

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

Updates in Hospital Medicine
Yee-Ping Sun, MD FACC
Assistant Professor of Medicine

Disclosures

- Consulting fees from Broadview Ventures

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:

90F with a history of hypertension (well managed with hydrochlorothiazide), bioprosthetic mitral valve replacement 10 years prior for endocarditis in the setting of known mitral valve prolapse (now on aspirin 81 mg daily only) 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, Weight 50 kg
- Comfortable appearing, appears much younger than stated age
- Erythematous posterior oropharynx and nasal mucosa, lungs clear
- Jugular venous pressure 6 cm H₂O, heartrate is irregularly irregular without murmurs, S3 not present, extremities warm and no edema

Testing

- BMP, CBC, LFTs and TSH notable for GFR ~45 ml/min/1.73 m²
- ECG reveals atrial fibrillation without significant ST/T changes
- TTE shows normal biventricular function, normal functioning bioprosthetic mitral valve and moderate LA dilation

Case 1 continued

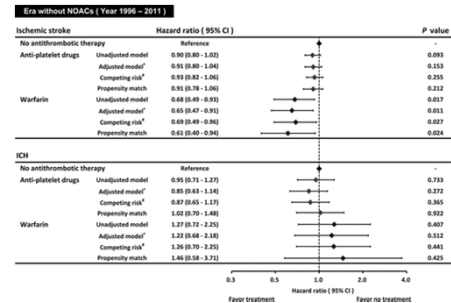
*25.1 In addition to initiating rate control therapy, would you recommend anticoagulation?

- Yes, her CHA₂DS₂-Vasc score is elevated
- 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

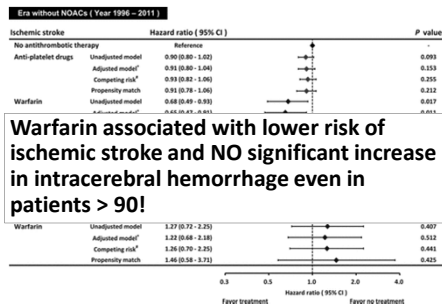
Case 1 continued

- *25.1 In addition to initiating rate control therapy, 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?

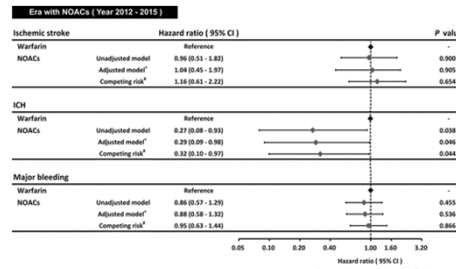


Is there an age cutoff for anticoagulation?

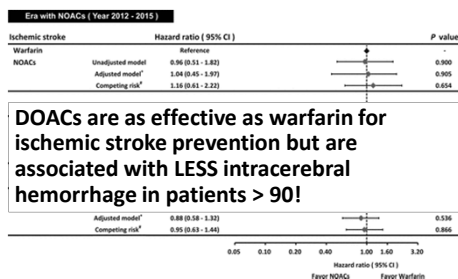


Warfarin associated with lower risk of ischemic stroke and NO significant increase in intracerebral hemorrhage even in patients > 90!

Is there an age cutoff for anticoagulation?



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!

Is there an age cutoff for anticoagulation?

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 1 continued

*25.2 What anticoagulant would you choose?

- Rivaroxaban 20 mg daily
- Dose adjusted warfarin for goal INR 2-3
- Apixaban 5 mg twice daily
- Apixaban 2.5 mg twice daily

Case 1 continued

*25.2 What anticoagulant would you choose?

