Atrial Fibrillation: Acute, Chronic, and Post-Operative

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AHA/ACC/HRS Practice Guidelines
http://circ.ahajournals.org

Case Vignette
A 75 year old woman with PMHx of HTN, HLD and DM, CKD presents to ED for new onset dizziness, shortness of breath and palpitations that began 3 hours ago while patient was gardening in her lawn. She denies any associated chest pain and no actual loss of consciousness.

Vital Signs: T: 37.5 C, BP 90s/60s (Baseline BP 115/80s), HR 140s-160s bpm and RR 24.
A&O x3 with facial grimmace
Cardiac exam: Irregular S1, S2, gr I/VI systolic murmur LSB, no gallop
Lungs CTA
Remainder of exam unremarkable.
She received a 2L bolus in the ED without increase in blood pressure

What is the next appropriate management for this patient?
A) IV diltiazem
B) Intubation
C) Urgent cardioversion
D) IV pain control
E) CT pulmonary angiogram

Question #1
An 82 year old man presents to ED for c/o right hip pain. What is the chance he has atrial fibrillation?
1. 1%
2. 5%
3. 10%
4. 25%

Prevalence of Diagnosed AF
Stratified by Age and Sex

Prevalence of Diagnosed AF
Stratified by Age and Sex

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Question #1

An 82 year old man presents to ED for c/o right hip pain. What is the chance he has atrial fibrillation?

1. 1%
2. 5%
3. 10%
4. 25%

Incidence of AF

<table>
<thead>
<tr>
<th>Index Age, yrs</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>26.0% (24.0–27.0)</td>
<td>23.0% (21.0–24.0)</td>
</tr>
<tr>
<td>50</td>
<td>23.9% (23.9–27.0)</td>
<td>23.2% (21.3–24.3)</td>
</tr>
<tr>
<td>60</td>
<td>23.8% (23.7–26.9)</td>
<td>23.4% (21.4–24.4)</td>
</tr>
<tr>
<td>70</td>
<td>24.3% (23.1–25.5)</td>
<td>23.0% (20.9–24.1)</td>
</tr>
<tr>
<td>80</td>
<td>22.7% (20.1–24.1)</td>
<td>21.6% (19.3–22.7)</td>
</tr>
</tbody>
</table>

1 in 4 Men & women >40 Years will develop AF

Lifetime risk if currently free of AF


Question #2

A 46 year old male patient presents to the ED with chest discomfort. What is his lifetime risk of developing AF?

1. 1%
2. 5%
3. 10%
4. 25%

Prevalence and Incidence of Atrial Fibrillation (AF)

- AF is the most common arrhythmia, affecting >2.7-6.2 million Americans
- approximately 1% of patients with AF are <60 years of age
- up to 12% of patients with AF are 75 to 84 years of age
- more than one third of patients with AF are ≥80 years of age
- Prevalence of AF begins to increase after age 40, and rises rapidly after age 65
- AF occurs in 7-14% of the elderly
- Median age of patients with AF is ~ 75 yrs
- AF is more prevalent in men than women

Prevalence of AF in HF trials

The more severe the HF, the higher the incidence of AF.
What are the most common conditions associated with AF?

10 Most Common Comorbid Chronic Conditions Among Medicare Beneficiaries With AF

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Hypertension</td>
<td>65.0%</td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>65.0%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>62.1%</td>
</tr>
<tr>
<td>HF</td>
<td>51.4%</td>
</tr>
<tr>
<td>Aneurysm</td>
<td>42.3%</td>
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<tr>
<td>Arthritis</td>
<td>35.8%</td>
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<tr>
<td>Diabetes mellitus</td>
<td>35.5%</td>
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<tr>
<td>CHF</td>
<td>32.3%</td>
</tr>
<tr>
<td>COPD</td>
<td>23.2%</td>
</tr>
<tr>
<td>Colorectal</td>
<td>22.5%</td>
</tr>
</tbody>
</table>

OSA, increased PR-interval

Mechanisms of AF

More AF FACTOIDS

Clinical Implications AF Associated with...

