ATRIAL FIBRILLATION

web: elliotlakeeducation.com

DR. Frank Chi
B.Sc., M.D., M.C.F.P. (F.P.A.)

Elliot Lake
• Atrial Fibrillation is the most common arrhythmia managed by emergency physicians. Atrial fibrillation is a global healthcare problem.

• Overall Prevalence of AF ~ 1%.

• 70% ≥ age 65, 45% ≥ age 80

• Estimated from ATRIA study 1997 2.3 million with AF in USA

• Incidence increases with advancing age

• 2050 prevalence 5.6 million
Artrial Fibrillation

1. No Conflict of Interest
2. No Commercial Bias
ATRIAL FIBRILLATION

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Atrial Fibrillation

• Learning Objectives

• Residents will be able to:

1. In a patient who presents with new onset atrial fibrillation, look for an underlying cause (e.g., ischemic heart disease, acute myocardial infarction, congestive heart failure, cardiomyopathy, pulmonary embolus, hyperthyroidism, alcohol, etc.)

2. In a patient presenting with atrial fibrillation,
   a. Look for hemodynamic instability,
   b. Intervene rapidly and appropriately to stabilize the patient.

3. In an individual presenting with chronic or paroxysmal atrial fibrillation,
   a. Explore the need for anticoagulation based on the risk of stroke with the patient,
   b. Periodically reassess the need for anticoagulation.

4. In patients with atrial fibrillation, when the decision has been made to use anticoagulation, institute the appropriate therapy and patient education, with a comprehensive follow-up plan.

5. In a stable patient with atrial fibrillation, identify the need for rate control.

6. In a stable patient with atrial fibrillation, arrange for rhythm correction when appropriate
Atrial Fibrillation

• Definition

• Atrial fibrillation (AF) is a supraventricular tachyarrhythmia characterized by uncoordinated atrial activation with resulting deterioration of atrial mechanical function.
Classification

**American Heart Association 2014**

1. New-onset AF – Not previously documented
2. Paroxysmal (self terminating or intermittent) AF. Terminates spontaneously or with intervention within 7 days of onset.
3. Persistent AF Fails to self terminate within 7 days. Requires pharmacologic or electric cardioversion to restore sinus rhythm
4. Long-standing persistent AF- AF more than 12 months
5. Permanent AF- No longer pursue a rhythm control
<table>
<thead>
<tr>
<th>Cardiac Causes of ATRIAL FIBRILLATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common Cardiac Causes</strong></td>
</tr>
<tr>
<td>1. Hypertension (especially with associated left ventricular hypertrophy)</td>
</tr>
<tr>
<td>2. Ischemic heart disease</td>
</tr>
<tr>
<td>3. Rheumatic heart disease</td>
</tr>
<tr>
<td>4. Valvular heart disease (esp. mitral valve stenosis)</td>
</tr>
<tr>
<td>5. Cardiac surgery</td>
</tr>
<tr>
<td>6. Myocarditis</td>
</tr>
<tr>
<td>7. Sick sinus syndrome</td>
</tr>
<tr>
<td>8. Pre-excitation syndrome with accessory conduction pathways (e.g. Wolff-Parkinson-White syndrome)</td>
</tr>
<tr>
<td><strong>Less Common Cardiac Causes</strong></td>
</tr>
<tr>
<td>1. Dilated and hypertrophic cardiomyopathy</td>
</tr>
<tr>
<td>2. Pericardial disease (e.g. pericardial effusion, constrictive pericarditis)</td>
</tr>
<tr>
<td>3. Atrial septal defect</td>
</tr>
<tr>
<td>4. Atrial myxoma</td>
</tr>
</tbody>
</table>
Non-Cardiac Causes of Atrial Fibrillation

1. Hyperthyroidism
2. Acute Infections, esp. pneumonia in the elderly
3. Acute excess alcohol intake or chronic excess alcohol intake
4. Narcotic abuse
5. Obesity
6. Sleep apnea
7. Hemochromatosis
8. Sarcoidosis

Respiratory Causes
1. Lung cancer
2. COPD
3. Pleural effusion
4. Pulmonary embolism
5. Pulmonary hypertension
Symptoms

Identify the presence of the following symptoms:

A. Palpitations
B. Dyspnea
C. Dizziness, pre-syncope, or syncope
D. Chest pain
E. Weakness or fatigue
## CCS-SAfrican American Scale

<table>
<thead>
<tr>
<th>Class</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Asymptomatic with respect to AF</td>
</tr>
<tr>
<td>1</td>
<td>Minimal effect on pt.’s general quality of life. Single episode of AF without syncope or heart failure</td>
</tr>
<tr>
<td>2</td>
<td>Minor effect on pt.’s general quality of life. Rare episodes (less than a few per year)</td>
</tr>
<tr>
<td>3</td>
<td>Moderate effect on pt.’s general quality of life. More frequent episodes (more than every few months)</td>
</tr>
<tr>
<td>4</td>
<td>Severe effect on pt.’s general quality of life. Frequent or highly symptomatic episodes. Syncope and/or CHF secondary to AF</td>
</tr>
</tbody>
</table>
STEP 1

• How symptomatic is the Patient?

Class 0-4
New onset of atrial fibrillation

How symptomatic is the patient?

