Atrial Fibrillation

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Learning Objectives

• Review the growing incidence and importance of AF in the population
• Discuss the use of anticoagulation in AF for stroke prevention
• Summarize pharmacologic and non-pharmacologic options for AF management

Projected Number of Adults With AF in the US

Go et al., JAMA. 2001;285:2370-2375.
Costs to the Health Care System

Estimated US cost burden 15.7 billion annually

- 35% of arrhythmia hospitalizations
- Average hospital stay = 5 days
- Mean cost of hospitalization = $18,800
- Does not include:
  - Costs of outpatient cardioversions
  - Costs of drugs/side effects/monitoring
  - Costs of AF-induced strokes

Quality of Life with AF

![Quality of Life Graph]

Quality of Life with AF

1 Jung et al., JACC. 1999
2 Ware et al, New England Medical Center Health Survey, 1993.

Diagnostic Evaluation

Minimum Evaluation

- History and physical – Sx with AF, CV disease
- Electrocardiogram – LVH, MI, BBB, WPW
- Echocardiogram – LVH, LAE, LVEF, Valves
- Labs – TSH, Renal fxn
- Sleep history

AHA / ACC / ECS Guidelines 2006

Diagnostic Evaluation

Additional Testing

- ETT – CAD, Exercise induced SVT / AF
- Holter / Event Monitor – Confirm AF and Sxs
- TEE – LA clot
- EPS – SVT triggered AF
- Sleep Study

AHA / ACC / ECS Guidelines 2006
Incidence of AF Based on Presence or Absence of OSA

![Graph showing incidence of AF based on presence or absence of OSA.](image)

**Classification of Atrial Fibrillation**

ACC/AHA/ESC Guidelines

- **First Detected**
  - Paroxysmal (Self-terminating)
  - Persistent (Not self-terminating)

- **Permanent**

**Treatment Options**

- **Rate control**
  - Pharmacologic
    - Ca²⁺ blockers
    - β-blockers
    - Digitalis
    - Amiodarone
  - Nonpharmacologic
    - Ablate and pace

- **Maintenance of SR**
  - Pharmacologic
  - Catheter ablation
  - Surgery (MAZE)
  - Pacing
  - ACE-I
  - ARB

- **Stroke prevention**
  - Pharmacologic
    - Warfarin
    - Thrombin inhibitor
    - Aspirin
  - Nonpharmacologic
    - Removal / isolation
    - LA appendage

**ACCF/AHA/HRS Focused Update**

2011 ACCF/AHA/HRS Focused Update on the Management of Patients With Atrial Fibrillation (Updating the 2006 Guideline)

A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines

2011 WRITING GROUP MEMBERS

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Heart Rhythm 2011; 8: 157-176.

Adapted from Prystowsky, Am J Cardiol. 2000;85:3D-11D.
Atrial Fibrillation and Stroke

- 5 fold increased risk of CVA
- AF accounts for 1 out of every 6 CVAs
- Paroxysmal same risk as persistent
- Thromboemboli originating from LAA

Stroke Risk Assessment in AF: CHADS<sub>2</sub> Score

<table>
<thead>
<tr>
<th>Clinical Parameter</th>
<th>Points</th>
<th>CHADS&lt;sub&gt;2&lt;/sub&gt; Score</th>
<th>Annual Stroke Risk %</th>
<th>NNT</th>
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<td>CHF</td>
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<tr>
<td>Hypertension</td>
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<td>1</td>
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<td>Age &gt; 75yo</td>
<td>1</td>
<td>2</td>
<td>4.0</td>
<td>81</td>
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<tr>
<td>Diabetes</td>
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<td>3</td>
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<tr>
<td>Stroke</td>
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<td>4</td>
<td>8.5</td>
<td>27</td>
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<tr>
<td>5 or 6</td>
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<td>5</td>
<td>12.18</td>
<td>44</td>
</tr>
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</table>

Gage et al., JAMA 2001; 285:2864.

