Atrial Fibrillation: 
The Regular Irregularity

Brian Shahan, MD

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Dr. Shahan earned his medical degree from the University of Nebraska Medical Center, Omaha, and completed his family medicine residency at Tripler Army Medical Center in Honolulu, Hawaii. After his residency, he spent four years in Alaska, providing full-scope primary care in remote and austere locations. He returned to academic medicine to pursue specialty training in hospital medicine. Currently serving as the program director for a family medicine hospitalist fellowship, he plans to continue to train family medicine hospitalists and to improve inpatient residency training for family medicine residents.
Learning Objectives

1. Utilize current clinical practice guidelines for the management of AF, and the stroke risk score to prescribe appropriate medications.

2. Review the coagulation cascade and compare targets of medications that affect the coagulation pathway with specific applications to current recommendations of medications for patients with atrial fibrillation.

3. Recognize potential indications for nonpharmacologic interventions (e.g., electrical cardioversion, surgical ablation) for atrial fibrillation and managing patients properly following ablation.

4. Educate patients on lifestyle modifications they can make to ensure heart health and prevent complications from AF, including stroke or heart failure.

Audience Engagement System

Step 1

Step 2

Step 3
Case

77 year female with no PMH presents to the clinic for upper respiratory symptoms. Examination of the heart shows irregularly irregular rhythm with no murmurs. Review of patient’s chart says RRR in previous cardiac exams.

ECG courtesy of Ryan Flannigan, MD FAAP FACC
AES Question 1

Which of the following is **NOT** in the definition of atrial fibrillation?

A. Irregular R-R intervals  
B. Narrow complex QRS  
C. Irregular atrial activity  
D. Absence of distinct, repeating P waves

Atrial Fibrillation

- **5x** increase risk of stroke  
- **3x** increase risk of HF  
- **2x** increase risk of dementia  
- **2x** increase risk of hospitalization

Atrial Fibrillation

- Most common cardiac arrhythmia worldwide
- Disease of aging
  - 1% patients < 60
  - 8-12% patients > 80
- 450,000 admission per year in the US
- Doubles mortality rate

Pathophysiology
Management

1. Embolic stroke prophylaxis
2. Rate/Rhythm control

AES Question 2

How should Ms Rose be managed for stroke prevention (77 yo female with no PMH)?

A. No additional treatment
B. Aspirin
C. Xa inhibitor
D. Warfarin
E. Clopidogrel
Stroke Risk

<table>
<thead>
<tr>
<th>CHADS₂ Risk</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHF</td>
<td>1</td>
</tr>
<tr>
<td>HTN</td>
<td>1</td>
</tr>
<tr>
<td>Age ≥ 75</td>
<td>1</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1</td>
</tr>
<tr>
<td>Stroke/TIA</td>
<td>2</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>CHA₂DS₂VASc Risk</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHF</td>
<td>1</td>
</tr>
<tr>
<td>HTN</td>
<td>1</td>
</tr>
<tr>
<td>Age ≥ 75</td>
<td>2</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1</td>
</tr>
<tr>
<td>Stroke/TIA</td>
<td>2</td>
</tr>
<tr>
<td>Vascular Disease</td>
<td>1</td>
</tr>
<tr>
<td>Age 65 – 74</td>
<td>1*</td>
</tr>
<tr>
<td>Sex (Female)</td>
<td>1</td>
</tr>
</tbody>
</table>

* Sex only counts as risk factor for females if age > 65 (NEW)


AHA Guidelines

- CHA₂DS₂-VASc score recommended to assess stroke risk (Class I, LOE B).
- If CHA₂DS₂-VASc score ≥ 2 in men and ≥ 3 in women (NEW), oral anticoagulants recommended (Class I, LOE A).
AHA Guidelines

• For patients with AF and a CHA₂DS₂-VASc score of 1 in men and 2 in women, prescribing an oral anticoagulant to reduce thromboembolic stroke risk may be considered (Class IIB, LOE C) (NEW)

<table>
<thead>
<tr>
<th>CHA₂DS₂-VASc Score</th>
<th>Men</th>
<th>Women</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>No AC</td>
<td>N/A</td>
</tr>
<tr>
<td>1</td>
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<tr>
<td>2</td>
<td>AC</td>
<td>Consider AC</td>
</tr>
<tr>
<td>3 or greater</td>
<td>AC</td>
<td>AC</td>
</tr>
</tbody>
</table>

