A Review of Common Clinical Scenarios in the Management of Atrial Fibrillation

Updates in Hospital Medicine
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Assistant Professor of Medicine

Disclosures

• None
Goals of this talk

• Review common clinical scenarios around atrial fibrillation
• Highlight guideline recommendations regarding workup and rate control of atrial fibrillation
• Considerations for cardioversion and rhythm control strategy
• Decision making regarding anticoagulation and anticoagulation alternatives
• Indications for PPM implantation in AFib

Case 1

History of the Present Illness:
91F with a history of hypertension (well managed with hydrochlorothiazide), presenting with 3 days of cough with upper respiratory symptoms and shortness of breath who is found to be in atrial fibrillation. She drinks 2-3 glasses of wine weekly. She remains fully independent and prior to this acute illness was walking 1 mile daily. She has no symptoms of thyroid dysfunction.
Case 1

**Exam:**
- HR 116 bpm, BP 140/92, RR 14, O2 Sat 98% on Room Air
- Comfortable appearing, appears much younger than stated age
- Erythematous posterior oropharynx and nasal mucosa, lungs clear
- Jugular venous pressure 6 cm H₂O, heart rate is irregularly irregular without murmurs, S3 not present, extremities warm and no edema

**Testing**
- BMP, CBC, LFTs and TSH are normal
- ECG reveals atrial fibrillation without significant ST/T changes
- TTE normal except for moderate LA dilation
- High sensitivity troponin T is mildly elevated but downtrends (30 ng/L initial followed by 16 ng/L, upper limit of normal 10 ng/L)

Case 1 continued

*25.1 Would you recommend ischemic testing?*
- Yes, I would do it as an inpatient given the elevated troponin
- Yes, but I would do it as an outpatient
- No, there are no other clinical indicators to suggest ischemic heart disease
**Case 1 continued**

*25.1 Would you recommend ischemic testing?*

- Yes, I would do it as an inpatient given the elevated troponin
- Yes, but I would do it as an outpatient
- **No, there are no other clinical indicators to suggest ischemic heart disease**

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**Value of Troponin Testing?**

- 354 consecutive patients with Afib had TnC checked
- 15% (51/354) had elevation of TnC
- 23 with elevated TnC underwent angiography
  - 6/23 had significant CAD
- 77 without positive TnC underwent angiography based on clinical suspicion
  - 25/77 had significant CAD
**Value of Troponin Testing?**

**Take-home**

1. Concomitant significant CAD is not that common with new-onset Afib (< 10%)
2. Troponin elevation should not be the sole driver in deciding to pursue ischemia testing
3. Decision to pursue ischemic testing should be based on the presence of other clinical signs and is not a routine part of the assessment

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**Case 1 continued**

*25.2 Would you recommend anticoagulation?*

- Yes, her CHA$_2$DS$_2$-Vasc score is elevated
- No, while her CHA$_2$DS$_2$-Vasc score is elevated, given her age, she is at increased risk for serious bleeding and the risk outweighs the benefit
Case 1 continued

*25.2 Would you recommend anticoagulation?

* Yes, her CHA2DS2-Vasc score is elevated and there is evidence of net benefit even in this age group.

* No, while her CHA2DS2-Vasc score is elevated, given her age, she is at increased risk for serious bleeding and the risk outweighs the benefit.

Is there an age cutoff for anticoagulation?

<table>
<thead>
<tr>
<th>Ischemic stroke</th>
<th>Hazard ratio [95% CI]</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No anti-platelet therapy</strong></td>
<td>Reference</td>
<td>-</td>
</tr>
<tr>
<td>Anti-platelet drugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unadjusted model</td>
<td>0.90 (0.86 - 1.00)</td>
<td>0.086</td>
</tr>
<tr>
<td>Adjusted model</td>
<td>0.93 (0.86 - 1.00)</td>
<td>0.135</td>
</tr>
<tr>
<td>Warfarin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unadjusted model</td>
<td>0.95 (0.87 - 1.03)</td>
<td>0.081</td>
</tr>
<tr>
<td>Adjusted model</td>
<td>0.97 (0.89 - 1.06)</td>
<td>0.560</td>
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</table>