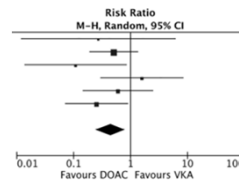
- Rivaroxaban 20 mg daily
- Dose adjusted warfarin for goal INR 2-3
- Apixaban 5 mg twice daily
- **Apixaban 2.5 mg twice daily**

DOACs in Valvular AF

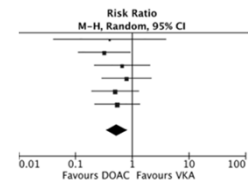
- Valvular atrial fibrillation = atrial fibrillation with moderate to severe MS, valve replacement or valve repair
- Native AS, AI, MR and TR are NOT considered valvular AF
- DOACs with mechanical valves are absolutely contraindicated!
- DOACs should not be used with moderate to severe MS

DOACs with Bioprosthetic Valves?

Embololic risk

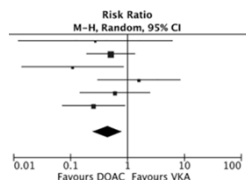


Bleeding Risk

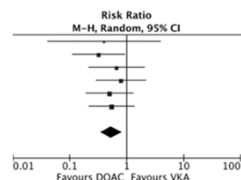


DOACs with Bioprosthetic Valves?

Embololic risk



Bleeding Risk



DOACs probably safe among patients with bioprosthetic valves.

DOACs with Bioprosthetic Valves?

- Warfarin preferred in first 3-6 months after bioprosthetic valve replacement
- After 3-6 months, DOACs can be considered (ACC/AHA class IIb recommendation) among patients with bioprosthetic valves or valve repair and Afib
- If initial indication for bioprosthetic MVR was mitral stenosis, warfarin still preferred

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



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

Case 2 continued

*25.3 What would be your next management steps for her atrial flutter?

- A. Increase to metoprolol 100 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

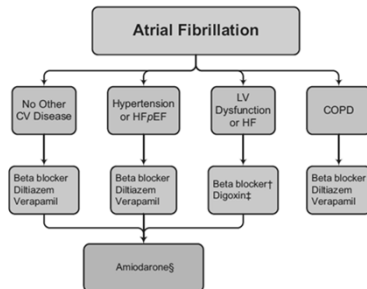
Rate Control Agents

	Advantages	Disadvantages	Practical Tips
Beta-Blockers	<ul style="list-style-type: none"> • Most effective • Safe with LV dysfunction 	<ul style="list-style-type: none"> • Bolus IV for metoprolol • Esmolol available as continuous infusion • Bronchospasm possible 	<ul style="list-style-type: none"> • Always load with oral after IV • Cardioselective safe in COPD <ul style="list-style-type: none"> • Cardioselective: bisoprolol >> atenolol > metoprolol • Carvedilol: non-cardioselective
Non-dihydropyridine Calcium Channel Blockers	<ul style="list-style-type: none"> • No issues with bronchospasm • Diltiazem available as continuous infusion 	<ul style="list-style-type: none"> • Avoid with LV dysfunction 	<ul style="list-style-type: none"> • Always load with oral after IV • Verapamil sometimes more effective than diltiazem

Rate Control Agents

	Advantages	Disadvantages	Practical Tips
Digoxin	<ul style="list-style-type: none"> • No negative inotropic effect 	<ul style="list-style-type: none"> • Slows resting ventricular response but not with exercise • Narrow therapeutic window • Slow onset 	<ul style="list-style-type: none"> • Replace K/Mg first • Level < 1, check after a few doses • Avoid in elderly and CKD • Should not be used as monotherapy
Amiodarone	<ul style="list-style-type: none"> • Continuous infusion • Minimal negative inotropic effect 	<ul style="list-style-type: none"> • Thromboembolism with pharmacologic conversion • Long-term toxicity • Thrombophlebitis 	<ul style="list-style-type: none"> • Reserve only for those who cannot tolerate above therapies • Load slowly • Transition to oral as soon as possible

Rate Control Agents



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?