Severe symptoms (CCS-SAF = 4)
or hemodynamically unstable

To ED or start acute management
(i.e., follow ACLS algorithms)

Further assessment for
long-term anticoagulation

Minimal to moderate symptoms (CCS-SAF ≤ 3)
and hemodynamically stable

Consider anticoagulation for stroke prevention

Pharmacological ventricular rate control

Conversion to sinus rhythm

Remains in AF with good rate
control and minimal symptoms

Assess for stroke risk
with cardioversion

Low Risk
AF <48 hours, or
therapeutic OAC ≥ 3 weeks

Pharmacological or
electrical cardioversion

High Risk
No therapeutic OAC ≥3 weeks
and one of:
- AF > 48 hours or unknown, or
- stroke/TIA < 6 months, or
- mechanical or rheumatic
valve disease

TEE-guided cardioversion or
3 weeks of OAC followed by
outpatient cardioversion

Abbreviations: ACLS = advanced cardiovascular life support; AF = atrial fibrillation; CCS-SAF = Canadian Cardiovascular Society Severity of Atrial Fibrillation score; ED = emergency department; OAC = oral anticoagulants; TEE = transesophageal echocardiography; TIA = transient ischemic attack.
New onset of atrial fibrillation

How symptomatic is the patient?

Severe symptoms (CCS-SAF = 4) or hemodynamically unstable

To ED or start acute management (i.e., follow ACLS algorithms)

Further assessment for long-term anticoagulation

Conversion to stable state
1. Immediate electrical cardioversion
2. Duration of AF < 48 hrs. No anticoagulation.
3. AF > 48 hours or high risk for stroke Administer IV unfractionated heparin or LMW heparin before cardioversion.
4. Bridge with heparin and start on course of oral anticoagulant for > 4 weeks post cardioversion.
Minimal to moderate symptoms (CCS-SAF ≤ 3) and hemodynamically stable

Consider anticoagulation for stroke prevention

Pharmacological ventricular rate control

Conversion to sinus rhythm

Remains in AF with good rate control and minimal symptoms

Assess for stroke risk with cardioversion

Low Risk
AF < 48 hours, or therapeutic OAC ≥3 weeks

Pharmacological or electrical cardioversion

High Risk
No therapeutic OAC ≥3 weeks and one of:
- AF > 48 hours or unknown, or
- stroke/TIA < 6 months, or
- mechanical or rheumatic valve disease

TEE-guided cardioversion or 3 weeks of OAC followed by outpatient cardioversion
STEP 2

Should an Anticoagulant be used for Stroke Prevention?
STEP 2: Should an anticoagulant be used for stroke prevention?  
2001

<table>
<thead>
<tr>
<th>Letter</th>
<th>Clinical Characteristic</th>
<th>Score (if present)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Congestive heart failure</td>
<td>1</td>
</tr>
<tr>
<td>H</td>
<td>Hypertension</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>Age 75+</td>
<td>1</td>
</tr>
<tr>
<td>D</td>
<td>Diabetes</td>
<td>1</td>
</tr>
<tr>
<td>S</td>
<td>Prior Stroke or TIA</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total CHADS2 Score**  
Maximum score = 6
<table>
<thead>
<tr>
<th>CHADS2 Score</th>
<th>Approximate annual stroke risk without treatment (%)</th>
<th>Annual stroke risk with treatment (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ASA</td>
</tr>
<tr>
<td>0</td>
<td>1.9</td>
<td>1.3</td>
</tr>
<tr>
<td>1</td>
<td>2.8</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>4.0</td>
<td>2.8</td>
</tr>
<tr>
<td>3</td>
<td>5.9</td>
<td>4.1</td>
</tr>
<tr>
<td>4+</td>
<td>8.5 or more</td>
<td>6.0 or more</td>
</tr>
</tbody>
</table>
Annual bleeding complications due to treatment based on CHADS2 score

<table>
<thead>
<tr>
<th>CHADS2 Score</th>
<th>Bleeding complication</th>
<th>Annual risk of bleeding complication (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All scores</td>
<td>Major bleed (all types)</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Intracranial bleed</td>
<td>&lt; 0.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2 to 0.8</td>
</tr>
</tbody>
</table>

ASA Anticoagulants

Up to 1.043
Bleeding Risks

HAS-BLED Score

Risk of major bleed 1.04%

Risk of stroke Chads=0  1.9%  Warfarin  1.0%
Risk of stroke Chads=1  2.8%  Warfarin  1.4%
Risk of stroke Chads=2  4.0%  Warfarin  2.0%
Risk of stroke Chads=3  5.9%  Warfarin  3.0%
Risk of stroke Chads=4+  8.5%+ Warfarin  4.3%+
## 2010 CHA2DS2-VASc Score

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestive Heart Failure/LV dysfunction</td>
<td>1</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1</td>
</tr>
<tr>
<td>Age &gt;= 75</td>
<td>2</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>1</td>
</tr>
<tr>
<td>Stroke/ TIA / Thromboembolism</td>
<td>2</td>
</tr>
<tr>
<td>Vascular Disease (MI, PAD, Aortic Plaques)</td>
<td>1</td>
</tr>
<tr>
<td>Age 65-74</td>
<td>1</td>
</tr>
<tr>
<td>Sex Category (female gender)</td>
<td>1</td>
</tr>
<tr>
<td><strong>Maximum Score</strong></td>
<td>9</td>
</tr>
</tbody>
</table>
2014 CCS Guideline

Danish Cohort study BMJ 2011

Female sex 0.9%
Vascular Disease 1.4%
Assess Thromboembolic Risk (Age + CHADS$_2$)

CHADS$_2$ = 0

Increasing stroke risk

- No Antithrombotic Therapy: Age < 65 and no additional risk factors for stroke
- ASA Therapy: Age < 65 and CAD or arterial vascular disease
- OAC$^*$ Therapy: Age > 65 years

CHADS$_2$ > 1

- OAC$^*$ Therapy: *ASA is a reasonable alternative in patients with unacceptable bleeding risk