AC = anticoagulation
AHA Guidelines

NOACs (non-vitamin K oral anticoagulant) are recommended over warfarin in eligible patients. (Class I, LOE A) (NEW)

- Based on repeated trials that showed at least non-inferior stroke prevention and lower risks of bleeding

Anticoagulants

- Warfarin -> valvular AF, ESRD
- NOACs
  - Dabigatran (Pradaxa) -> Direct thrombin inhibitor
  - Rivaroxaban (Xarelto) -> Once daily
  - Apixaban (Eliquis) -> Less bleeding, ESRD
  - Edoxaban (Savaysa) -> Cancer (Non-GI)
What about antiplatelets? **NO**

- Meta-analysis shows ASA is either ineffective completely or has very little benefit (NNT 125).
- ACTIVE-W trial terminated early when clopidogrel was found inferior to warfarin
- ACTIVE-A trial found ASA + clopidogrel reduced stroke in low CHADS2VASC better than ASA alone, however bleeding increased (↑57%)


AES Question 3
You obtain an echocardiogram on Ms Rose. Which of the following would categorize Ms Rose as having **valvular AF**?

A. Moderate-to-severe aortic stenosis  
B. Moderate-to-severe aortic regurgitation  
C. Moderate-to-severe mitral stenosis  
D. Moderate-to-severe mitral regurgitation
Valvular AF

Moderate-to-severe mitral stenosis
-OR-
Mechanical heart valve

Treat with Warfarin (Class I, LOE B)

AES Question 4

What is the most common cause of death in Ms Rose now that she has atrial fibrillation?

A. Sudden cardiac death
B. Heart Failure
C. Ischemic stroke
D. Fatal Hemorrhage
Are there high risk patients that shouldn’t be anticoagulated?

<table>
<thead>
<tr>
<th>HAS BLED risk</th>
<th>Score</th>
<th>HAS BLED Score</th>
<th>% risk bleed yearly</th>
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</thead>
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<tr>
<td>HTN (&gt;160/100)</td>
<td>1</td>
<td>0</td>
<td>1.13</td>
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<tr>
<td>Abnormal renal or liver function</td>
<td>1 or 2</td>
<td>1</td>
<td>1.02</td>
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<tr>
<td>Stroke</td>
<td>1</td>
<td>2</td>
<td>1.88</td>
</tr>
<tr>
<td>Bleeding</td>
<td>1</td>
<td>3</td>
<td>3.74</td>
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<td>Labile INRs</td>
<td>1</td>
<td>4</td>
<td>8.70</td>
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<td>Elderly (Age &gt; 65)</td>
<td>1</td>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>Drugs or alcohol</td>
<td>1 or 2</td>
<td></td>
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</tr>
</tbody>
</table>

Withhold Anticoagulation?

- HAS BLED should not be used to exclude patients from anticoagulation
  - Modify risk factors for bleeding
- Patients with HAS BLED > 3 still did better with anticoagulation
- Aspirin safer?
  - Aspirin and warfarin have same bleeding risk

Modify HAS BLED Risk Factors

<table>
<thead>
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<th>HAS BLED risk</th>
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</tr>
<tr>
<td>Drugs or alcohol</td>
<td>1 or 2</td>
</tr>
</tbody>
</table>


AES Question 5

What type of atrial fibrillation does Ms Rose have?

A. Paroxysmal  
B. Persistent  
C. Long standing  
D. Permanent  
E. Who cares?
Classification

Paroxysmal  Persistent  Long Standing

Onset AFib  7 Days  12 Months

Permanent – no longer pursuing rhythm control

Types of AF

- Paroxysmal AF has same stroke risk as persistent. Likely same mortality.
- AHA lumps all types of AF together for treatment recommendations
- Type of AF important if attempting rhythm control strategy
AES Question 6

A week later, Ms Rose presents to the ED with fever and cough. She is still in Afib and her HR is 130. Blood pressure is 95/60. What is the next step in management?