- Add digoxin
- Schedule TEE with DCCV
- Add amiodarone
- Continue the current therapy

Case 2 continued

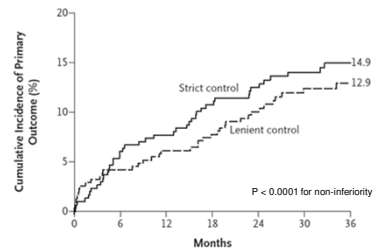
*25.4 What would you do next?

- Add digoxin
- Schedule TEE with DCCV
- Add amiodarone
- Continue the current therapy**

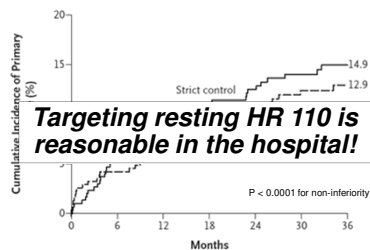
What HR to aim for

- 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

What HR to aim for



What HR to aim for



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?

- Enoxaparin 1 mg/kg twice daily
- Dose-adjusted warfarin for goal INR 2-3
- Apixaban 2.5 mg twice daily
- Rivaroxaban 15 mg daily

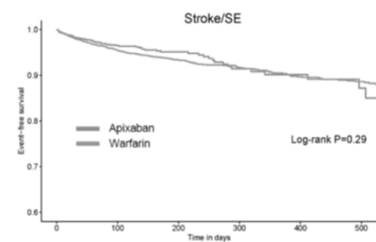
Case 2 continued

- 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?

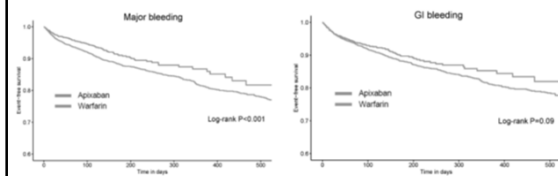
- Enoxaparin 1 mg/kg twice daily
- Dose-adjusted warfarin for goal INR 2-3**
- Apixaban 2.5 mg twice daily
- Rivaroxaban 15 mg daily

DOACs in ESRD



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

DOACs in ESRD



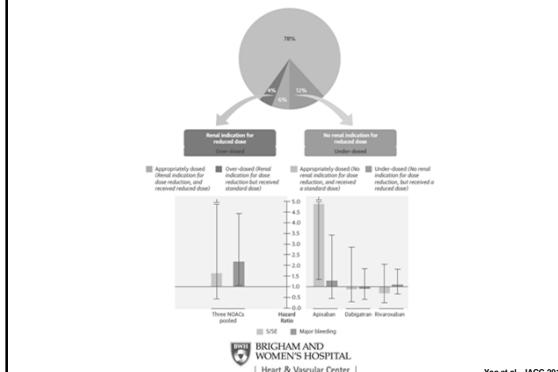
**Apixaban (5 and 2.5 mg doses)
associated with lower risk of
bleeding than warfarin**

DOACs in ESRD/advanced CKD

Take-homes:

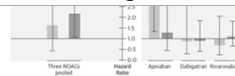
- Dosage adjusted warfarin versus apixaban reasonable (Class IIb recommendation)
- Optimal apixaban dose not clear in ESRD
- Dabigatran, edoxaban and rivaroxaban should NOT be used in ESRD

Make sure dosing is correct!



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**



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

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



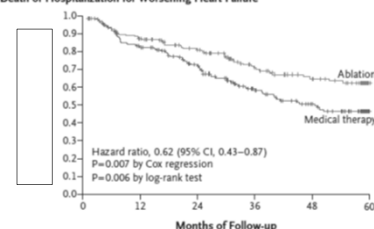
Catheter Ablation for Atrial Fibrillation with Heart Failure

Nasser F. Marrouche, M.D., Johannes Brachmann, M.D., Dietrich Andresen, M.D., Jürgen Siebels, M.D., Lucas Bevilacqua, M.D., Luc Jordeaux, M.D., Billy Merkley, M.D., Eugeny Potapov, M.D., Prakashan Sanders, M.D., Jochen Proff, B.S., Heibert Schunkert, M.D., Hildegard Christ, M.D., Jürgen Vogt, M.D., and Dietmar Bänsch, M.D., for the CASTLE-AF Investigators*