Abbreviations: ASA = acetyl-salicylic acid; CAD = coronary artery disease; OAC = oral anticoagulants.
All Studies based on OAC (Warfarin)

Should we use OAC (Warfarin) or NOAC

1. Dabigatran (*Pradaxa*) ?
2. Rivaroxaban (*Xarelto*) ?
3. Apixaban (*Eliquis*) ?
4. Edoxiban (*Savasya*) ?
Comparison of Anticoagulants for Atrial Fibrillation
Non-Vitamin K Antagonist Oral Anticoagulants (NOACs) versus warfarin for prevention of stroke or systemic embolism

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Dabigatran 119 mg BID</th>
<th>Dabigatran 150 mg BID</th>
<th>Rivaroxaban 20mg OD</th>
<th>Apixaban 5mg BID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke or systemic embolism prevention</td>
<td>=</td>
<td>&lt;</td>
<td>=</td>
<td>&lt;</td>
</tr>
<tr>
<td>Major Bleeding</td>
<td>&lt;</td>
<td>=</td>
<td>=</td>
<td>&lt;</td>
</tr>
<tr>
<td>Intracranial Bleeding</td>
<td>&lt;</td>
<td>&lt;</td>
<td>&lt;</td>
<td>&lt;</td>
</tr>
</tbody>
</table>
OAC (warfarin) vs NOAC (non-vitamin K antagonist Oral Anticoagulants)

RE-LY, ROCKET, ARISTOTLE, ENGAGE

1. Non-inferior to warfarin for stroke or systemic embolization
2. None caused more major bleeding
3. All superior for intra-cranial hemorrhage
<table>
<thead>
<tr>
<th>Organization</th>
<th>Recommendations</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian Agency for Drugs and Technologies in Health (CADTH)</td>
<td>Warfarin over NOACs</td>
<td>NOACs are as effective at preventing stroke as warfarin but are more expensive</td>
</tr>
<tr>
<td>American Heart Association (AHA)</td>
<td>No recommendation of one over another</td>
<td>Selection individualized on basis of risk factors, costs, tolerability, patient preference, potential for drug interactions.</td>
</tr>
<tr>
<td>American College of Cardiology (ACC) Heart Rhythm Society (HRS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canadian Cardiovascular Society (CCS)</td>
<td>NOACs over Warfarin for non-valvular AF</td>
<td>Less marked preference in patients already receiving warfarin with stable therapeutic INRs. Patient preference</td>
</tr>
<tr>
<td>European Cardiovascular Society (ECS)</td>
<td>NOACs over Warfarin for non-valvular AF</td>
<td>NOACs non-inferior compared with warfarin with better safety re: intracranial hemorrhage</td>
</tr>
</tbody>
</table>
## Advantages of Warfarin versus NOACs

<table>
<thead>
<tr>
<th>WARFARIN</th>
<th>NOAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Inexpensive</td>
<td>1. Convenience</td>
</tr>
<tr>
<td>2. Reversal agents available</td>
<td>2. Able to skip lab testing</td>
</tr>
<tr>
<td>3. Extremes of body weight (&lt;49 kg or &gt;129 kg)</td>
<td>3. Poor venous access or lab access</td>
</tr>
<tr>
<td>4. Pt. skipping doses (dementia)</td>
<td>4. Variable diet</td>
</tr>
<tr>
<td>5. Valvular Heart</td>
<td>5. History of intracranial bleed</td>
</tr>
<tr>
<td>Generic Name</td>
<td>Trade name (dosage form and strength)</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td><strong>Oral anticoagulants</strong></td>
<td></td>
</tr>
<tr>
<td>Warfarin</td>
<td>Coumadin® G (IR tablet: 1, 2, 2.5, 3, 4, 5, 6, 7.5, 10 mg)</td>
</tr>
<tr>
<td><strong>Direct Factor Xa Inhibitors</strong></td>
<td></td>
</tr>
<tr>
<td>Dabigatran</td>
<td>Pradaxa® (IR capsule: 110, 150 mg)</td>
</tr>
<tr>
<td><strong>Direct Thrombin Inhibitors</strong></td>
<td></td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>Xarelto® (IR tablet: 10, 15, 20 mg)</td>
</tr>
<tr>
<td>Apixaban</td>
<td>Eliquis® (IR tablet: 2.5, 5 mg)</td>
</tr>
</tbody>
</table>
Step 3
Rate or Rhythm Control?

<table>
<thead>
<tr>
<th>Favours Rate Control</th>
<th>Favours Rhythm Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Persistent AF</td>
<td>• Paroxysmal AF</td>
</tr>
<tr>
<td>• Less symptomatic</td>
<td>• Newly detected AF</td>
</tr>
<tr>
<td>• Aged ≥ 65 years</td>
<td>• More symptomatic</td>
</tr>
<tr>
<td>• Hypertension</td>
<td>• Aged &lt; 65 years</td>
</tr>
<tr>
<td>• No history of CHF</td>
<td>• No hypertension</td>
</tr>
<tr>
<td>• Previous antiarrhythmic drug failure</td>
<td>• HF clearly exacerbated by AF</td>
</tr>
<tr>
<td>• Patient preference</td>
<td>• No previous antiarrhythmic drug failure</td>
</tr>
<tr>
<td>• High stroke risk with cardioversion</td>
<td>• Patient preference</td>
</tr>
<tr>
<td></td>
<td>• Low stroke risk with cardioversion</td>
</tr>
</tbody>
</table>

*Abbreviations:* AF = atrial fibrillation; CHF = congestive heart failure; HF = heart failure.