A. Give diltiazem 15mg IV  
B. Give metoprolol 5mg IV  
C. Bolus LR 30mg/kg  
D. Electro-cardioversion

Rapid Ventricular Response

• Rule out other causes of tachycardia before blocking HR!  
  • Sepsis, GI bleed, fever, dehydration, etc.
AES Question 7

Ms Rose’s BP improved to 130/80 with bolus of LR however her HR is still 140. She is otherwise asymptomatic sitting in bed. Bedside echo estimates EF of 25%. JVD and orthopnea are present. Which of the following is the best option for rate control?

A. Diltiazem 15mg IV  
B. Metoprolol 5mg IV  
C. Digoxin 4-6mcg/kg IV load  
D. Observation

Treatment of RVR in HFrEF

- IV B-blockers can be used with caution in RVR with reduced EF. Calcium channel blockers can be used in HFpEF. (Class I, Level of Evidence: B)
- In the absence of pre-excitation, intravenous digoxin or amiodarone is recommended to control heart rate acutely in patients with HFrEF. (Class I, Level of Evidence: B)

Why treat RVR?

• Reduce risk of
  • hemodynamic instability
  • tachycardia induced cardiomyopathy

• Hospitalization recommended if HR > 120

Tachycardia-Induced Cardiomyopathy

• Dilated cardiomyopathy secondary to sustained tachycardia
• Sustained tachycardia for months
• Reversible with control of HR
Acute Treatment of AF with RVR

- If hemodynamically unstable
  - Electrical cardioversion
- If hemodynamically stable (with no pre-excitation, no HFrEF)
  - Metoprolol 2.5-5.0 mg IV bolus every 3 min; up to 3 doses
  - Verapamil 0.075-0.15 mg/kg IV bolus over 2 min; may give an additional 10.0 mg after 30 min if no response, then 0.005 mg/kg/min infusion
  - Diltiazem 0.25 mg/kg IV bolus over 2 min; then 5-15 mg/hr


Goal Heart Rate

- A heart rate control (resting heart rate <80) strategy is reasonable for symptomatic management of AF. (Class IIa, LOE: B)
- A lenient rate-control strategy (resting heart rate <110 bpm) may be reasonable as long as patients remain asymptomatic and left ventricular systolic function is preserved. (Class IIb, LOE: B)

RACE II

<table>
<thead>
<tr>
<th></th>
<th>Lenient</th>
<th>Strict</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal achieved</td>
<td>304 (97%)</td>
<td>203 (67%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>HR</td>
<td>93</td>
<td>76</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Primary outcomes</td>
<td>12.9%</td>
<td>14.3%</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Visits</td>
<td>75</td>
<td>684</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Rate Control

- Beta blockers
  - esmolol
  - propranolol
  - metoprolol
- Nondihydropyridine calcium channel blockers
  - diltiazem
  - verapamil
- Digoxin
- Amiodarone (Caution!!! Also rhythm control)
Rhythm Control

• Always remember anticoagulation before rhythm control!
  • Anticoagulation 3 weeks prior to cardioversion or TEE with no atrial thrombus (unless onset < 48 hours)
• Electro-cardioversion
• Antiarrhythmic drugs
• Catheter ablation (very difficult with AF)

Cardioversion

• Electrical - synchronized
• Pharmacological
  • Flecainide
  • Dofetilide
  • Propafenone
  • Ibutilide
  • Amiodarone
Rate vs. Rhythm Control

- AFFIRM and RACE trials
- Rate control equivalent to rhythm control
- Rhythm control
  - Proarrhythmic
  - Requires monitoring
  - Reoccurs in 20-60% at one year
  - Increased hospitalization rate

Q8

After starting Ms Rose on metoprolol, the patients HR improves to 80. Her EKG now shows...
AES Question 8
Which of the following is true?

A. A flutter cannot coexist with A fib  
B. Catheter ablation can restore NSR  
C. No anticoagulation needed  
D. Rate control is generally easier with Flutter than if atrial fibrillation

Pathophysiology

Atrial Flutter

- Reentrant atrial arrhythmia
- Regular atrial rate
- Constant p-wave morphology
- Similar risk factors for atrial fibrillation
- Atrial flutter and atrial fibrillation can coexist in same patient
AES Question 9

Despite our best efforts, Ms Rose continues to have AF with HR of 130 and LV dysfunction. She was electrocardioverted and started on amiodarone but went back into AF with RVR. What is the next best intervention?