- 5-fold increased risk of stroke
- Stroke likely to be more severe than non-AF related stroke
- 3-fold risk of HF
- 2-fold increased risk of dementia and mortality
- Hospitalizations with AF as primary dx >467,000 annually
- Increased hospital admissions; Increased in-hospital mortality
- Other risk factors such as previous TIA, stroke or systemic embolism, poor left ventricular function, age >75 years, hypertension, coronary artery disease, diabetes or thyrotoxicosis increase the risk of stroke associated with atrial fibrillation

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
Consequences of AF

- Hemodynamic instability
- Complaints and symptoms
  - fatigue, palpitations, dyspnea, hypotension, syncope
- Reduced cardiac function; hemodynamic changes; shorten diastolic filling time
- Decrease CPP (coronary perfusion pressure); Lose atrial contribution to filling-ventricles maintain higher pressure
- Asymptomatic pt can rapidly become symptomatic
  - tachycardia-induced ventricular dysfunction and HF(tachycardia-induced cardiomyopathy) when the ventricular rate is not adequately controlled

Prevalence of Symptoms


Guideline Recommendations

- Initial clinical evaluation
- Preventing thromboembolism
- Rate control
- Rhythm control
What’s in a Name?

Types & Classification of Atrial Fibrillation

Temporal Pattern

Acute
- 24-48 hours
- anticoagulation not needed
- high success rate of cardioversion

Paroxysmal
- recurrent
- resolving spontaneously, or following Rx to sinus rhythm

Persistent
- continuous AF that is sustained >7 days
- long-standing persistent AF
- Continuous AF >12 ms in duration
- Permanent AF
- used when the patient and clinician make a joint decision to stop further attempts to restore and/or maintain sinus rhythm

Definitions of AF: A Simplified Scheme

- Paroxysmal AF
  - AF that terminates spontaneously or with intervention within 7 d of onset
  - Episodes may recur with variable frequency
- Persistent AF
  - Continuous AF that is sustained >7 d
- Long-standing persistent AF
- Continuous AF >12 ms in duration
- Permanent AF
- used when the patient and clinician make a joint decision to stop further attempts to restore and/or maintain sinus rhythm
- Nonvalvular AF
  - AF in the absence of rheumatic mitral stenosis, a mechanical or bioprosthetic heart valve, or mitral valve repair

Post-Operative AF

- High prevalence (20-45%)
- Complications
  - Increased cost/length of stay
  - ~$10,000+/patient
  - Adding ~ 5 days
- Symptoms
  - Adverse hemodynamics
  - Risk of CVA
  - Increased mortality?

AF Onset After Cardiac Surgery Timing


Post OP AF: Definition & Etiologies/Treatments

- New-onset AF within 30 days of surgery
- Excessive adrenergic tone
  - Beta-blockers
- Pericarditis/Inflammatory response
  - Steroids
  - Omega-3
  - Acellular matrix
- Atrial myopathy/fibrosis-reentry
  - Antiarrhythmic agents
  - Pacing
Post OP AF: Definition & Etiologies/Treatments (con’t)

- Ischemia
- Beta and calcium channel blockers
- Nitrates
- Electrolyte imbalance
- Magnesium and potassium
- Multi-factorial

New-Onset Atrial Fibrillation Predicts Long-term Mortality after CABG

- 1996-2007 Emory-16,169 isolated CABG
- Mortality from Social Security Death Index
- New onset post-op AF: 2,2985 (18.5%)
- Multivariate analysis with 32 covariates
- Found an independent association (not causal effect) between post-op AF and a 21% relative increase in mortality
  - Within the group of post-op AF pts, warfarin therapy resulted in a 22% relative reduction in mortality

JACC 2010;55:1370

AF After Cardiac Surgery Clinical Risk Factors

- Older age
- Previous history of AF
- Pre-op atrial dilatation
- Post-op increase in atrial pressures
- Withdrawal of pre-op β-blockers

Therapies that do not inhibit beta-receptors are ineffective

- Quinidine/Proacilamide
- Dioxin
- Calcium channel blockers
- Nitrates
- Electrolytes: K/Mg

Treat with pre-op beta blockers(preferred); if intolerant/contraindicated then amiodarone, sotolol