Rate Control Therapy

- Heart Failure: Beta-blocker ± Digoxin
- CAD: Beta-blocker non-DHP CCB Combination Therapy
- No Heart Failure or CAD: Beta-blocker non-DHP CCB Digoxin Combination Therapy
<table>
<thead>
<tr>
<th>Drug</th>
<th>Brand Name(s)</th>
<th>Dosing</th>
<th>Side Effects</th>
<th>Use with Caution</th>
<th>Beta-Adrenergic Selectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>atenolol</td>
<td>Tenormin®, G</td>
<td><strong>IR tablet:</strong> 50-150 mg PO once daily. Reduce dose by 25-50% if used concurrently with digoxin, calcium channel blockers, or amiodarone.</td>
<td>Bradycardia, hypotension, dyspnea, fatigue, and depression</td>
<td>Use with caution in patients with diabetes, heart failure, or bronchospastic lung disease.</td>
<td>Beta1-selective. Less likely to cause depression.</td>
</tr>
<tr>
<td>bisoprolol</td>
<td>G</td>
<td><strong>IR tablet:</strong> 5-20 mg PO once daily. Reduce dose by 25-50% if used concurrently with digoxin, calcium channel blockers, or amiodarone.</td>
<td>Bradycardia, hypotension, dyspnea, fatigue, and depression</td>
<td>Use with caution in patients with diabetes, heart failure, or bronchospastic lung disease.</td>
<td>Beta1-selective.</td>
</tr>
<tr>
<td>metoprolol</td>
<td>Betaloc®, Lopresor®, G</td>
<td><strong>IV Injection:</strong> 5-10 mg q5 min x 3 doses. <strong>IR tablet:</strong> 50-200 mg PO BID. <strong>SR tablet:</strong> 100-400 mg PO once daily. Reduce dose by 25-50% if used concurrently with digoxin, calcium channel blockers, or amiodarone.</td>
<td>Bradycardia, hypotension, dyspnea, fatigue, and depression</td>
<td>Use with caution in patients with diabetes, heart failure, or bronchospastic lung disease.</td>
<td>Beta1-selective.</td>
</tr>
</tbody>
</table>
## Drugs for Rate Control Beta Blockers

<table>
<thead>
<tr>
<th>Drug</th>
<th>Brand Name</th>
<th>Dosage Form</th>
<th>Dosage</th>
<th>Cost</th>
<th>Drug Interactions</th>
<th>Adverse Effects</th>
<th>Patient Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>nadolol</td>
<td>Nadolol, G</td>
<td>(IR tablet: 40, 80, 160 mg)</td>
<td>20-160 mg PO once daily. Reduce dose by 25-50% if used concurrently with digoxin, calcium channel blockers, or amiodarone.</td>
<td>$8-39 (G)</td>
<td>Bradycardia, hypotension, dyspnea, fatigue, and depression</td>
<td>Use with caution in patients with diabetes, heart failure, or bronchospastic lung disease. Less likely to cause depression.</td>
<td></td>
</tr>
<tr>
<td>propranolol</td>
<td>Inderal®</td>
<td>(IV injection: 1 mg/mL; IR tablet: 10, 20, 40, 80, 120 mg; SR capsule: 60, 80, 120, 160 mg)</td>
<td><strong>IV injection:</strong> 1-3 mg q2 minutes x 2 doses. May repeat in 4 hours. <strong>IR tablet:</strong> 20-80 mg PO TID. <strong>SR capsule:</strong> 80-240 mg PO once daily. Reduce dose by 25-50% if used concurrently with digoxin, calcium channel blockers, or amiodarone.</td>
<td>IR tablet: $9-14 (G) SR tablet: $21-64</td>
<td>Bradycardia, hypotension, dyspnea, fatigue, and depression</td>
<td>Use with caution in patients with diabetes, heart failure, or bronchospastic lung disease. SR dosage forms preferred to prolong the dosing interval and improve patient compliance.</td>
<td></td>
</tr>
</tbody>
</table>
## Drugs for Rate Control Calcium Channel Blocker
### Non Dihydropyridine

| Drug       | Trade Name | IV injection | Starting dose | Maximum dose | IR tablet | SR tablet | Regular Coverage | Bradycardia, hypotension, constipation, and flushing | Use with caution in patients with heart failure. SR dosage generally preferred to prolong the dosing interval and improve patient compliance. |
|------------|------------|--------------|---------------|--------------|-----------|------------|-----------------|----------------------------------------------------|
| verapamil  | Isoptin®, G| 2.5 mg/mL; IR tablet: 80, 120 mg; SR tablet: 120, 180, 240 mg | 120 mg/day PO | 480 mg/day PO | $14-55 (G) | $17-33 (G) |               | Bradycardia, hypotension, and flushing               | Use with caution in patients with heart failure. SR dosage generally preferred to prolong the dosing interval and improve patient compliance. |
| diltiazem  | Cardizem®, G| 5 mg/mL; IR tablet: 30, 60 mg; ER capsule: 120, 180, 240, 300 mg | 0.25 mg/kg | 120-540 mg/day PO | $32-99 (G) | $7-46 (G) |               | Bradycardia, hypotension, and ankle swelling         | Use with caution in patients with heart failure. SR dosage generally preferred to prolong the dosing interval and improve patient compliance. |
|            | Tiazac®, G |              |               |              |           |            |                 |                                                    |                                                      |
## Drugs for Rate Control Digitalis