<table>
<thead>
<tr>
<th>ONH</th>
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<tbody>
<tr>
<td><strong>No anti-platelet therapy</strong></td>
<td>Reference</td>
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<tr>
<td>Anti-platelet drugs</td>
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<td></td>
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<tr>
<td>Unadjusted model</td>
<td>1.01 (0.91 - 1.12)</td>
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<td>0.95 (0.86 - 1.05)</td>
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<tr>
<td>Warfarin</td>
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<tr>
<td>Unadjusted model</td>
<td>1.02 (0.92 - 1.18)</td>
<td>0.802</td>
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<tr>
<td>Adjusted model</td>
<td>1.23 (0.88 - 2.61)</td>
<td>0.956</td>
</tr>
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</table>

Is there an age cutoff for anticoagulation?

**I. Era without NOACs (Year 1986 - 2011)**

<table>
<thead>
<tr>
<th>Ischemic stroke</th>
<th>Hazard ratio (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No antithrombotic therapy</td>
<td>Reference</td>
<td>-</td>
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<tr>
<td>Anti-platelet drugs</td>
<td>Unadjusted model: 0.93 (0.86 - 1.01)</td>
<td>-</td>
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<tr>
<td></td>
<td>Adjusted model: 0.85 (0.68 - 1.04)</td>
<td>0.096</td>
</tr>
<tr>
<td></td>
<td>Corticosteroids: 1.03 (0.86 - 1.24)</td>
<td>0.246</td>
</tr>
<tr>
<td></td>
<td>Corticosteroids x2: 1.07 (0.97 - 1.18)</td>
<td>0.172</td>
</tr>
<tr>
<td>Warfarin</td>
<td>Unadjusted model: 0.93 (0.86 - 1.00)</td>
<td>0.036</td>
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</tbody>
</table>

*Warfarin associated with lower risk of ischemic stroke and no significant increase in intracerebral hemorrhage even in patients > 90!*

**II. Era with NOACs (Year 2012 - 2015)**

<table>
<thead>
<tr>
<th>Ischemic stroke</th>
<th>Hazard ratio (95% CI)</th>
<th>P value</th>
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</thead>
<tbody>
<tr>
<td>Warfarin</td>
<td>Unadjusted model: 1.27 (0.92 - 1.82)</td>
<td>0.500</td>
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<td>Adjusted model: 1.22 (0.96 - 1.56)</td>
<td>0.096</td>
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<tr>
<td></td>
<td>Corticosteroids: 1.34 (0.97 - 1.83)</td>
<td>0.162</td>
</tr>
<tr>
<td></td>
<td>Corticosteroids x2: 1.38 (0.99 - 1.93)</td>
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</table>

<table>
<thead>
<tr>
<th>Major bleeding</th>
<th>Hazard ratio (95% CI)</th>
<th>P value</th>
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<tbody>
<tr>
<td>Warfarin</td>
<td>Unadjusted model: 0.27 (0.09 - 0.81)</td>
<td>0.039</td>
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<tr>
<td></td>
<td>Adjusted model: 0.25 (0.09 - 0.80)</td>
<td>0.040</td>
</tr>
<tr>
<td></td>
<td>Corticosteroids: 0.22 (0.08 - 0.65)</td>
<td>0.084</td>
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</tbody>
</table>

*Chao et al. Circulation 2018.*
Is there an age cutoff for anticoagulation?

DOACs are as effective as warfarin for ischemic stroke prevention but are associated with LESS intracerebral hemorrhage in patients > 90!