Post-Operative AF Clinical Care Pathway

- Nurses initiate protocol
- With AF >30 min begin:
  - IV Diltiazem for HR >110
  - Amiodarone 400 mg TID x 3 days then 200 mg qd x 2-4 weeks
  - IV heparin if AF persists>4 hours
    - LMWH/Dabigatran(difficult to reverse)
  - NPO; consult cardiology/EP
  - Arrange CV within 12 hours

Survival Curves Stratified by New-Onset Post-Operative AF

- 1 yr
- 10 yr
- Yes AF
- No AF
- 90% vs 90%
- 70% vs 55%
Post CV

- AF stops <12 hours, often no other therapy
- For AF > 12 hours then CV
  - Continue Amiodarone for 2-4 weeks after restoration of SF
- If AF recurs after successful CV and pt ready for discharge, then rate control + Coumadin + amiodarone and repeat CV in about 2-3 weeks
- Continue Amiodarone for 2-4 weeks after restoration of SF
- Anticoagulation to continue for 4-8 weeks after stopping amiodarone

After Discharge

- 30-day event monitor - 4 weeks after stopping amiodarone, but before stopping Coumadin
- Screen for Afib in absence of antiarrhythmic drug and beyond Post-Operative state

Treatment Options

Or now what?

Management Objectives

- Stabilize patient as indicated
- Determine underlying cardiac disease
  - Primary AF vs Secondary AF
- Achieve rate control
- Restore sinus rhythm vs rate control
  - look at associated comorbidities
- ??? how long in AF—new onset?? chronic???

Acute Management

- Presentation depends on LV function
- May be asymptomatic -- acute pulmonary edema
- Options for treatment
  - Rate control
  - Cardioversion
  - AV junction ablation with pacemaker
Case Revisited

What is the next appropriate management for this patient?

A) IV diltiazem
B) Intubation
C) Urgent Cardioversion
D) IV pain control
E) CT pulmonary angiogram

Indications for Urgent Direct Cardioversion

- Hemodynamic Instability:
  - Patient with decompensated heart failure
  - Active ischemia: if symptomatic with angina or evidence of ischemia/infarction on EKG
  - Evidence of organ hypoperfusion (altered mental status, cold clammy skin, acute kidney injury)
  - Restoration of NSR takes precedence over need for protection from thromboembolic risk

If Patient is Hemodynamically Stable

- Goal is ventricular rate control (<100 bpm) and anticoagulation
- Resting HR goal should be 60-85 bpm in asymptomatic patient
- Roughly 50% of patients with new onset AF will spontaneously convert to NSR spontaneously within 48 hours of onset—frequent in those without structural heart disease
- Rate control or Rhythm control?
- AFFIRM trial and RACE trial
  - No survival advantage in terms of stroke prevention rhythm control over rate control rate control
- Rate control agents:
  - Calcium Channel Blockers
  - Beta blockers (caution in patients with reactive airway disease)
  - Digoxin
  - Amiodarone (for patients intolerant or unresponsive to other agents)

AFFIRM AF Follow-up Investigation of Rhythm Management

- 4060 pts randomized to rate control or rhythm control—primary endpoint overall mortality
- Rate control:
  - Digoxin, beta-blocker &/or diltiazem (don’t use dig by itself)
  - rhythm control:
  - Amiodarone, sotalol, propafenone
- 3.5 years more deaths in rhythm control group
- Rate control + <80 BPM at rest; <115 with exercise

Drug | Labeled | Loading Dose | Maintenance Dose
--- | --- | --- | ---
Diltiazem | Dihydropyridine blockers (nifedipine, amlodipine) not effective; avoid in HFrEF | 10 mg IV over 2 minutes Can repeat up to 20 mg IV | 30 mg PO q6 hrs (can transition to long acting) Can use 10 mg IV q6 hrs prn
Metoprolol | Short duration of action, easy to titrate to HR goal | 5 mg IV x 3 doses | 25 mg PO BID, can up titrate to 100mg PO BID
Esmolol | Short duration of action, easy to titrate to HR goal | 500 mcg/kg IV over 1 min, can repeat in 5 minutes | 25 mg PO QD
Amiodarone | Can promote cardioversion need to be on anticoagulation, preferred in WPW | 150 mg IV/10 min → 1mg/min x 6 hrs → 0.5 mg/min x 18 hrs | 100-200 mg PO QD
Digoxin | Not effective, takes days to be therapeutic, rarely used as monotherapy; caution in elderly; avoid WPW | 0.5 mg IV loading dose → 0.25mg IV in 6 hrs → 0.25mg IV 6 hrs after | 0.125 mg PO QD
Pre-excited AF in WPW