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage Details</th>
<th>Loading</th>
<th>Maintenance</th>
<th>IR tablet:</th>
<th>Regular Coverage</th>
<th>Bradycardia, nausea, vomiting, visual disturbances, and proarrhythmogenic</th>
<th>Only in patients with AF due to heart failure.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digoxin</td>
<td>Toloxin®️, G (IV injection: 50, 250 μg/mL; IR tablet: 0.0625, 0.125, 0.25)</td>
<td>1-1.5 mg in divided doses PO or IV. <strong>Maintenance:</strong> 0.125-0.375 mg PO daily. Reduce dose by 25-50% if used concurrently with beta-blockers, calcium channel blockers, or quinidine.</td>
<td>$8-16</td>
<td>Correct hypokalemia if present.</td>
<td>Check serum and potassium levels.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Loading: Initial dose
- Maintenance: Daily dose
- IR tablet: Immediate release tablet
- Regular Coverage: Other adverse effects
Rhythm Control

Rhythm Control Drug Choices

No history of congestive heart failure
Normal Systolic Function

- Flecaïnide
- Propafenone
- Sotalol

- Catheter Ablation
- Amiodarone

History of congestive heart failure or
Left Ventricular Systolic Dysfunction

- Ejection fraction > 35%
  - Amiodarone
  - Sotalol

- Ejection fraction ≤ 35%
  - Amiodarone
  - Sotalol
  - Catheter Ablation

Footnote: * In patients with left ventricular ejection fraction ≤ 35% amiodarone is the only drug recommended because of the low risk of proarrhythmia in heart failure. Amiodarone or sotalol are recommended in those with ejection fraction > 35%. †
<table>
<thead>
<tr>
<th>Drug</th>
<th>Class</th>
<th>Starting dose</th>
<th>Titrations</th>
<th>Regular Coverage</th>
<th>Ventricular proarrhythmia, tremor, blurred vision, and heart failure</th>
<th>Should be used concurrently with a beta-blocker or nondihydropyridine calcium channel blocker.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flecainide</td>
<td>Class 1C</td>
<td>50 mg PO q12h. Reduce by 50% in patients with renal dysfunction. Titrations: increase by 50 mg increments based on QRS intervals. Reduce dose if QRS increases &gt;20% from baseline. Maximum dose: 200 mg q12h PO.</td>
<td>$26-104 (G)</td>
<td>Regular Coverage</td>
<td>Ventricular proarrhythmia, tremor, blurred vision, and heart failure</td>
<td>Should be used concurrently with a beta-blocker or nondihydropyridine calcium channel blocker.</td>
</tr>
</tbody>
</table>

Do not use in patients with coronary artery or structural heart disease.

Metabolized by CYP2D6, resulting in many potential drug interactions.
<table>
<thead>
<tr>
<th>Propafenone</th>
<th><strong>Rythmol®, G (IR tablet: 150, 300 mg)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>150 – 300 mg PO q8h.</strong></td>
<td>Reduce initial dose by 50% and increase dosing interval to q12h in patients with renal or hepatic dysfunction.</td>
</tr>
<tr>
<td><strong>$29-51 (G)</strong></td>
<td><strong>Regular Coverage</strong></td>
</tr>
<tr>
<td><strong>Constipation, headache, metallic taste, and ventricular proarrhythmia</strong></td>
<td>Should be used concurrently with a beta-blocker or nondihydropyridine calcium channel blocker. Do not use in patients with coronary artery or structural heart disease. Reduce dose of concurrently administered digoxin by 25-50%. Metabolized by CYP2D6, resulting in many potential drug interactions. Monitor QRS duration carefully as active metabolites accumulate in rapid metabolizers.</td>
</tr>
<tr>
<td>Drug</td>
<td>Brand Name</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>amiodarone</td>
<td>Cardarone®, G (IV: 50 mg/ml; IR tablet: 100, 200 mg)</td>
</tr>
<tr>
<td>dronedarone</td>
<td>Multaq® (IR tablet: 400 mg)</td>
</tr>
<tr>
<td>sotalol</td>
<td>Sotalol, G (IR tablet: 80, 160, 240 mg)</td>
</tr>
</tbody>
</table>
Indications for Referral

• Cardiology or Internal Medicine:
  • A review by a specialist can be considered for patient eligibility for long-term OAC or for an alternative treatment if the patient has a contraindication to anticoagulants.
  • Consider referral if poor or incomplete response, or ongoing symptoms.

• Neurology or Internal Medicine:
  • Recurrent TIA/minor stroke.

• Specialty Clinics:
  • AF clinics.
  • Management of co-morbid conditions (e.g., diabetes clinics, heart failure clinics).
Case 1

60-year-old male presents to ER with atrial fibrillation. His blood pressure is 70/30 with a heart rate of 140 irregularly, irregular. He is short of breath and has chest pains. He is on no medication and has been healthy.
Case 1

Step 1   How symptomatic is patient

- Hemodynamically unstable
- CCS-SAF Class 4
Case 1

New onset of atrial fibrillation

How symptomatic is the patient?

Severe symptoms (CCS-SAFA = 4)
or hemodynamically unstable

To ED or start acute management
(i.e., follow ACLS algorithms)

Further assessment for
long-term anticoagulation

Minimal to moderate symptoms (CCS-SAFA ≤ 3)
and hemodynamically stable

Consider anticoagulation for stroke prevention

Pharmacological ventricular rate control

Conversion to sinus rhythm

Remains in AF with good rate control and minimal symptoms

Assess for stroke risk with cardioversion

Low Risk
AF <48 hours, or
therapeutic OAC ≥3 weeks

Pharmacological or
electrical cardioversion

High Risk
No therapeutic OAC ≥3 weeks
and one of:
- AF > 48 hours or unknown, or
- stroke/TIA < 6 months, or
- mechanical or rheumatic
  valve disease

TEE-guided cardioversion or
3 weeks of OAC followed by
outpatient cardioversion

Abbreviations: ACLS = advanced cardiovascular life support; AF = atrial fibrillation; CCS-SAFA = Canadian Cardiovascular Society Severity of Atrial Fibrillation score; ED = emergency department; OAC = oral anticoagulants; TEE = transesophageal echocardiography; TIA = transient ischemic attack.
New onset of atrial fibrillation

How symptomatic is the patient?