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<td>Unadjusted model</td>
<td>0.95 (0.81 - 1.12)</td>
</tr>
<tr>
<td></td>
<td>Adjusted model</td>
<td>1.04 (0.86 - 1.25)</td>
</tr>
<tr>
<td></td>
<td>Competing risk</td>
<td>1.10 (0.85 - 1.43)</td>
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</tbody>
</table>

Take-home

- Age alone should not dissuade you from anticoagulation
- There is evidence of net clinical benefit even in the very elderly population
- Certainly if the individual patient has high bleeding risk, reasonable to hold though should have a thorough risk-benefit discussion with patient
Case 2

History of the Present Illness:
69F with long standing atrial fibrillation status post 3 prior ablations, baseline stage IV chronic kidney disease and pancreatic cancer receiving abraxane/gemcitabine presenting with gastric outlet obstruction from tumor compression, severe dehydration and malnutrition with difficult to control atrial fibrillation.

She is on apixaban 5 mg twice daily though she has missed a few doses recently and is also on metoprolol 50 mg every 6 hours.

Case 2 continued

Exam:
On exam, she is febrile, tachycardic to 128, blood pressure is 110/67 and she is saturating well on room air. She is chronically ill appearing with dry mucous membranes. Her jugular venous pressure is < 5 cm H2O. On cardiovascular exam, she is irregularly irregular without murmurs or S3. Her lungs are clear and her extremities are warm without any peripheral edema.
Case 2 continued

Workup:
Comprehensive metabolic panel notable for creatinine 5 mg/dL (442 umol/L), potassium 3 mmol/L and magnesium 1 mmol/L
Thyroid stimulating hormone normal
Blood counts normal
Transthoracic echocardiogram shows normal biventricular function without significant valvular abnormalities
Case 2 continued

*25.3 What would be your next management steps for her atrial flutter?
   A. Increase to metoprolol 100 mg every 6 hours
   B. Continue metoprolol and initiate verapamil
   C. Continue metoprolol and load with digoxin
   D. Continue metoprolol and start amiodarone
   E. Schedule TEE and cardioversion
# Rate Control Agents

<table>
<thead>
<tr>
<th>Beta-Blockers</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Practical Tips</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Most effective</td>
<td>• Bolus IV for metoprolol</td>
<td>• Always load with oral after IV</td>
</tr>
<tr>
<td></td>
<td>• Safe with LV dysfunction</td>
<td>• Esmolol available as continuous infusion</td>
<td>• Cardioselective safe in COPD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bronchospasm possible</td>
<td>• Cardioselective: bisoprolol &gt;&gt; atenolol &gt; metoprolol</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Carvedilol: non-cardioselective</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-dihydropyridine Calcium Channel Blockers</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Practical Tips</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• No issues with bronchospasm</td>
<td>• Avoid with LV dysfunction</td>
<td>• Always load with oral after IV</td>
</tr>
<tr>
<td></td>
<td>• Diltiazem available as continuous infusion</td>
<td></td>
<td>• Verapamil sometimes more effective than diltiazem</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Digoxin</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Practical Tips</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• No negative inotropic effect</td>
<td>• Slows resting ventricular response but not with exercise</td>
<td>• Replace K/Mg first</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Level &lt; 1, check after a few doses</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Avoid in elderly and CKD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Should not be used as monotherapy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amiodarone</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Practical Tips</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Continuous infusion</td>
<td>• Thromboembolism with pharmacologic conversion</td>
<td>• Reserve only for those who cannot tolerate above therapies</td>
</tr>
<tr>
<td></td>
<td>• Minimal negative inotropic effect</td>
<td>• Long-term toxicity</td>
<td>• Load slowly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Thrombophlebitis</td>
<td>• Transition to oral as soon as possible</td>
</tr>
</tbody>
</table>
Case 2 continued

- Metoprolol 50 q6h continued
- Magnesium/Potassium repleted
- Fluid resuscitated, nutrition improved
- Diltiazem added but HR remains 140-150s
- Transition to verapamil 120 mg every 8 hours
- Heart rate 110s, Blood pressures 110-120s/50-60s
- Asymptomatic from a CV standpoint
Case 2 continued

*25.4 What would you do next?
A. Add digoxin
B. Schedule TEE with DCCV
C. Add amiodarone
D. Continue the current therapy
What HR to aim for

- Race II Trial
- Randomized 600 patients to resting HR < 80 or < 110
- 3-year follow-up
- Healthy population
  - 60% CHADS 0 or 1
  - 2/3 NYHA Class I, 30% Class II, ~5% Class III
  - 15% LVEF < 40%
- Primary outcome was combined endpoint
- Designed as a non-inferiority trial

Van Gelder et al. NEJM. 2010.
What HR to aim for

Targeting resting HR 110 is reasonable in the hospital!

