Atrial Fibrillation

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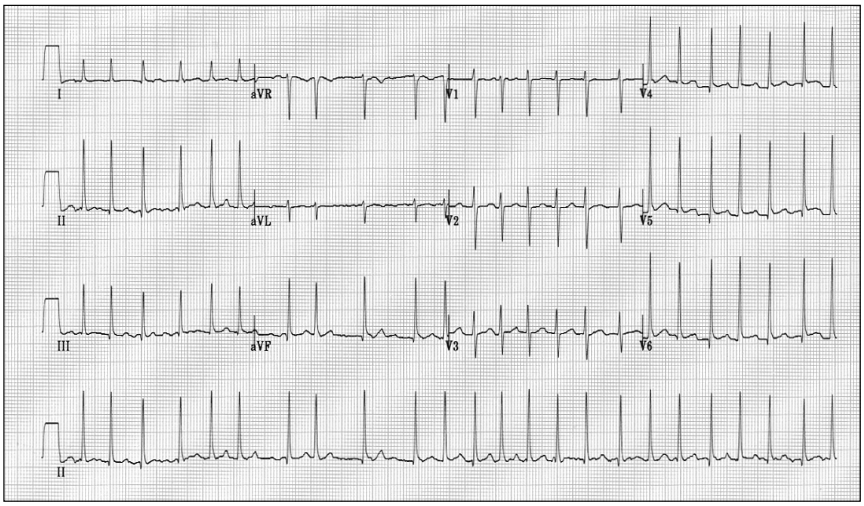
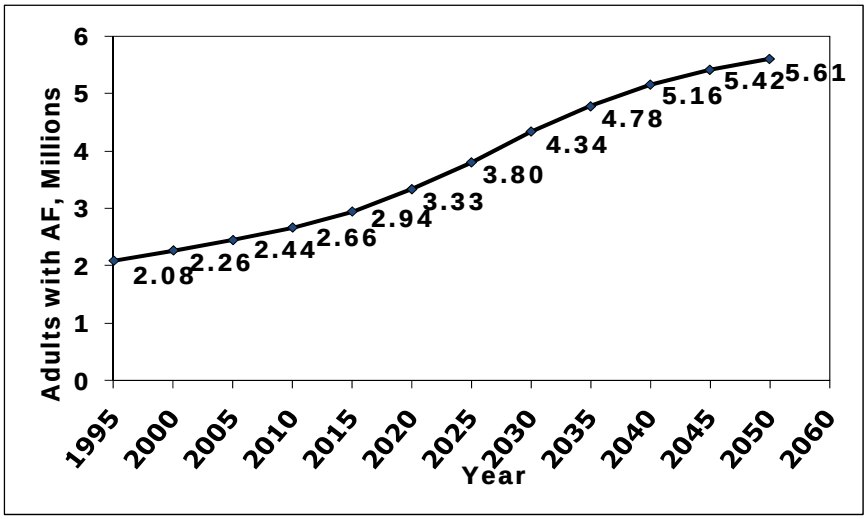
Learning Objectives

- **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**

Atrial Fibrillation



Projected Number of Adults With AF in the US



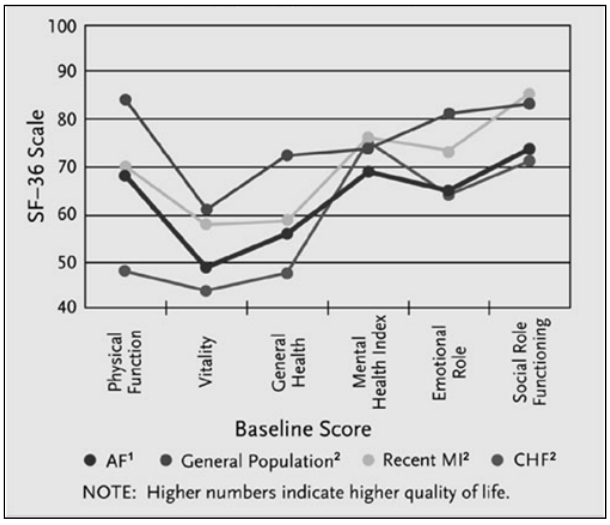
Go et al. *JAMA*. 2001;285:2370-2375.