Severe symptoms (CCS-SAF = 4) or hemodynamically unstable

To ED or start acute management (i.e., follow ACLS algorithms)

Further assessment for long-term anticoagulation

Conversion to sinus rhythm
Case 1

Uncommon Presentation

1. Immediate electrical cardioversion
2. Duration of AF < 48 hrs. No anticoagulation.
3. AF > 48 hours or high risk for stroke Administer IV unfractionated heparin or LMW heparin before cardioversion.
4. Bridge with heparin and start on course of oral anticoagulant for > 4 weeks post cardioversion.
Case 1

Step 2  Should an anticoagulant be used for stroke Prevention?

1. Short term
2. Long term
Assess Thromboembolic Risk (Age + CHADS$_2$)

CHADS$_2$ = 0

- No Antithrombotic Therapy
  - Age < 65 and no additional risk factors for stroke
- ASA Therapy
  - Age < 65 and CAD or arterial vascular disease
- OAC Therapy
  - Age > 65 years

CHADS$_2$ > 1

- OAC Therapy
  - * ASA is a reasonable alternative in patients with unacceptable bleeding risk

Abbreviations: ASA = acetyl-salicylic acid; CAD = coronary artery disease; OAC = oral anticoagulants.
### Step 3 Rate or Rhythm Control?

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**Abbreviations:** AF = atrial fibrillation; CHF = congestive heart failure; HF = heart failure.

Rhythm Control

Rhythm Control Drug Choices

No history of congestive heart failure
Normal Systolic Function

- Flecainide
- Propafenone
- Sotalol

Catheter Ablation

Amiodarone

History of congestive heart failure or Left Ventricular Systolic Dysfunction

- Ejection fraction > 35%
  - Amiodarone
  - Sotalol
- Ejection fraction ≤ 35%
  - Amiodarone*

Catheter Ablation

Footnote: * In patients with left ventricular ejection fraction ≤ 35% amiodarone is the only drug recommended because of the low risk of proarrhythmia in heart failure. Amiodarone or sotalol are recommended in those with ejection fraction > 35%.
Case 1

What if?
1. 65-year-old
2. Diabetes, Hypertension, etc.
3. Previous MI

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<th>Clinical Characteristic</th>
<th>Score (if present)</th>
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<td>C</td>
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<td>Hypertension</td>
<td>1</td>
</tr>
<tr>
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<td>1</td>
</tr>
<tr>
<td>S</td>
<td>Prior Stroke or TIA</td>
<td>2</td>
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Total CHADS2 Score  Maximum score = 6
Assess Thromboembolic Risk (Age + CHADS$_2$)

CHADS$_2$ = 0

- Increasing stroke risk
  - No Antithrombotic Therapy
    - Age < 65 and no additional risk factors for stroke
  - ASA Therapy
    - Age < 65 and CAD or arterial vascular disease
  - OAC* Therapy
    - Age > 65 years

CHADS$_2$ > 1

- OAC* Therapy
  - *ASA is a reasonable alternative in patients with unacceptable bleeding risk

Abbreviations: ASA = acetyl-salicylic acid; CAD = coronary artery disease; OAC = oral anticoagulants.
Case 2

75-year-old male with a history of NIDDM, hypertension and PVD, presents with a 3-day history of feeling unwell, palpitations and short of breath going up a flight of stairs. His blood pressure is 100/50, heart rate of 120/min.
Case 2

Step 1

How symptomatic?
Class 2 CCS-SAF (Minor to Moderate)

New onset of atrial fibrillation

How symptomatic is the patient?

Severe symptoms (CCS-SAF = 4) or hemodynamically unstable

To ED or start acute management (i.e., follow ACLS algorithms)

Further assessment for long-term anticoagulation

Minimal to moderate symptoms (CCS-SAF ≤ 3) and hemodynamically stable

Consider anticoagulation for stroke prevention

Pharmacological ventricular rate control

Conversion to sinus rhythm

Remains in AF with good rate control and minimal symptoms

Assess for stroke risk with cardioversion

Low Risk
AF < 48 hours, or therapeutic OAC ≥ 3 weeks

Pharmacological or electrical cardioversion

High Risk
No therapeutic OAC ≥ 3 weeks and one of:
- AF > 48 hours or unknown, or
- stroke/TIA < 6 months, or
- mechanical or rheumatic valve disease

TEE-guided cardioversion or 3 weeks of OAC followed by outpatient cardioversion

Abbreviations: ACLS = advanced cardiovascular life support; AF = atrial fibrillation; CCS-SAF = Canadian Cardiovascular Society Severity of Atrial Fibrillation score; ED = emergency department; OAC = oral anticoagulants; TEE = transesophageal echocardiography; TIA = transient ischemic attack.
Case 2

Step 2

Should an Anticoagulant be used for Stroke Prevention?