P < 0.0001 for non-inferiority

Tips for Rate Control in the Inpatient Setting

- Treat the underlying illness and be patient!
- Replenish electrolytes
- Optimize fluid status
- Use BB and/or CCB as first line therapy
- Digoxin can be added as 2nd/3rd line therapy
- Amiodarone can be considered in hemodynamically unstable patient (not due to Afib)
Case 2 continued

- Her renal function fails to improve and she develops significant electrolyte disturbances and ultimately is initiated on HD
- She is being managed with IV heparin but is now ready to be transitioned to an agent that she can leave the hospital with

---

Case 2 continued

- Her renal function does not normalize and her GFR is 19 ml/min (creatinine 2.6 mg/dL or 230 umol/L)
- She is being managed with IV heparin but is now ready to be transitioned to an oral agent
- Her weight is 75 kg

*25.5 What agent would you transition to?
  A. Enoxaparin 1 mg/kg twice daily
  B. Dose-adjusted warfarin for goal INR 2-3
  C. Apixaban 2.5 mg twice daily
  D. Rivaroxaban 15 mg daily
Case 2 continued

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D. Rivaroxaban 15 mg daily

DOACs in ESRD

Apixaban as effective as warfarin in ESRD
5 mg superior, 2.5 mg equivalent
DOACs in ESRD

Apixaban (5 and 2.5 mg doses) associated with lower risk of bleeding than warfarin


DOACs in ESRD/advanced CKD

Take-homes:
• Dosage adjusted warfarin versus apixaban reasonable (Class IIb recommendation)
• Optimal apixaban dose not clear in ESRD
• Dabigatran, edoxaban and rivaroxaban should NOT be used in ESRD
Make sure dosing is correct!

Overdosing increases bleeding
Underdosing decreases efficacy WITHOUT less bleeding
Be careful to use prescribing guidelines for the direct oral anticoagulants

Yao et al. JACC 2017.
Case 3

History of the Present Illness:
68 year old man with a history of hypertension presents with multiple embolic strokes and is found to have newly diagnosed atrial fibrillation. He has good functional capacity and has no anginal symptoms. He has been cleared by neurology to start anticoagulation and is currently on apixaban 5 mg twice daily and metoprolol 50 mg twice daily.

Case 3

Exam:
HR 86, BP 130/70, Right sided facial droop but remainder of neurologic exam normal, JVP 6 cm H2O, irregularly irregular, no murmurs, no S3/S4, extremities warm and no edema

TTE: LVEF 30-35% with global hypokinesis, no significant valvular abnormalities, LVEF significantly changed from 1 year prior
Case 3 continued

*25.6 What is the next best management step?
A. Ischemic evaluation with angiography
B. Ischemic evaluation with stress testing
C. No further testing, continuation of metoprolol and apixaban
D. Transesophageal echocardiography and cardioversion
Benefits of Rhythm Control

- 1) LVEF ≤ 35%
- 2) NYHA Class II-IV
- 3) ICD in place

- Optimal medical therapy (OMT) versus OMT + catheter ablation

Benefits of Catheter Ablation in Low EF

Catheter ablation in patients with symptomatic HFrEF improves outcomes
**Rhythm Control For Low EF**

- Strongly consider rhythm control strategy in patients with low LVEF
- In patients with symptomatic heart failure on optimal medical therapy with high burden of AF → catheter ablation reasonable
- Not quite ready for primetime as a one-size fits all but threshold for ablation getting lower