A. Use non-FDA approved dose of metoprolol
B. AV node ablation with pace maker placement
C. Start a second antiarrhythmic
D. Allow her to have a more lenient HR goal

AES Question 10

Ms Rose now must undergo repair of an abdominal aortic aneurysm. She has been tolerating apixaban well for nonvalvular AF. How should her anticoagulation be managed?

A. Last dose apixaban 2 days before procedure. Restart in 24 hours
B. Continue apixaban through surgery
C. Last dose apixaban 3 days before procedure and start bridging heparin drip until surgery
D. Last dose apixaban 3 days before procedure. Restart in 48 hours.
Procedural Bleed Risk

<table>
<thead>
<tr>
<th>Anticoagulant</th>
<th>High Bleed Risk</th>
<th>Low Bleed Risk</th>
<th>High Bleed Risk</th>
<th>Low Bleed Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dabigatran</td>
<td>Last dose 3 days before procedure*</td>
<td>Last dose 2 days before procedure*</td>
<td>Resume 48-72 hours post op</td>
<td>Resume 24 hours post op</td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>Last dose 3 days before procedure</td>
<td>Last dose 2 days before procedure</td>
<td>Resume 48-72 hours post op</td>
<td>Resume 24 hours post op</td>
</tr>
<tr>
<td>Apixaban</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edoxaban</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

*Changes if renally dosed

Clot Risk

- **Very high risk**
  - $\text{CHA}_2\text{DS}_2\text{VAS}_c$ of $\geq 6$
  - Mechanical heart valve
    - Any Mitral valve
  - Rheumatic valvular disease
  - VTE previous 3 months
- **High risk**
  - $\text{CHA}_2\text{DS}_2\text{VAS}_c$ of 4-5
  - Bileaflet aortic valve prosthesis and AF
  - VTE in past 3-12 months
- **Low risk**
  - $\text{CHA}_2\text{DS}_2\text{VAS}_c < 4$
  - VTE > 12 month
Heparin Bridge

• Stop warfarin approx. 5 days before surgery
• Start LMWH or heparin until procedure
• Restart LMWH/heparin after procedure and oral warfarin
• Continue LMWH/heparin until warfarin therapeutic

• BRIDGE trial showed bridge not needed
  • Excluded from the trial:
    • Mechanical heart valve
    • VTE/Stroke < 12 weeks
    • Cardiac, intracranial, or intraspinal surgery
    • CrCl < 30
    • Platelets < 100K
    • Recent major bleeding
    Most still bridge if CHADS2VASC ≥ 6

Reversal Agents

<table>
<thead>
<tr>
<th>Warfarin</th>
<th>Unactivated PCC (Kcentra)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vit K</td>
</tr>
<tr>
<td></td>
<td>FFP</td>
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<tr>
<td>Dabigatran</td>
<td>Idarucizumab (Praxbind)</td>
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<tr>
<td></td>
<td>Activated PCC</td>
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<tr>
<td></td>
<td>TXA</td>
</tr>
<tr>
<td>Apixaban</td>
<td>Andexanet alfa (Andexxa)</td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>Unactivated PCC</td>
</tr>
<tr>
<td>Edoxaban</td>
<td>TXA</td>
</tr>
</tbody>
</table>
AES Question 11

Ms Rose fell and now has a small subdural hematoma and she is admitted to a rehab facility and recovering well. Which of the following is a possible treatment course regarding her anticoagulation?

A. Restart apixaban in 3 days
B. Switch to dabigatran in 3 days
C. Discontinue all anticoagulation forever
D. Refer patient for LAA closure

LAA Occlusion

• Percutaneous LAA occlusion may be considered in patients with AF at increased risk of stroke who have contraindications to long-term anticoagulation (Class IIb, LOE B)

Photo from http://www.naharnet.com/stories/en/186746
AES Question 12

Ms Rose is back on apixaban and has an NSTEMI and gets a single Drug-Eluding Stent. How should her anticoagulation be managed?