1. Short term
2. Long Term
Case 2  Short term Anticoagulant

Minimal to moderate symptoms (CCS-SAF ≤ 3) and hemodynamically stable

Consider anticoagulation for stroke prevention

Pharmacological ventricular rate control

Conversion to sinus rhythm  Remains in AF with good rate control and minimal symptoms

Assess for stroke risk with cardioversion

Low Risk
AF <48 hours, or therapeutic OAC ≥3 weeks

Pharmacological or electrical cardioversion

High Risk
No therapeutic OAC ≥3 weeks and one of:
- AF > 48 hours or unknown, or
- stroke/TIA < 6 months, or
- mechanical or rheumatic valve disease

TEE-guided cardioversion or 3 weeks of OAC followed by outpatient cardioversion
75 year old, Diabetes, Hypertension, Vascular disease

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**Total CHADS\textsubscript{2} Score**

Maximum score = 6
Chads score = 3

<table>
<thead>
<tr>
<th>CHADS2 Score</th>
<th>Approximate annual stroke risk without treatment (%)</th>
<th>Annual stroke risk with treatment (%)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>ASA</td>
</tr>
<tr>
<td>0</td>
<td>1.9</td>
<td>1.3</td>
</tr>
<tr>
<td>1</td>
<td>2.8</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>4.0</td>
<td>2.8</td>
</tr>
<tr>
<td>3</td>
<td>5.9</td>
<td>4.1</td>
</tr>
<tr>
<td>4+</td>
<td>8.5 or more</td>
<td>6.0 or more</td>
</tr>
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</table>
Vascular Disease, CHADS = 3

- Assess Thromboembolic Risk (Age + CHADS₂)

  - CHADS₂ = 0
    - Increasing stroke risk
      - No Antithrombotic Therapy
      - ASA Therapy
        - Age < 65 and no additional risk factors for stroke
      - OAC* Therapy
        - Age < 65 and CAD or arterial vascular disease
    - CHADS₂ > 1
      - OAC* Therapy
        - Age > 65 years

*ASA is a reasonable alternative in patients with unacceptable bleeding risk*

**Abbreviations:** ASA = acetyl-salicylic acid; CAD = coronary artery disease; OAC = oral anticoagulants.
### Step 3 Rate or Rhythm?

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Abbreviations: AF = atrial fibrillation; CHF = congestive heart failure; HF = heart failure.
Rate Control

- **Rate Control Drug Choices**
  - **Heart Failure**
    - Beta-blocker ± Digoxin
  - **CAD**
    - Beta-blocker non-DHP CCB Combination Therapy
  - **No Heart Failure or CAD**
    - Beta-blocker non-DHP CCB Digoxin Combination Therapy
Case 3

66-year old grandmother presents with some shortness of breath with exertion, irregular heartbeats, dizziness, and feeling tired since last night. She is hypertensive, non-insulin dependent diabetic.
Case 3

Step 1

How symptomatic?

CCS-SAFA Class 2
CCS-SAF = 2, Onset < 24 hours

New onset of atrial fibrillation

How symptomatic is the patient?

Severe symptoms (CCS-SAF = 4) or hemodynamically unstable

To ED or start acute management (i.e., follow ACLS algorithms)

Further assessment for long-term anticoagulation

Minimal to moderate symptoms (CCS-SAF ≤ 3) and hemodynamically stable

Consider anticoagulation for stroke prevention

Pharmacological ventricular rate control

Conversion to sinus rhythm

Remains in AF with good rate control and minimal symptoms

Assess for stroke risk with cardioversion

Low Risk
AF < 48 hours, or therapeutic OAC ≥ 3 weeks
Pharmacological or electrical cardioversion

High Risk
No therapeutic OAC ≥ 3 weeks and one of:
- AF > 48 hours or unknown, or
- stroke/TIA < 6 months, or
- mechanical or rheumatic valve disease
TEE-guided cardioversion or 3 weeks of OAC followed by outpatient cardioversion

Abbreviations: ACLS = advanced cardiovascular life support; AF = atrial fibrillation; CCS-SAF = Canadian Cardiovascular Society Severity of Atrial Fibrillation score; ED = emergency department; OAC = oral anticoagulants; TEE = transesophageal echocardiography; TIA = transient ischemic attack.
Step 2  Anticoagulation

Anticoagulant?

1. Short term
2. Long Term
66-years, Diabetes, Hypertension
CHADS = 2

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**Total CHADS\textsubscript{2} Score**

Maximum score = 6
66-years, Diabetes, Hypertension
CHADS = 2

Assess Thromboembolic Risk (Age + CHADS$_2$)

CHADS$_2$ = 0

- No Antithrombotic Therapy
  - Age < 65 and no additional risk factors for stroke

- ASA Therapy
  - Age < 65 and CAD or arterial vascular disease

- OAC* Therapy
  - Age > 65 years

CHADS$_2$ > 1

- OAC* Therapy
  - *ASA is a reasonable alternative in patients with unacceptable bleeding risk

**Abbreviations:** ASA = acetyl-salicylic acid; CAD = coronary artery disease; OAC = oral anticoagulants.
## Step 3  Rate or Rhythm?

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**Abbreviations:** AF = atrial fibrillation; CHF = congestive heart failure; HF = heart failure.

Rate Control

Rate Control Drug Choices

- Heart Failure: Beta-blocker ± Digoxin
- CAD: Beta-blocker non-DHP CCB Combination Therapy
- No Heart Failure or CAD: Beta-blocker non-DHP CCB Digoxin Combination Therapy
Case 4

- The patient is a 32 year old physician who the prior evening was out celebrating the marriage of his receptionist and consumed about 12 ounces of Johnny Walker Black Label.
- He went home by taxi, slept poorly and realized at about 6:00 A.M. that his heart was rapid and pulse irregular and he had a mild bitemporal headache.
- He is driven to the ED by his wife.
Case 4

• He has been well, no known hypertension, DM, heart disease, TIA/stroke and no known arrhythmias. No COPD or asthma.

• In ED he has no chest pain, has mild SOB and is slightly sweaty.

• HR 140, irregularly irregular, BP 140/90, JVD 4 cm, chest clear.