IV Digitalis

- Limited direct effects on AV nodal conduction
- Most effects are via cardiac innervation
- Not effective in cases of high sympathetic tone
- Delay in action up to 60 min
  - Full effect obtained only after 6 hours
- Risk of drug interactions and toxicity


Digoxin for Pharmacologic Conversion of Recent-Onset AF

A Randomized, Double-blind, Placebo-Controlled Trial


Factoid

Increased All-Cause Mortality Associated With Digoxin Therapy in Patients With Atrial Fibrillation: An Updated Meta-Analysis

Diagnostic Workup

- 2D echo; TEE
- Telemetry, even recorder
- Thyroid profile
- GXT - r/o ischemic origin
- Lytes
- Other tests as indicated by history and physical exam
  - Sleep study, pulmonary evaluation

Treatment Options: Electrical or Pharmacological Cardioversion

- For patients with AF or atrial flutter of 48 hours’ duration or longer or when duration of AF is unknown, anticoagulation with dabigatran, rivaroxaban, or apixaban is reasonable for at least 3 weeks before and 4 weeks after cardioversion (IIb)
- For patients with AF or atrial flutter of less than 48 hours’ duration who are at low thromboembolic risk, anticoagulation (intravenous heparin, LMWH, or a new oral anticoagulant) or no antithrombotic therapy may be considered for cardioversion, without the need for postcardioversion oral anticoagulation
- With AF or atrial flutter <48 h and high stroke risk, IV heparin or LMWH, or factor Xa or direct thrombin inhibitor, is recommended before or immediately after cardioversion, followed by long-term anticoagulation

48 hours—myth

- Need to look at risk factors
- No recent embolic event
- No MV (rheumatic) disease

CH\textsubscript{A2}DS\textsubscript{2}-VASc

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Score</th>
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<tr>
<td>Congestive heart failure/LV dysfunction</td>
<td>1</td>
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<tr>
<td>Hypertension</td>
<td>1</td>
</tr>
<tr>
<td>Age 75+</td>
<td>2</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>1</td>
</tr>
<tr>
<td>History of TIA/Stroke</td>
<td>2</td>
</tr>
<tr>
<td>Vascular disease (prior myocardial infarction, peripheral artery disease, or aortic plaque)</td>
<td>1</td>
</tr>
<tr>
<td>Age 65–74</td>
<td>1</td>
</tr>
<tr>
<td>Sex category (i.e., female gender)</td>
<td>1</td>
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CH\textsubscript{A2}DS\textsubscript{2} - Congestive heart failure/LV dysfunction (2010)
CHADS2 -> CHA2DS2-VASc

<table>
<thead>
<tr>
<th>CHADS2 Risk</th>
<th>Score</th>
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<tbody>
<tr>
<td>CHF</td>
<td>1</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1</td>
</tr>
<tr>
<td>Age &gt; 75</td>
<td>1</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1</td>
</tr>
<tr>
<td>Stroke or TIA</td>
<td>2</td>
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<table>
<thead>
<tr>
<th>CHA2DS2-VASc Risk</th>
<th>Score</th>
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<tbody>
<tr>
<td>CHF or LVEF ≤ 40%</td>
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<tr>
<td>Hypertension</td>
<td>1</td>
</tr>
<tr>
<td>Age &gt; 75</td>
<td>2</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1</td>
</tr>
<tr>
<td>Stroke/TIA/Vascular Disease</td>
<td>1</td>
</tr>
<tr>
<td>Age 65-74</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
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Bleeding Risk Scores in AF

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<tr>
<th>ATRIA</th>
<th>HAS-BLED</th>
<th>HEMORR-HAGES</th>
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<tr>
<td>Atrial fibrillation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Severe renal disease</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Age &gt; 75 yrs</td>
<td>2</td>
<td>1</td>
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<tr>
<td>Hypertension</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Diabetes</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Stroke</td>
<td>1</td>
<td>1</td>
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</tbody>
</table>