A. Apixaban, clopidogrel, and aspirin (“Triple therapy”)
B. Apixaban and aspirin
C. Clopidogrel and aspirin
D. Triple therapy for 4-6 weeks then stop ASA

Afib post MI/Stents

• Triple therapy rationale
  • Anticoagulation prevents stroke
  • DAPT prevents stent thrombosis

• The Bad...
  • 4x higher risk of bleeding than warfarin alone
  • 2x higher risk of ICH than DAPT alone

AF with Stents

- WOEST Trial (warfarin plus clopidogrel)
- PIONEER AF (rivaroxaban plus $P_2Y_{12}$)
- RE-DUAL PCI (dabigatran plus $P_2Y_{12}$)

All had less bleeding
None powered to detect increase in ischemic events

AUGUSTUS

- Apixaban with $P_2Y_{12}$ VS Triple Therapy
  - Apixaban better than warfarin
  - Dual therapy group less bleeding (significant)
  - More ischemic events (not significant)

STOPDAPT-2 Trial

- 1 month DAPT better than 12 months
  - Less bleeding, MI

- Not AF patients


AES Question 12

Ms Rose has a brother (Franky), who is 70 and has an ischemic stroke. MRI shows an embolic distribution. Carotid u/s does not show atherosclerosis. TEE shows no PFO or intra-atrial clot. Overnight telemetry and EKG show normal sinus rhythm. What is the next step in management?

A. Assume this is AF and treat with anticoagulation
B. Holter monitor for 24 hours
C. Extended Holter for 30 days
D. Implant a loop recorder
Cryptogenic Stroke/Silent AF

- Median time to find AF is 84 days
- Recommended course of action
  - Extended Holter for 30 days
  - If no AF, then Implantable Loop Recorder

- In patients with cryptogenic stroke (i.e., stroke of unknown cause) in whom external ambulatory monitoring is inconclusive, implantation of a cardiac monitor (loop recorder) is reasonable to optimize detection of silent AF (Class IIa, LOE B)

Q13
Franky now develops AF with RVR. His EKG 1 year prior:

![ECG Image](image-url)
AES Question 13

Which of the following medications is the safest for managing his RVR?

A. Beta blocker
B. Diltiazem/verapamil
C. Amiodarone
D. Digoxin
E. Procainamide

Pathophysiology

[Diagram showing the SA Node, AV Node, Bundle of His, and Left and right bundle branches]
Pre-excitation

• Don’t block the AV node!!!
  • Can deteriorate into Vfib

• Procainamide or Ibutilide are safe
• Can always electro-cardiovert

Summary

• Two prongs with management
  • Embolic stroke prophylaxis
  • Rate/Rhythm control
• HAS BLED to modify risk only
• Don’t use Dilt in HFrEF
• Watch out for pre-excitation
Summary

• Review perioperative recs for NOACs
• AF is a common cause of cryptogenic stroke
• Consider avoiding Triple Therapy
• A Flutter has same stroke risk

Summary 2019 Changes

• Anticoagulation in CHA$_2$DS$_2$-VASc score ≥ 2 in men and ≥ 3 in women
• NOACs for all (except mechanical heart valve/Mitral stenosis)
• Consider LAA closure in patients who can’t have anticoagulation
Practice Recommendations

• If CHA₂DS₂-VASc score ≥ 2 in men and ≥ 3 in women (NEW), oral anticoagulants recommended (Class I, LOE A).


Practice Recommendations

• NOACs (non-vitamin K oral anticoagulant) are recommended over warfarin in eligible patients. (Class I, LOE A)

Practice Recommendations

• Percutaneous LAA occlusion may be considered in patients with AF at increased risk of stroke who have contraindications to long-term anticoagulation (Class IIb, LOE B)


Contact Information

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Email: brian.t.shahan.mil@mail.mil
References


Doshi A, Lane, Gregory Y.Lip. Use of the Oak(®) vitaLink and HES-6LED Scores to Aid Decision Making for Thromboprophylaxis in Nonvalvular Atrial Fibrillation. Circulation. 2013;126;80–86.


ICD-10 Codes

I48.-- Atrial fibrillation and flutter
I48.0 Paroxysmal atrial fibrillation
I48.1 Persistent atrial fibrillation
I48.2 Chronic atrial fibrillation
Questions