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



[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

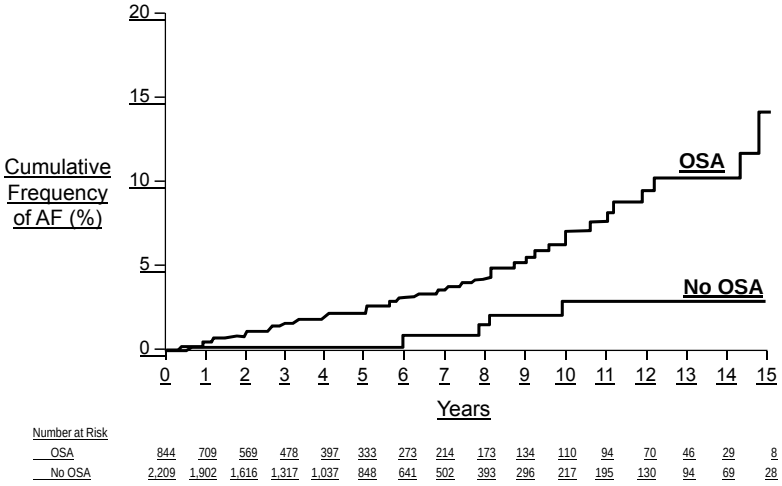
Diagnostic Evaluation

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



Number at Risk																
OSA	844	709	569	478	397	333	273	214	173	134	110	94	70	46	29	8
No OSA	2,209	1,902	1,616	1,317	1,037	848	641	502	393	296	217	195	130	94	69	28

Gami et al. *JACC* 2007;49:565-71

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

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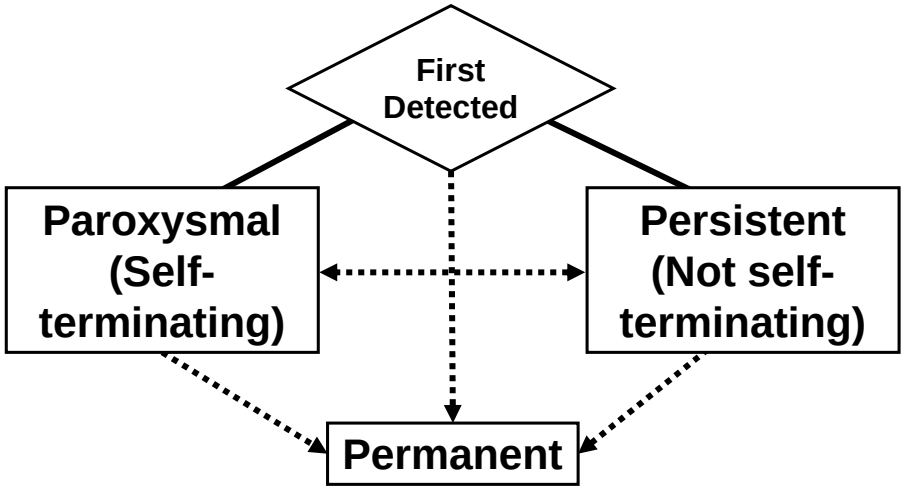
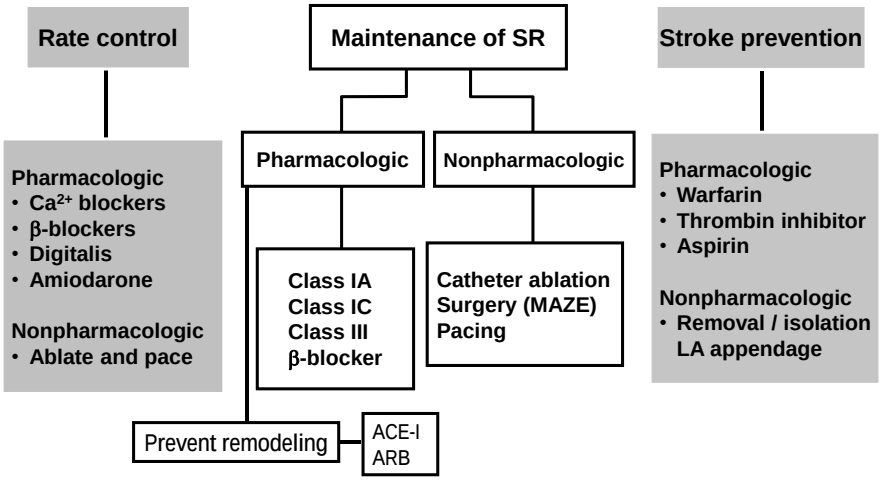
Heart Rhythm 2011; 8: 157-176.

Classification of Atrial Fibrillation ACC/AHA/ESC Guidelines



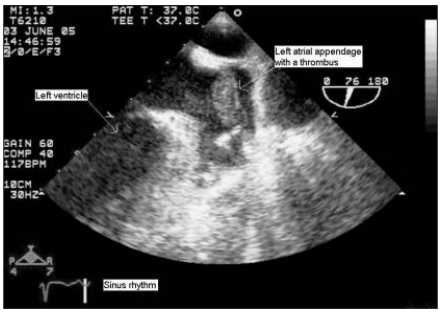
Treatment Options



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: $CHADS_2$ Score

Clinical Parameter	Points
CHF	1
Hypertension	1
Age > 75yo	1
Diabetes	1
Stroke	2

$CHADS_2$ Score	Annual Stroke Risk %	NNT
0	1.9	417
1	2.8	125
2	4.0	81
3	5.9	33
4	8.5	27
5 or 6	12-18	44

Gage et al, JAMA 2001; 285:2864.