- 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

A Death or Hospitalization for Worsening Heart Failure

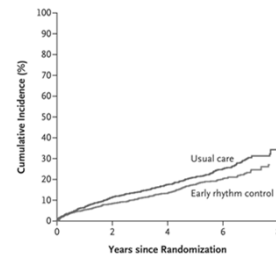


Catheter ablation in patients with symptomatic HFrEF improves outcomes

Benefits of Early Rhythm Control

- East AFNET 4 Trial – NEJM 2020
- 2800 patients at 135 centers with:
 - AF 1 < year
 - Randomized to rhythm control versus usual care (rhythm control only for symptoms)
 - 5 year follow-up
 - Composite outcome of death from CV cause, stroke or CV hospitalization
 - Average CHADS-Vasc = 3
 - 28% with NYHA Class II symptoms OR LVEF < 50%

Benefits of Early Rhythm Control



Decreased primary endpoint but increased risk of adverse event!

When to consider rhythm control!

- Strongly consider rhythm control strategy in patients with low LVEF and new onset AF
- In patients with symptomatic heart failure on optimal medical therapy with high burden of AF → catheter ablation reasonable
- Catheter ablation is probably more effective than oral antiarrhythmic therapy
- Not quite ready for primetime as a one-size fits all but threshold for ablation getting lower

Case 3 continued

- The patient was successfully cardioverted
- Repeat TTE 3 months later showed resolution of LV function
- Not interested in rhythm control
- 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?
- Transition from apixaban to rivaroxaban
 - Transition from apixaban to aspirin 81 mg daily
 - Transition from apixaban to warfarin
 - Cessation of anticoagulation
 - Cessation of anticoagulation and referral for LAA occlusion with the Watchman device

Case 3 continued

- *25.7 What is the next best management step?
- Transition from apixaban to rivaroxaban
 - Transition from apixaban to aspirin 81 mg daily
 - Transition from apixaban to warfarin
 - Cessation of anticoagulation
 - Cessation of anticoagulation and referral for LAA occlusion with the Watchman device**

Percutaneous LAA occlusion

- Non-inferior to warfarin
- WATCHMAN-FLX is FDA approved for
 - $\text{CHA}_2\text{DS}_2\text{-Vasc} \geq 2$
 - *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



BRIGHAM AND WOMEN'S HOSPITAL
Heart & Vascular Center

<https://www.bwhscientific.com/en/EU/products/labc-system/watchman-flx.html>

Practical Application of LAA closure

- Consider referral in patients with :
 - $\text{CHA}_2\text{DS}_2\text{-Vasc} \geq 2$
 - Cannot tolerate anticoagulation
- Benefit is not immediate and rarely done acutely
- Procedural complication rate with newest generation device 0.5% in experienced hands

BRIGHAM AND WOMEN'S HOSPITAL
Heart & Vascular Center

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.

BRIGHAM AND WOMEN'S HOSPITAL
Heart & Vascular Center

Case 4 continued

*25.8 What are your next best management steps?

- Initiate beta-blocker
- Initiate beta-blocker and aspirin
- Initiate beta-blocker and arrange follow-up with cardiology
- Discharge home without any changes
- Initiate beta-blocker and anticoagulation

BRIGHAM AND WOMEN'S HOSPITAL
Heart & Vascular Center

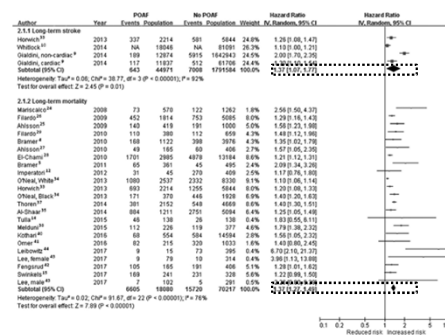
Case 4 continued

*25.8 What are your next best management steps?