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**Case 3 continued**

- The patient was successfully cardioverted
- Repeat TTE 3 months later showed resolution of LV function
- He remained on metoprolol and apixaban with outstanding compliance.
- 1 year later, develops a lower GI bleed without clear identifiable source requiring hospitalization and multiple transfusion.
Case 3 continued

*25.7 What is the next best management step?
A. Transition from apixaban to rivaroxaban
B. Transition from apixaban to aspirin 81 mg daily
C. Transition from apixaban to warfarin
D. Cessation of anticoagulation
E. Cessation of anticoagulation and referral for LAA occlusion with the Watchman device
Percutaneous LAA occlusion

• Non-inferior to warfarin
• FDA approved for
  – CHA$_2$DS$_2$-Vasc ≥ 2
  – Appropriate rationale for forgoing anticoagulation
  – Candidate for 6 weeks of anticoagulation
• Can consider if patient cannot tolerate AC at all but ideally on short-term anticoagulation to prevent device thrombosis

Vainrib et al. JASE. 2018.

Practical Application of LAA closure

• Consider referral in patients with:
  – CHA$_2$DS$_2$-Vasc ≥ 2
  – Cannot tolerate anticoagulation
• Benefit is not immediate and rarely done acutely
• Procedural complication rate ~3-4% in experienced hands

Vainrib et al. JASE. 2018.
Case 4

History of the Present Illness

A 67 year-old man with a history of hypertension (well-controlled on lisinopril and amlodipine) and diabetes presents for an elective knee replacement. On POD 3, he is noted to have an irregular pulse though asymptomatic. 12-lead ECG shows sinus rhythm. Over the next 24 hours, he is placed on telemetry and is noted to have paroxysmal atrial fibrillation with 3 episodes of atrial fibrillation lasting 30-60 minutes.

Exam and Workup

Pulse is 86 and blood pressure 130/72 and is otherwise unremarkable. ECG and transthoracic echocardiogram are also unremarkable except for a mildly dilated left atrium.

Case 4 continued

*25.8 What are your next best management steps?
A. Initiate beta-blocker
B. Initiate beta-blocker and aspirin
C. Initiate beta-blocker and arrange follow-up with cardiology
D. Discharge home without any changes
E. Initiate beta-blocker and anticoagulation
*25.8 What are your next best management steps?
A. Initiate beta-blocker  
B. Initiate beta-blocker and aspirin  
C. Initiate beta-blocker and arrange follow-up with cardiology  
D. Discharge home without any changes  
E. Initiate beta-blocker and anticoagulation

How much Afib is too much Afib?

<table>
<thead>
<tr>
<th>Clinical Outcome</th>
<th>Subclinical Atrial Tachyarrhythmias between Enrollment and 3 Months</th>
<th>Hazard Ratio with Subclinical Atrial Tachyarrhythmias (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present (N=213)</td>
<td>Absent (N=2139)</td>
<td></td>
</tr>
<tr>
<td>Ischemic stroke</td>
<td>11</td>
<td>1.69</td>
<td>40</td>
</tr>
<tr>
<td>Ischemic stroke</td>
<td>10</td>
<td>1.54</td>
<td>36</td>
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<tr>
<td>Systemic embolism</td>
<td>1</td>
<td>0.15</td>
<td>4</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>7</td>
<td>1.07</td>
<td>39</td>
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<tr>
<td>Death from vascular causes</td>
<td>19</td>
<td>2.92</td>
<td>153</td>
</tr>
<tr>
<td>Stroke, myocardial infarction, or death from vascular causes</td>
<td>29</td>
<td>4.45</td>
<td>206</td>
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<tr>
<td>Hospitalization for heart failure</td>
<td>20</td>
<td>3.07</td>
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<tr>
<td>Clinical atrial fibrillation on surface electrocardiogram</td>
<td>41</td>
<td>6.29</td>
<td>71</td>
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</table>
How much Afib is too much Afib?