Stroke Risk Assessment in AF: $CHADS_2$ Score

Clinical Parameter	Points
CHF	1
Hypertension	1
Age > 75yo	1
Diabetes	1
Stroke	2

$CHADS_2$ Score	Treatment
0	ASA
1	ASA or Warfarin (INR 2-3)
2+	Warfarin (INR 2-3)

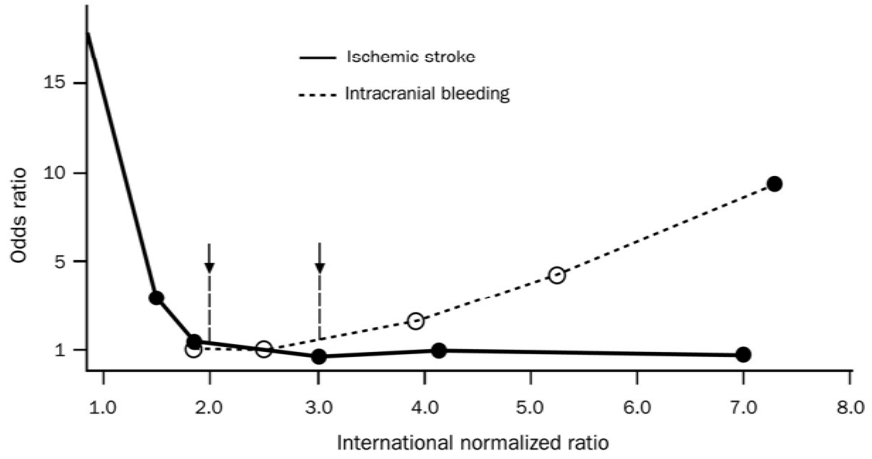
Gage et al. JAMA 2001; 285:2864.

Anticoagulation

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

CHADS2 Score	Events per 100 person-years		NNT
	Warfarin	No Warfarin	
0	0.25	0.49	417
1	0.72	1.52	125
2	1.27	2.50	81
3	2.20	5.27	33
4	2.35	6.02	27
5 or 6	4.60	6.88	44

Atrial Fibrillation-Anticoagulation



Hylek EM and Singer DE. Ann Intern Med. 1994;120(11):897-902.

Warfarin Limitations

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

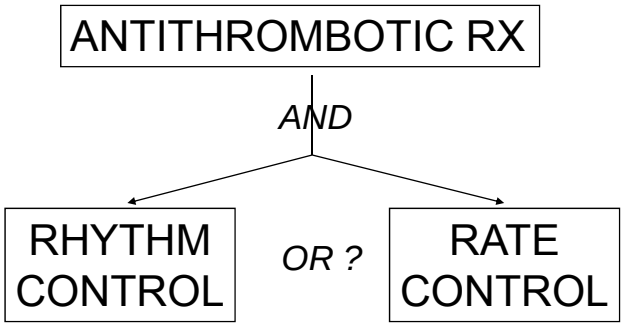
Dabigatran

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

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

Management of AF



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**

Lenient versus Strict Rate Control in Patients with Atrial Fibrillation

Isabelle C. Van Gelder, M.D., Hessel F. Groenveld, M.D., Harry J.G.M. Crijns, M.D., Ype S. Tuininga, M.D., Jan G.P. Tijssen, Ph.D., A. Marco Alings, M.D., Hans L. Hillege, M.D., Johanna A. Bergsma-Kadijk, M.Sc., Jan H. Cornel, M.D., Otto Kamp, M.D., Raymond Tukkie, M.D., Hans A. Bosker, M.D., Dirk J. Van Veldhuisen, M.D., and Maarten P. Van den Berg, M.D., for the RACE II Investigators*

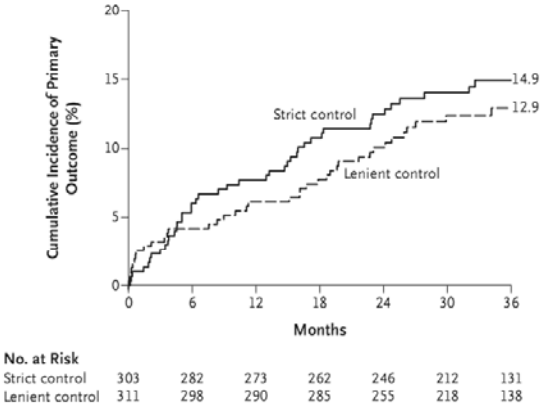
RACE II

- **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**

The RACE II Investigators. *N Engl J Med.* 2010;362: 1363-1373.

