primarily regular beat
- Wide QRS complex
- No P waves

Mechanisms PVC & VT

One Cycle = PVC
Two or more = VT
Regular Ventricular Rate

Rate = 100 -250 BPM
Ventricular Fibrillation

- Irregular chaotic beat
- Non distinguishable QRS
- No P waves

Mechanisms of Ventricular Fibrillation

Chaotic Ventricular Rate

Symptoms & Risks

VT → Ventricular Rate → IBP & CO → O2 Demand and Supply → Dizziness, SOB → Ischemia - Chest Pain

Symptoms & Risks

VF → No Ventricular Rate → No IBP & CO → Death

Causes of Ventricular Arrhythmias

Cardiac causes
- Acute and chronic ischemic heart disease
- Cardiomyopathy – Heart Failure
- Cardiac Hypertrophy
- Valvular heart disease
- Ion Channel Gene Defect
- Congenital heart disease

Noncardiac causes
- Stimulants: caffeine, cocaine, alcohol
- Metabolic abnormalities: acidosis, hypoxemia, hyperkalemia, hypokalemia, hypomagnesemia
- Drugs: digoxin (Lanoxin), theophylline, antipsychotics, tricyclic antidepressants, antiarrhythmics with proarrhythmic potential (e.g., flecainide [Tamboor], dofetilide [Tikosyn], sotalol [Betapace], quinidine)

Treatment of Acute Ventricular Tachycardia and VF

Hemodynamically Stable

No

DC Cardioversion and ACLS protocol
Patient resuscitated
Amiodarone
Lidocaine
Procainamide
Are there reversible Causes

Yes

No

Correct cause

Assess for ICD and/or chronic antiarrhythmic drug therapy

No

Yes
Chronic Management and Prevention of Sudden Cardiac Death (SCD)

SCD Risk Stratification:

At Risk:

- Post MI
- EF <40%
- NSVT
- Inducible VT
- VT/VF event
- Genetic ion channel defect with SCD family history

Patient Stratification

- Primary prevention
  - Patients at risk for life threatening ventricular arrhythmias
- Secondary prevention
  - Resuscitated arrhythmic sudden death
  - Sustained ventricular tachycardia
  - Hemodynamically unstable non sustained VT

Primary Prevention Clinical Trials: Sudden Death Prevention

<table>
<thead>
<tr>
<th>Post-MI</th>
<th>Heart Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA drugs vs. placebo</td>
<td>CABG Patch</td>
</tr>
<tr>
<td>ICD vs. AA drugs</td>
<td></td>
</tr>
<tr>
<td>ICD vs. placebo</td>
<td></td>
</tr>
</tbody>
</table>

*Ongoing

SCD Primary Prevention: Drug Therapy?

<table>
<thead>
<tr>
<th>Ineffective SCD Total</th>
<th>Effective SCD Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>Amiodarone</td>
</tr>
<tr>
<td></td>
<td>• GESICA ↔ ↓</td>
</tr>
<tr>
<td>CAST I &amp; II</td>
<td>• CHF-STAT ↔ ↔</td>
</tr>
<tr>
<td>Sotalol</td>
<td>• EMIAT ↔ ↔</td>
</tr>
<tr>
<td>Julian Study</td>
<td>• CAMIAT ↓ ↔</td>
</tr>
<tr>
<td>SWORD</td>
<td></td>
</tr>
<tr>
<td>Dofetilide</td>
<td>Beta Blockers</td>
</tr>
<tr>
<td>Alive Study</td>
<td>↔ ↔</td>
</tr>
</tbody>
</table>

Non-Pharmacologic Therapies: Implantable Cardioverter Defibrillator (ICD)

Class I antiarrhythmic drugs for primary prevention (CAST Trial)

Survival (%) vs. Days after Randomization

- Placebo (n = 725)
- Encainide or flecainide (n = 730)

P = 0.0006

NEJM 1989;321:406
**β Blockers for primary prevention**

**Importance of heart rate**

- Alpranolol
- Timolol
- Metoprolol
- Propranolol
- Pindolol
- Oxprenolol
- Sotalol

Reduction in mortality (%)

Reduction in heart rate (beats/min)

**Amiodarone for primary prevention - Mortality Trials**

- EMIAT
  - Arhythmia death + resuscitated cardiac arrest
  - All-cause mortality

- CAMIAT
  - All-cause mortality

**Amiodarone + Beta Blocker**

- Non-cardiac death
- Non arrhythmic death
- Resus Cardiac arrest
- Arrhythmic Death

**ICD vs Drugs MUSTT and MADITT**

- CAD, NSVT, EF < 0.40
- Evaluate and Treat Ischemia
- EPS
  - N=2202
  - N=1435 (65%)
  - Randomized
  - N=767 (35%)
  - Refused
  - N=704 (92%)
  - Registry
  - Inducible Sustained VT
  - N=63 (8%)

- MADIT II – Primary Prevention

- Patient Inclusion
  - Documented prior MI
  - EF <30%
  - >3 months from cardiac event or surgery.
  - No previous VT/VF events.
1998 ACC/AHA Class I Indication: RCT Evidence (MADIT)

**Primary Prevention**

- A history of previous MI and EF <30% or all of the following:
  - Ischemic heart disease
  - NSVT on Holter monitoring
  - LVEF <35% and NYHA Class I-III
  - Inducible VT on EP testing

What to do with the non MUSTT and MADIT patients?

- B Blocker therapy
- Amiodarone therapy
- Combination of both

Await outcome of SCD-HEFT

Secondary prevention: Drugs vs Devices (AVID Study)

![Graph showing survival rates for ICD and AAT](NEJM 1997;337:1576-83)

Proportion Surviving

- ICD: 75.4%
- AAT: 64.1%

p<0.02

Years after Randomization

Antiarrhythmic drugs for secondary prevention:

First line therapy:
- Only to used if an implantable defibrillator is refused by patient
- If ICD can not be used

Second line therapy:
- Used with ICD to reduce number of shocks

Indicated drugs:
- Amiodarone
  - no placebo controlled trials
- Beta blockers
  - no placebo controlled trials

1998 ACC/AHA Class I Indication: RCT Evidence (AVID)

**Secondary Prevention**

1. Cardiac arrest due to VF or VT not due to transient or reversible cause.
2. Spontaneous sustained VT.
3. 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.


On Going Trials

SCD-HeFT: EF <35%

Placebo vs Amiodarone vs ICD
Drug vs Device Tradeoff

- ICDs trade one problem for another
  - SCD versus ICD complications

- ICDs are not preventative
  - ICD therapy is noxious and unwanted
  - Therapy storms are detrimental and can cause PTSD (Int J Emerg Ment Health 2000 Fall;2 (4): 259–63).
  - Requires support groups and psychosocial therapy

- 20% of patients do not accept ICD therapy
  - Worsen quality of life
  - Preexisting psychiatric illness predict poor acceptance (Pacing Clin Electrophysiol 2000 Jun;23(6):939)

Conclusions

Secondary Prevention:
- ICD are Superior

Primary Prevention:
- ICDs are Superior in high risk post MI patients with inducible VT/VF.
- Beta blockers ± amiodarone in all patients with EF <40%

Beta blockers should be aggressively employed in ALL ICD patients: Drug plus Device Paradigm.

Patients should be carefully selected for ICD therapy to assure psychological acceptance.