6 minutes of continuous AF was associated with a 2.5-fold increased risk of stroke or embolism.

What is the risk of post-operative Afib?

<table>
<thead>
<tr>
<th>Author</th>
<th>Type</th>
<th>POAF</th>
<th>EPOAF</th>
<th>Hazard Ratio</th>
<th>Hazard Ratio</th>
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<tbody>
<tr>
<td>Healey et al.</td>
<td>NEJM 2012.</td>
<td>2011</td>
<td>307</td>
<td>314</td>
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<td>Williams et al.</td>
<td>Stroke. 2019.</td>
<td>2014</td>
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<tr>
<td>Dorian et al.</td>
<td>Stroke. 2019.</td>
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<td>11</td>
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<tr>
<td>Keene et al.</td>
<td>Stroke. 2019.</td>
<td>2015</td>
<td>186</td>
<td>113</td>
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<td>Branger et al.</td>
<td>Stroke. 2019.</td>
<td>2010</td>
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<td>Naka et al.</td>
<td>Stroke. 2019.</td>
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<td>76</td>
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What is the risk of post-operative Afib?


Strongly consider anticoagulation even in post-operative AFib!

Management of short-duration Afib

Take Home Points

• Very little atrial fibrillation is needed to increase stroke risk
• Risk of stroke is increased even in isolated post-operative AFib
• Strongly consider anticoagulation based on the CHA₂DS₂-Vasc score regardless of duration and post-operative status
Case 4 continued

Given his CHA$_2$DS$_2$-Vasc of 3 and given that it seemingly occurred while asymptomatic and as his clinical illness was improving, the decision was made to start him on rivaroxaban.

Case 5

A 74 year old man with a long-standing history of atrial fibrillation presents with acute decompensated heart failure. He has undergone 4 prior atrial fibrillation ablations that have failed. He is currently being managed on amiodarone 200 mg daily, metoprolol 200 mg daily, verapamil 360 mg daily and digoxin 0.125 mg daily. On exam, he is normotensive and hypoxic. On auscultation, he is irregularly irregular without murmurs, jugular venous pressure is elevated, crackles are present bilaterally, lower extremity edema is present but they are warm. ECG shows atrial fibrillation with ventricular rates in the 140s. TTE shows a reduction in LV function with massive biatrial enlargement despite a recent negative ischemic evaluation. Thyroid function testing is normal.
Case 5 continued

*25.9 What is the next best step
A. IV furosemide, continue all of his remaining medications
B. IV furosemide, continue all of his remaining medications except his calcium channel blocker
C. Cardioversion
IV diuresis is implemented effectively. His verapamil is stopped. Overnight, his ventricular rates improve but he is noted to have a 4 second pause when he converts from afib to sinus while asleep. Once awake, he returns to ventricular rates in the 140-150s.

*25.10 What is the next best step
A. Cardioversion
B. EP request for repeat ablation
C. EP request for pacemaker implantation
D. EP request for pacemaker implantation with AV junction ablation
Case 5 continued

*25.10 What is the next best step
A. Cardioversion
B. EP request for repeat ablation
C. EP request for pacemaker implantation
D. EP request for pacemaker implantation with AV junction ablation

Indications for PPM in AFib

• High grade AV block in awake, symptom-free patients with AF and bradycardia with 1 or more pauses of at least 5 seconds or longer
• After catheter ablation of the AV junction
• Permanent AF and symptomatic bradycardia

Kusumoto et al. JACC 2019.
January et al. JACC 2008.
Take-Home Points

- Ischemic evaluation is not necessary
- BB/CCB are 1st line therapy for rate control, amiodarone should be used sparingly
- Advanced age is not a contraindication to anticoagulation
- Strongly consider cardioversion for the 1st presentation
- Consider LAA occlusion in patients who are poor anticoagulation candidates
- CHA₂DS₂-Vasc is the most important consideration
- PPM therapy should only be considered in patients with concomitant significant bradyarrhythmias