Rate Control

- **No significant difference in two groups**

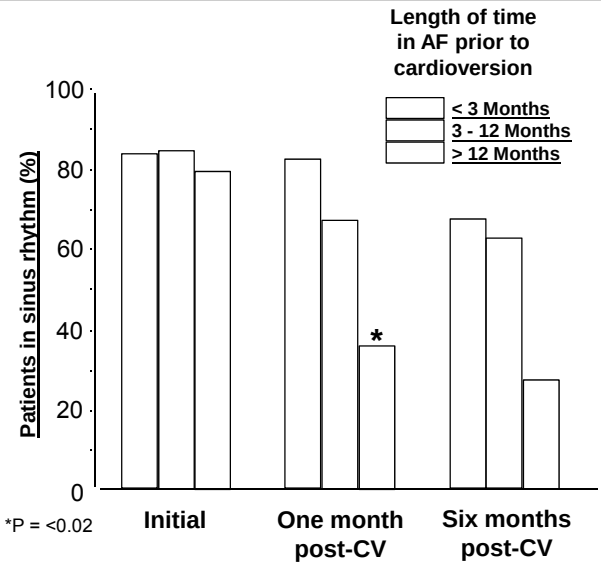


The RACE II Investigators. *N Engl J Med.* 2010;362:.

Rhythm Control

Conversion of AF

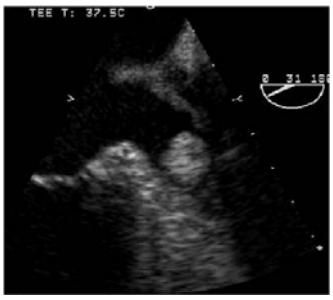
Duration of AF is the best predictor of recurrent AF after cardioversion



Dittrich HC. Am J Cardiol. 1989;63:193-197.

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**



Mattioli, AV. et al. Am J Cardiol 1998; 82:1368.

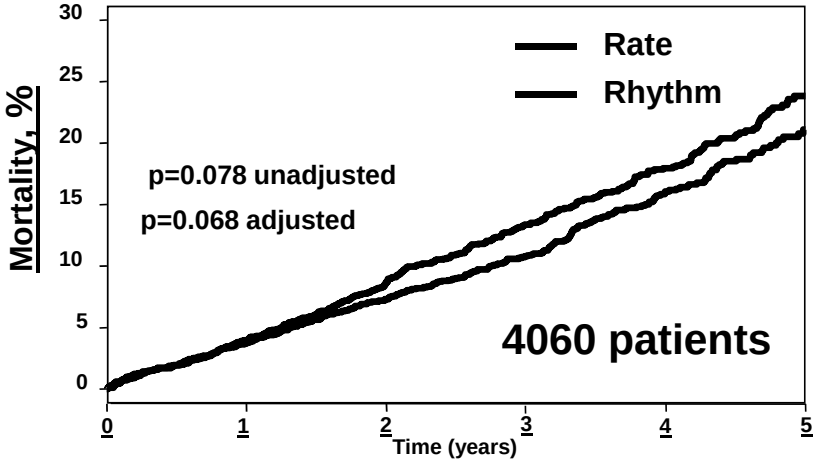
Cardioversion

- **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



Rhythm N:	2033	1932	1807	1316	780	255
Rate N:	2027	1925	1825	1328	774	236

The AFFIRM Investigators. *N Engl J Med.* 2002;347:1825-1833.

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 <u>not</u> define whether it is better to be in NSR.**

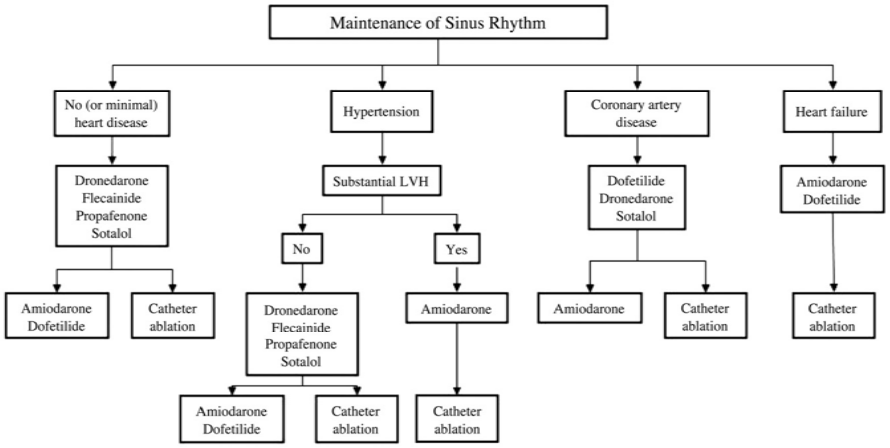
Rhythm Control

ADVANTAGES

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

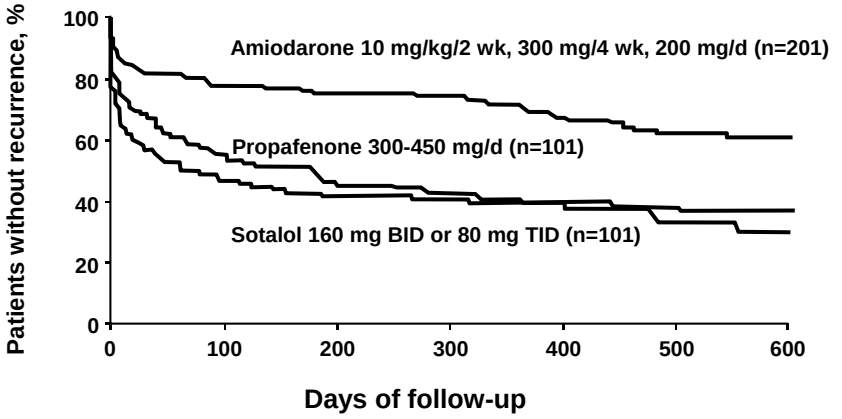
DISADVANTAGES

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



Heart Rhythm 2011; 8: 157-176.