Anticoagulation

- Overall
  - 62% reduction with warfarin
  - 19% with ASA
- AFFIRM
  - 80% of CVAs occurred after coumadin was stopped or was subtherapeutic

<table>
<thead>
<tr>
<th>CHADS&lt;sub&gt;2&lt;/sub&gt; Score</th>
<th>Events per 100 person-years</th>
<th>NNT</th>
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<tbody>
<tr>
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<td>2.50</td>
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<td>2.20</td>
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<tr>
<td>4</td>
<td>2.35</td>
<td>6.02</td>
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<tr>
<td>5 or 6</td>
<td>4.60</td>
<td>6.88</td>
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</table>

Gage et al., JAMA 2001; 285:2864.
Atrial Fibrillation-Anticoagulation


- Slow onset/offset
- Unpredictable dosing
- Drug/diet interactions
- Warfarin resistance (genetic)
- Narrow therapeutic index
- Routine monitoring
- Patient dissatisfaction (“rat poison”)
- Prescriber dissatisfaction

Dabigatran

- Direct thrombin inhibitor
  - Reversible binding
  - Free & clot-bound thrombin
- Inhibits platelet aggregation
- Inhibits tissue factor-induced thrombin generation
- Renally cleared
- No antidote

Warfarin Limitations

- Warfarin resistance (genetic)
- Narrow therapeutic index
- Routine monitoring
- Patient dissatisfaction (“rat poison”)
- Prescriber dissatisfaction

FDA-Approved Labeling

- Who it’s for:
  - Non-valvular AF patients for stroke prevention
- Who it’s NOT for:
  - Mechanical heart valves
  - PE
  - DVT
  - Prophylaxis for knee/hip replacements
  - HIT

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Management of AF

ANTITHROMBOTIC RX

AND

RHYTHM CONTROL

OR

RATE CONTROL

Rate Control

Atrial Fibrillation

Rate control – Drug Therapy

Digoxin – controls resting rate, OK in CHF patients.

Beta, Calcium channel blockers – controls resting and exercise rates.

Best therapy – combination of beta blocker and digoxin.

Primary Goal – Avoid Tachycardia Induced Cardiomyopathy

What is optimum rate control?

• AFFIRM trial
  • Resting heart rate less than 80 bpm
  • Peak heart rate less than 110 bpm

• RACE II

The NEW ENGLAND JOURNAL OF MEDICINE

Lenient versus Strict Rate Control in Patients with Atrial Fibrillation

Selected versus Strict Rate Control in Patients with Atrial Fibrillation

Kathleen C. Van Gelder, M.D., Marsha G. Guzowski, M.D., Henry M.T. Crandall, M.D., Karen J. Cowan, M.D., Marc T. Arnold, M.D., Jon D. U. Struthers, M.D., James A. Haines, M.D., Andrea L. L. Leong, M.D., Ph.D., Carol M. F. White, M.D., Peter J. W. Cartoon, M.D., Matthew H. Van Gelder, M.D., and the RACE Investigators
**RACE II**

- 614 patients
- Lenient Control (<110 bpm) versus strict control (<80 at rest, <110 at peak).
- Mean follow up 2 years.
- Primary Outcomes of death, CHF, stroke embolism, life threatening arrhythmias


**Rate Control**

- No significant difference in two groups


**Rhythm Control**

**Conversion of AF**

- Duration of AF is the best predictor of recurrent AF after cardioversion

Anticoagulation - Cardioversion

- Atrial stunning
  - Stunning can occur even with one hour of atrial fibrillation
  - If duration < 2 weeks, function may return within 24 hours to one week
  - If duration > 2 weeks, stunning may persist for one month

Cardioversion

- Less than 48 hours duration
  - Cardioversion without TEE
  - Heparin at time of cardioversion
  - Warfarin for a month and re-evaluation as outpatient

Cardioversion

- If greater than 48 hours
  - Option 1: Anticoagulate for 4 weeks and then cardiovert
  - Option 2: TEE and if no thrombus, cardiovert
    - If thrombus, 4 weeks warfarin and recheck
  - Anticoagulate for minimum of one month and re-evaluate

AFFIRM: Rate vs. Rhythm Control

All-Cause Mortality

<table>
<thead>
<tr>
<th>Time (years)</th>
<th>Rate N:</th>
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<th>0.068 adjusted</th>
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<td>0</td>
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<tr>
<td>4</td>
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</tr>
<tr>
<td>5</td>
<td>255</td>
<td></td>
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</tr>
</tbody>
</table>

4060 patients

Rate vs. Rhythm Control Trials: Implications

• AFFIRM demonstrated that a rate control “strategy” is an acceptable primary therapy in a selected high-risk subgroup of AF patients

• Continuous anticoagulation seems warranted in all patients with risk factors for stroke
  Asymptomatic recurrences

• AFFIRM did not define whether it is better to be in NSR.

Rhythm Control

ADVANTAGES
• Avoids electrical and anatomical remodeling
• Improves hemodynamics
• Enhanced exercise capacity
• Symptom relief
• Improves QOL
• Restores atrial transport
• Reduces thromboembolic events?