Characteristics | Warfarin | Dabigatran | Apixaban | Rivaroxaban | Betrixaban | Eliquis |
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<tr>
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<tr>
<td>Body weight (kg)</td>
<td>3.8</td>
<td>420</td>
<td>400</td>
<td>420</td>
<td>422</td>
<td>548</td>
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<td>Body mass index (BMI)</td>
<td>20-25</td>
<td>26-29</td>
<td>30-34</td>
<td>35-39</td>
<td>40-44</td>
<td>45+</td>
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<td>Gender</td>
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<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
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<tr>
<td>Age (years)</td>
<td>60-70</td>
<td>70-79</td>
<td>80-89</td>
<td>90-99</td>
<td>≥100</td>
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<tr>
<td>Concomitant use of drugs</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Monitoring required</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<td>Target INR</td>
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<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
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<td>Renal function</td>
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<td>Moderate</td>
<td>Severe</td>
<td>Normal</td>
<td>Moderate</td>
<td>Severe</td>
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<td>Warfarin therapy</td>
<td>INR not reached</td>
<td>INR not reached</td>
<td>INR not reached</td>
<td>INR not reached</td>
<td>INR not reached</td>
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<tr>
<td>Dabigatran</td>
<td>3.5 or 7.5 mg BID</td>
<td>3.5 or 7.5 mg BID</td>
<td>3.5 or 7.5 mg BID</td>
<td>3.5 or 7.5 mg BID</td>
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<tr>
<td>Apixaban</td>
<td>2.5 mg BID</td>
<td>2.5 mg BID</td>
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<td>2.5 mg BID</td>
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<tr>
<td>Rivaroxaban</td>
<td>10 mg QD</td>
<td>10 mg QD</td>
<td>10 mg QD</td>
<td>10 mg QD</td>
<td>10 mg QD</td>
<td>10 mg QD</td>
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<tr>
<td>Betrixaban</td>
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<td>5.0 mg BID</td>
<td>5.0 mg BID</td>
<td>5.0 mg BID</td>
<td>5.0 mg BID</td>
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<tr>
<td>Eliquis</td>
<td>2.5 mg BID</td>
<td>2.5 mg BID</td>
<td>2.5 mg BID</td>
<td>2.5 mg BID</td>
<td>2.5 mg BID</td>
<td>2.5 mg BID</td>
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Lowest Effective Intensity for Warfarin Therapy

INR Odds Ratio

1.0 2.0

1.5 2.0

1.3 3.0

1.0 1.5 2.0 3.0 4.0 5.0 6.0

INR

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Early Cardioversion

- More rapid recovery from AF
- <2 weeks atrial recovery rapid
- >6 weeks ~ 1 month atria to recover
- Check peak A wave velocity
- Thrombus in ~12% atrial appendage
- Need INR >2.5
  - Lower risk of embolic event

AF Recurrence After Electrical Conversion

Detection of LA and LAA Thrombus

- LA and LAA are immediately anterior to the esophagus
- High-frequency, multiplane transducers are available
- Sensitivity and specificity of TEE for LA and LAA (left atrial appendage) thrombi range from 93 to 100%
- Short-term IV heparin is given in conjunction with the TEE exam

Multiple Thrombi in AF

- Decreased LAA velocities (<20 cm/s) (fibrillatory waves)
- Thrombus
  - Give Coumadin; 10-12% mortality
- Sludge
  - Thrombotic risk similar to thrombus
- Embolic events can still occur even though thrombus not identified—need to anticoagulate prior and post

Detection of LA and LAA Thrombus

- LA and LAA are immediately anterior to the esophagus
- High-frequency, multiplane transducers are available
- Sensitivity and specificity of TEE for LA and LAA (left atrial appendage) thrombi range from 93 to 100%
- Short-term IV heparin is given in conjunction with the TEE exam
Bridging anticoagulation for interruption of warfarin with AF

- BRIDGE trial
  - Excluded pt groups at high risk of stroke
  - 97% had CHADS2 score of 4 or less
  - Need more data so need to bridge
  - Results suggest that pts at moderate risk, do not benefit from bridging
  - Canadian Hematology Society suggests that bridging not be offered unless the thrombotic risk exceeds the bleeding risk

Rate Control

Goals of rate control:

- normal stroke volume
- absence of a pulse deficit
  - presence indicates that cardiac stroke output is significantly impaired
- ventricular rate below 100 BPM??