CTAF Trial*: Maintenance of SR



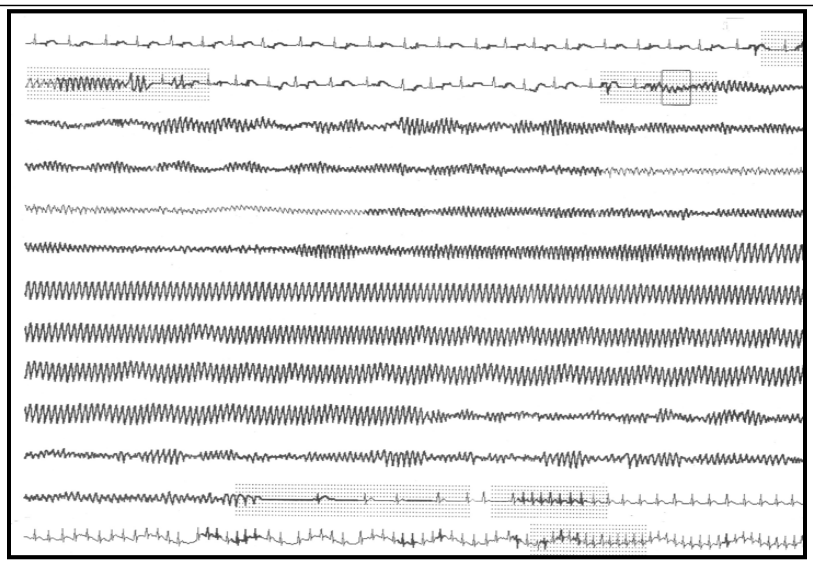
* Excluded recurrence in first 21 days.

Roy D, et al. *N Engl J Med*. 2000;342:913-920.

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

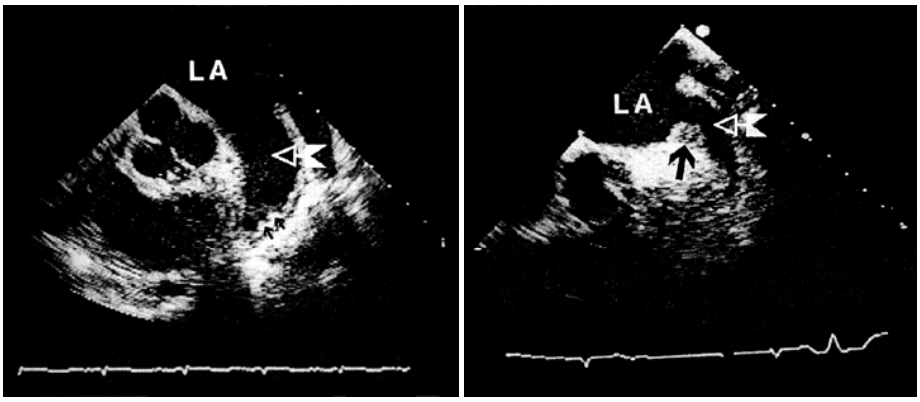
- Hypokalemia, hypomagnesemia
- Long QT at baseline
- CHF / Decreased EF
- Ventricular hypertrophy
- Bradycardia
- Female gender
- Reduced drug metabolism or clearance
- Amiodarone has lowest risk

Alternatives to Drug Therapy "Non-Pharmacologic Therapy"

- ❑Coumadin – LAA closure (Watchman)
- ❑Rate Control – AVN RFA + PCMK
- ❑AARx – Adjunctive AFL RFA
- ❑AARX – Curative Afib RFA

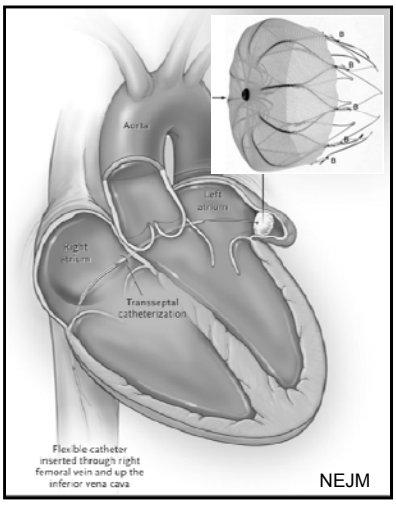
The Rational for the Watchman Device

Clean Left Atrial Appendage **Left Atrial Appendage Clot**



Manning WJ. N Engl J Med. 1993;328:750-755.