DISADVANTAGES
• Ventricular proarrhythmia
• Increased mortality?
• Drug-induced bradyarrhythmias
• End-organ toxicity
• Adverse effects
• Recurrences are likely
• Asymptomatic (silent) AF

CTAF Trial*: Maintenance of SR

Amiodarone 10 mg/kg/2 wk, 300 mg/4 wk, 200 mg/d (n=201)

Propafenone 300-450 mg/d (n=101)

Sotalol 160 mg BID or 80 mg TID (n=101)

* Excluded recurrence in first 21 days.

### AF Antiarrhythmic Therapy

- **Treatment goals**
  - ↓ frequency of recurrences
  - ↓ duration of recurrences
  - ↓ severity of recurrences
  - Not to abolish every episode
- **Safety is primary concern**
- **Minimize risk of proarrhythmia**

### Drug-Induced Proarrhythmia - Torsades

### Factors Which Influence Ventricular Proarrhythmia Risk

- Hypokalemia, hypomagnesemia
- Long QT at baseline
- CHF / Decreased EF
- Ventricular hypertrophy
- Bradycardia
- Female gender
- Reduced drug metabolism or clearance
- Amiodarone has lowest risk

### Alternatives to Drug Therapy

**“Non-Pharmacologic Therapy”**

- **Coumadin – LAA closure (Watchman)**
- **Rate Control – AVN RFA + PCMK**
- **AARx – Adjunctive AFL RFA**
- **AARX – Curative Afib RFA**
The Rational for the Watchman Device

Clean Left Atrial Appendage  Left Atrial Appendage Clot


Watchman®

- Efficacy of Watchman was non-inferior to warfarin for stroke prophylaxis in patients with non-valvular atrial fibrillation
- Higher rate of adverse events in the intervention group was mainly result of periprocedural complications
- Awaiting FDA approval


Pacemaker + AV Node Ablation

AVN RF Ablation
Objective Benefits of AV Nodal Ablation

AVN Ablation

Advantages:
- 100% efficacy
- 85% symptomatic improvement
- Improved EF (LV remodeling)
- Eliminates need for rate control drugs

Disadvantages:
- Pacemaker dependant

Good Candidates:
- Tachy / Brady Syndrome
- PPM present – CHF with BiV device
- Medication refractory / intolerant
- Elderly

IC Antiarrhythmic Induced Atrial Flutter
1:1 Conduction

Atrial Flutter Circuit
Approximately 15% of AF patients treated with an AARx will develop AFL

Advantages:
- 95% efficacy
- ≈ 80% arrhythmia control if AARx continued
- As primary Tx RFA more effective than AARx

Disadvantages: Invasive

Good Candidates:
- Typical AFL (IVC / TV isthmus)
- Primary or AARx related Atrial Flutter

94% of AF triggers from Pulmonary Veins

“90-95% of all AF is initiated by PV ectopy”

Comparison of Antiarrhythmic Drug Therapy and Radiofrequency Catheter Ablation in Patients with Paroxysmal Atrial Fibrillation: A Randomized Controlled Trial

JAMA 2010

Major Adverse Events: Ablation 4.9% vs. AARx 8.8%
Repeat Ablation in 12.6% of patients

Conclusion: Among patients with paroxysmal AF who had not responded to at least 3 antiarrhythmic drugs, the use of antiarrhythmic ablation compared with AARx resulted in a longer time to treatment failure during the 9-month follow-up period.

Hassaiguere M, NEJM, 1998
Current State of Curative Catheter-Based RFA
Who is a good candidate?

- Symptomatic / Frequent AF
- Limited Heart Dz
- \( EF > 35\% \)
- LA < 5.5cm
- No MS / Rheumatic Dz
- Younger Patients
- No LA thrombus or Hx of CVA
- Medically Refractory / Intolerant
  (Ablation now second line therapy)

New Technology Multielectrode Ablation Catheters

Catheter Positioning in Antrum of Left PVs

Balloon Technology

RSPV  LSPV

Stereotaxis Remote Magnetic Control
Atrial Fibrillation
New Technology / Studies at Ohio State University

<table>
<thead>
<tr>
<th>Stereotaxis – Magnetic Catheter Navigation</th>
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<tr>
<td>New Catheter Design / Energy Sources</td>
</tr>
<tr>
<td>High Intensity Focused Ultrasound (HIFU)</td>
</tr>
<tr>
<td>Ablation Frontiers – Circular Catheters</td>
</tr>
<tr>
<td>Cryoablation</td>
</tr>
<tr>
<td>Laser Ablation</td>
</tr>
<tr>
<td>Cabana trial – Drug vs Ablation (including primary therapy)</td>
</tr>
<tr>
<td>Watchman – Left Atrial Appendage Closure</td>
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<td>Surgical vs Catheter Ablation</td>
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