Lenient vs. Strict Rate Control

- **Lenient rate control was non-inferior**
- **Strict:** HR <80 bpm at rest, <110 bpm with moderate exercise
- **Lenient:** <110 bpm at rest

Common Misconceptions: Pharmacologic Cardioversion

- Pharmacologic cardioversion does not require anticoagulation.
- Patients being considered for pharmacologic conversion should undergo the same anticoagulation regimen as patients undergoing electrical conversion.
- Antiarrhythmic medications should not be administered until the appropriate duration of anticoagulation has been completed
When to Use Pharmacologic Conversion

- Low-risk patients
- Recent-onset AF
- Monitored setting
- Caution with some drugs in women (i.e., greater risk of torsade de pointes)

Propafenone (Rhythmol®)

- Single oral loading dose of 600 mg
- Results in a success rate of 76% at eight hours and 83% at 12 hours in patients without significant heart failure (NYHA Class I or II)

Pill in the Pocket

- Candidates
  - Recognize onset
  - No AAD risk markers
  - Adequate tolerance (no pulmonary edema, syncope, etc.)
- Step 1
  - Rate control (~100 bpm) to prevent 1:1 flutter
  - Short acting calcium channel or beta blocker
- Step 2
  - Propafenone 600 mg (single dose)
  - Flecainide 300 mg (single dose)
- Step 3
  - Observe for effect and tolerance (1st episode)
  - Subsequent events: treat at home (convenient and inexpensive)
TIKOSYN® (dofetilide)

Torsades de Pointes
Spontaneous conversion to NSR
(continuous lead II monitor strip)

Reason to hospitalize patients for 3 days; OK with HF
Females more prone to prolonged QT especially HTN females

Drugs to Maintain SR in AF

Ablation

Ablation....reasonable

- 2006: Catheter ablation is a reasonable alternative to pharmacological therapy to prevent recurrent AF in symptomatic patients with little or no left atrium enlargement. (Level of Evidence: C)
- 2011: Catheter ablation may be reasonable to treat symptomatic paroxysmal AF in patients with significant left atrial dilatation or with significant LV dysfunction. (Level of Evidence: A)
- 2014: Atrioventricular (AV) nodal ablation with permanent ventricular pacing is reasonable to control heart rate when pharmacological therapy is inadequate and rhythm control is not achievable. (Level of Evidence: B)

Catheter Ablation

- Destroys cardiac tissue by delivering electrical energy over an electrode on a catheter next to the area of endocardium related to the onset or maintenance of an arrhythmia.
- Radiofrequency Energy destroys tissue by controlled heat production.
Catheter Ablation in Atrial Fibrillation

- Palliative
  - Ablate and pace
- Curative
  - PAC, rather than persistent or permanent AF
  - Failed antiarrhythmic therapy
  - Left Atrial Size < 5.0 cm

Mechanism of Atrial Fibrillation

- Paroxysms of AF are initiated by spontaneous ectopy or "triggers" arising from several sites in the atria.
  - Ligament of Marshall, Coronary Sinus, Crista Terminalis, SVC & Pulmonary Veins
- Most originate from the pulmonary veins

Focal Origin of Atrial Fibrillation

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

AV Node Ablation: Technique

- Two venous catheters placed in right femoral vein
  - RV temporary pacing
  - Deflectable ablation catheter
  - Ablation catheter positioned at compact AV node
  - Radiofrequency (RF) energy applied
  - Modification involves a more inferoposterior "shaving" approach

Current State of Curative Catheter-Based RFA (radio frequency ablation)

Who is a good candidate?

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

LAA Occlusion Devices

- No need for long-term anticoagulation
- Can be done in moderately sedated patient

BUT

- Need for transseptal puncture
- Foreign body in central circulation
  - Erosion/migration
  - Infection
- Need for anticoagulation
- Need to size device to ostium
- Complex LLA-incomplete closure
- Non-inferior to Warfarin
IN SUMMARY

Selected References