• ECG shows AF, rate 140.
Case 4

Step 1  How symptomatic is patient

• CCS-SAF Class 2-3
Case 4

New onset of atrial fibrillation

How symptomatic is the patient?

Severe symptoms (CCS-SAF = 4) or hemodynamically unstable

To ED or start acute management (i.e., follow ACLS algorithms)

Further assessment for long-term anticoagulation

Minimal to moderate symptoms (CCS-SAF ≤ 3) and hemodynamically stable

Consider anticoagulation for stroke prevention

Pharmacological ventricular rate control

Conversion to sinus rhythm

Remains in AF with good rate control and minimal symptoms

Assess for stroke risk with cardioversion

Low Risk
AF <48 hours, or therapeutic OAC ≥3 weeks

Pharmacological or electrical cardioversion

High Risk
No therapeutic OAC ≥3 weeks and one of:
- AF > 48 hours or unknown, or
- stroke/TIA < 6 months, or
- mechanical or rheumatic valve disease

TEE-guided cardioversion or 3 weeks of OAC followed by outpatient cardioversion

Abbreviations: ACLS = advanced cardiovascular life support; AF = atrial fibrillation; CCS-SAF = Canadian Cardiovascular Society Severity of Atrial Fibrillation score; ED = emergency department; OAC = oral anticoagulants; TEE = transesophageal echocardiography; TIA = transient ischemic attack.
Minimal to moderate symptoms (CCS-SA ≤ 3) and hemodynamically stable

Consider anticoagulation for stroke prevention

Pharmacological ventricular rate control

Conversion to sinus rhythm

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Case 4

Step 2  Should an anticoagulant be used for stroke Prevention?

1. Short term
2. Long term
Minimal to moderate symptoms (CCS-SAF ≤ 3) and hemodynamically stable

Consider anticoagulation for stroke prevention

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High Risk
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TEE-guided cardioversion or 3 weeks of OAC followed by outpatient cardioversion
Assess Thromboembolic Risk (Age + CHADS<sub>2</sub>)

CHADS<sub>2</sub> = 0

Increasing stroke risk

- No Antithrombotic Therapy
  - Age < 65 and no additional risk factors for stroke

- ASA Therapy
  - Age < 65 and CAD or arterial vascular disease

- OAC* Therapy
  - Age > 65 years

CHADS<sub>2</sub> > 1

- OAC* Therapy
  - ASA is a reasonable alternative in patients with unacceptable bleeding risk

Abbreviations: ASA = acetyl-salicylic acid; CAD = coronary artery disease; OAC = oral anticoagulants.
## Step 3 Rate or Rhythm Control?

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Abbreviations: AF = atrial fibrillation; CHF = congestive heart failure; HF = heart failure.
Case 4

Rhythm Control Drug Choices

No history of congestive heart failure
Normal Systolic Function

- Flecaïnide
- Propafenone
- Sotalol

- Catheter Ablation

Amiodarone

History of congestive heart failure or
Left Ventricular Systolic Dysfunction

- Ejection fraction > 35%
  - Amiodarone
  - Sotalol

- Ejection fraction ≤ 35%
  - Amiodarone*
  - Sotalol

Catheter Ablation

Footnote: * In patients with left ventricular ejection fraction ≤ 35% amiodarone is the only drug recommended because of the low risk of proarrhythmia in heart failure. Amiodarone or sotalol are recommended in those with ejection fraction > 35%.
Summary

1. Determine the patient’s cardiac stability and provide emergency stabilization if needed.
2. Consider all patients with atrial fibrillation for antithrombotic therapy (short and long term).
3. The goals of rate and/or rhythm control strategies are to improve patient symptoms, exercise tolerance, quality of life, prevent hospitalizations and improve left ventricular function.
4. Manage co-morbidities that may raise atrial fibrillation risk, such as hypertension, diabetes and heart failure.
SUMMARY

Step 1  How Symptomatic is the Patient?

Step 2  Should an anticoagulant be Used for Stroke Prevention?

1. Short term
2. Long term

Step 3  Is this a Rate or Rhythm control strategy?
New onset of atrial fibrillation

How symptomatic is the patient?

Severe symptoms (CCS-SAFC = 4) or hemodynamically unstable

To ED or start acute management (i.e., follow ACLS algorithms)

Further assessment for long-term anticoagulation

Minimal to moderate symptoms (CCS-SAFC ≤ 3) and hemodynamically stable

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Assess Thromboembolic Risk (Age + CHADS₂)

CHADS₂ = 0

- Increasing stroke risk
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<td>No history of CHF</td>
<td>No hypertension</td>
</tr>
<tr>
<td>Previous antiarrhythmic drug failure</td>
<td>HF clearly exacerbated by AF</td>
</tr>
<tr>
<td>Patient preference</td>
<td>No previous antiarrhythmic drug failure</td>
</tr>
<tr>
<td>High stroke risk with cardioversion</td>
<td>Low stroke risk with cardioversion</td>
</tr>
</tbody>
</table>

**Abbreviations:** AF = atrial fibrillation; CHF = congestive heart failure; HF = heart failure.

Rate Control

Rate Control Drug Choices

Heart Failure
- Beta-blocker ± Digoxin

CAD
- Beta-blocker non-DHP CCB Combination Therapy

No Heart Failure or CAD
- Beta-blocker non-DHP CCB Digoxin Combination Therapy
Rhythm Control

Footnote: * In patients with left ventricular ejection fraction ≤ 35% amiodarone is the only drug recommended because of the low risk of proarrhythmia in heart failure. Amiodarone or sotalol are recommended in those with ejection fraction > 35%.
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