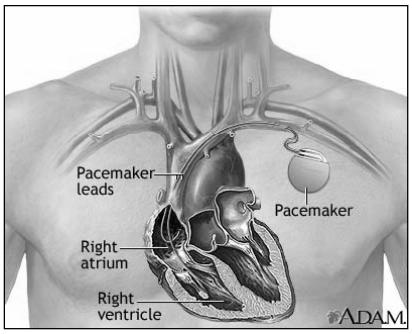
Watchman®

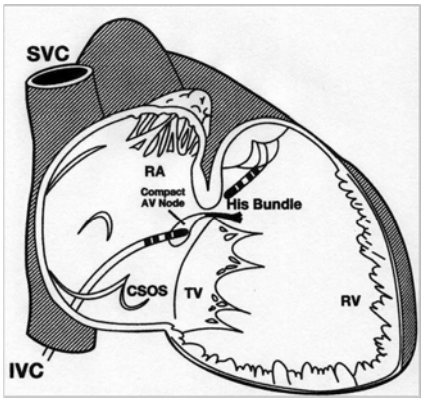


- Efficacy of Watchman was **non-inferior** to warfarin for stroke prophylaxis in patients with non-valvular atrial fibrillation
- Higher rate of adverse events in the intervention group was mainly result of periprocedural complications
- Awaiting FDA approval

Holmes et al. Lancet 2009; 374: 534-42.

Pacemaker + AV Node Ablation

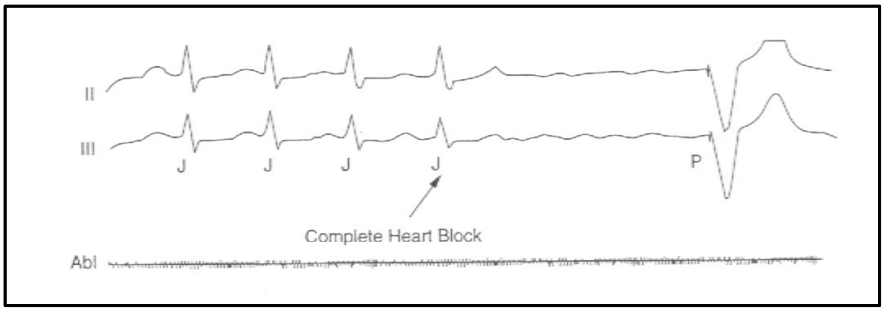




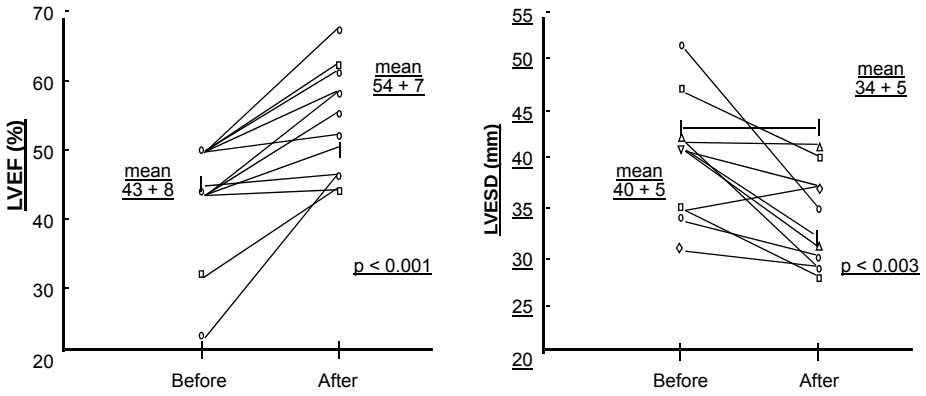
http://www.nlm.nih.gov/medlineplus/ency/images/ency/fullsize/19566.jpg

http://www.heartrhythmcenter.com/myweb2/av_nodal_ablation2.htm

AVN RF Ablation



Objective Benefits of AV Nodal Ablation



A Left ventricular ejection fraction (%)

B Left ventricular end systolic diameter (mm)

Rodriguez LM. Am J Cardiol. 1993;72:1137-1141.

AVN Ablation

Advantages:

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

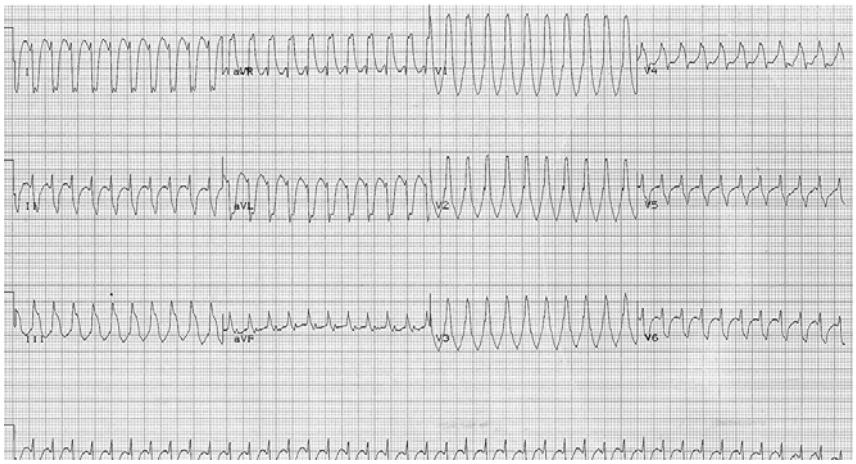
Disadvantages:

Pacemaker dependant

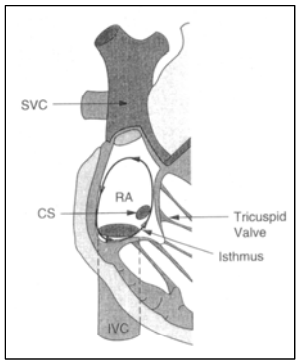
Good Candidates:

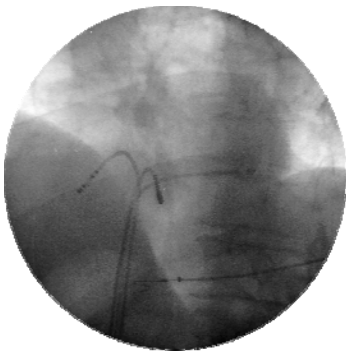
Tachy / Brady Syndrome
PPM present – CHF with BiV device
Medication refractory / intolerant
Elderly

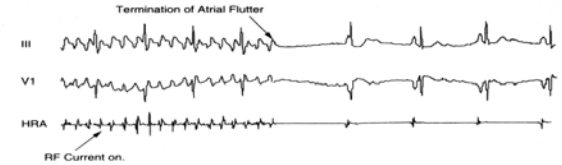
IC Antiarrhythmic Induced Atrial Flutter 1:1 Conduction



Atrial Flutter Circuit







Atrial Flutter Ablation

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:

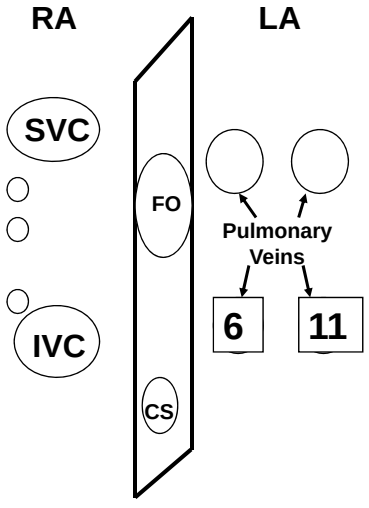
Typical AFL (IVC / TV isthmus)

Primary or AARx related Atrial Flutter

Focal Origin of Atrial Fibrillation

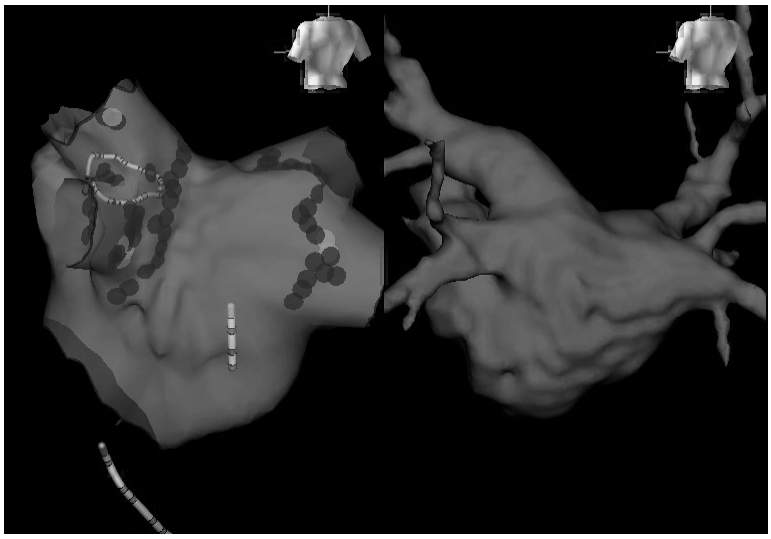
Hassaiguerre M, NEJM, 1998

- **94% of AF triggers from Pulmonary Veins**
- **"90-95% of all AF is initiated by PV ectopy"**

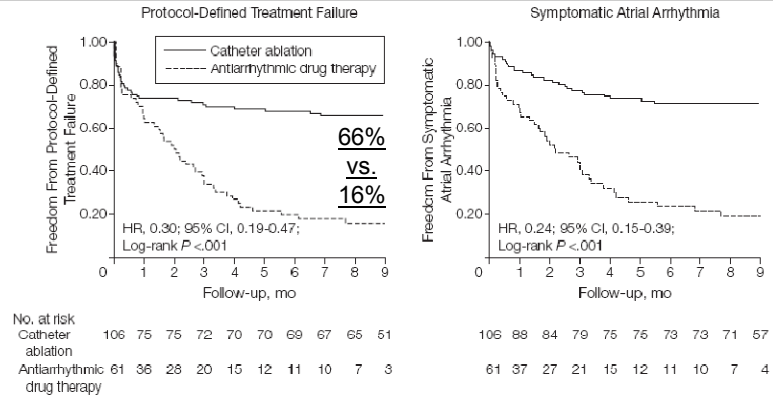


Atrial Fibrillation Ablation

Atrial Shell Cardiac MRI



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



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

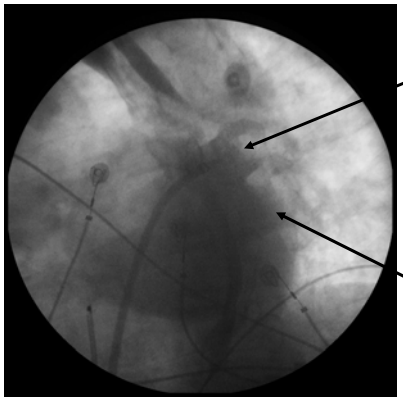
Conclusion Among patients with paroxysmal AF who had not responded to at least 1 antiarrhythmic drug, the use of catheter ablation compared with ADT resulted in a longer time to treatment failure during the 9-month follow-up period.

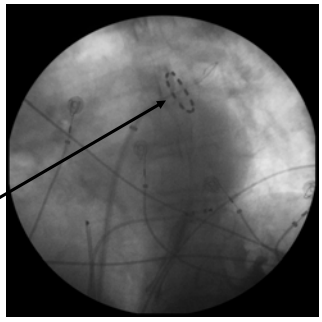
JAMA 2010

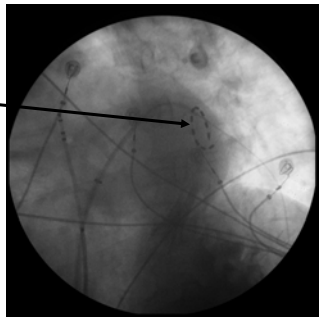
Current State of Curative Catheter-Based RFA Who is a good candidate?

- 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



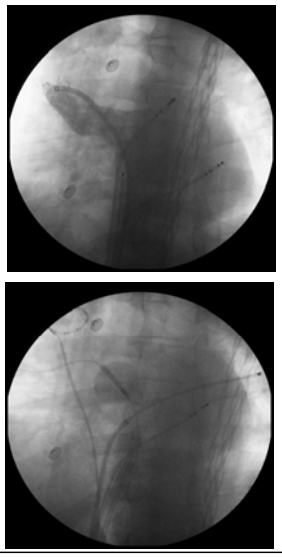




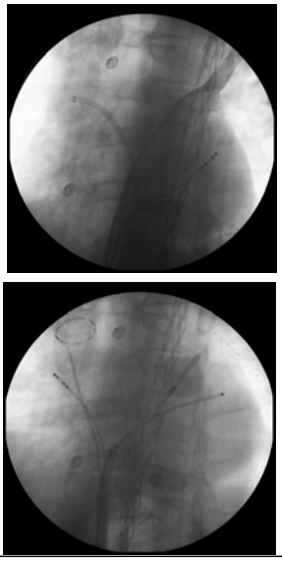
Catheter Positioning in Antrum of Left PVs

Balloon Technology

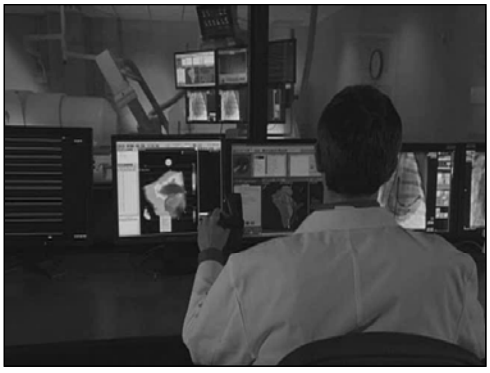
RSPV

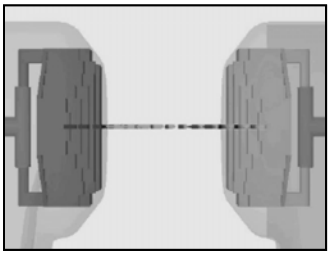


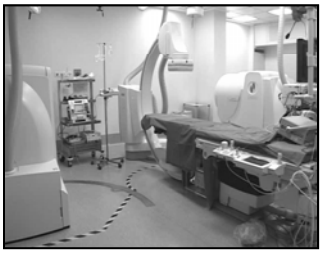
LSPV



Stereotaxis
Remote Magnetic Control







Atrial Fibrillation

New Technology / Studies at Ohio State University

Stereotaxis – Magnetic Catheter Navigation

New Catheter Design / Energy Sources

- **High Intensity Focused Ultrasound (HIFU)**
- **Ablation Frontiers – Circular Catheters**
- **Cryoablation**
- **Laser Ablation**

Cabana trial – Drug vs Ablation (including primary therapy)

Watchman – Left Atrial Appendage Closure

Surgical vs Catheter Ablation