- Initiate beta-blocker
- Initiate beta-blocker and aspirin
- Initiate beta-blocker and arrange follow-up with cardiology
- Discharge home without any changes
- Initiate beta-blocker and anticoagulation

BRIGHAM AND WOMEN'S HOSPITAL
Heart & Vascular Center

What is the risk of post-operative Afib?



BRIGHAM AND WOMEN'S HOSPITAL
Heart & Vascular Center

What is the risk of post-operative Afib?

Author	Year	POAF Events	POAF Population	No POAF Events	No POAF Population	Hazard Ratio No. Events, %	Hazard Ratio IV, Random, 95% CI
2.1.1 Long-term stroke							
Hemachin ¹⁰	2013	227	2214	581	5844	24.0%	1.20 (0.05, 1.47)
Widjaja ¹¹	2014	66	10646	NA	8100	28.3%	1.10 (0.00, 1.21)
Quattrin, non-cardiac ⁴	2014	189	12874	5915	184283	24.5%	2.00 (0.70, 2.26)
Quattrin, cardiac ⁴	2014	117	11837	522	87150	24.6%	1.20 (0.10, 1.54)
Subtotal (95% CI)		603	44871	7004	179184	100.0%	1.37 (1.07, 1.77)
Heterogeneity: Tau ² = 0.06; Chi ² = 38.77, df = 3 (P < 0.00001); I ² = 92%							
Test for overall effect: Z = 2.45 (P = 0.01)							
2.1.2 Long-term mortality							
Wattanasit ¹²	2008	73	570	122	1282	1.8%	2.56 (0.05, 4.37)
Farrar ¹³	2009	402	1814	793	8889	8.8%	1.29 (0.16, 1.43)
Alkhouli ¹⁴	2009	143	418	191	1000	5.0%	1.58 (0.75, 3.38)
Hemachin ¹⁰							
	2013	693	2214	1255	5844	9.0%	1.20 (0.06, 1.33)
Orlitz, Black ¹⁵	2013	171	370	446	1828	8.8%	1.40 (0.26, 1.63)
Thompson ¹⁶	2014	381	2152	549	4889	8.8%	1.40 (0.30, 1.51)
Al-Shay ¹⁷	2014	884	1211	2750	5084	6.4%	1.20 (0.06, 1.46)
Taha ¹⁸	2015	46	138	26	138	0.4%	1.03 (0.05, 6.11)
Wattanasit ¹²	2016	112	236	119	277	4.6%	1.79 (0.20, 2.32)
Kilbauer ¹⁹	2016	68	554	584	14884	2.8%	1.58 (0.05, 2.32)
Quattrin ⁴	2016	82	215	320	1023	1.6%	1.40 (0.06, 2.40)
Leibowitz ²⁰	2017	9	15	73	385	0.4%	6.79 (0.10, 21.37)
Lee, Hong ²¹	2017	9	79	19	394	4.4%	3.95 (0.13, 13.88)
Fangousa ²²	2017	105	165	191	408	0.1%	1.28 (0.1, 1.62)
Bernstein ²³	2017	169	241	270	320	1.6%	1.10 (0.08, 1.62)
Lee, Hong ²¹	2017	7	92	5	281	0.1%	2.28 (0.08, 4.38)
Subtotal (95% CI)		6695	18886	15720	70217	100.0%	1.37 (1.07, 1.66)
Heterogeneity: Tau ² = 0.02; Chi ² = 91.87, df = 22 (P < 0.00001); I ² = 76%							
Test for overall effect: Z = 7.88 (P < 0.00001)							

Strongly consider anticoagulation even in post-operative AF!

Management of short-duration Afib

Take Home Points

- 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 CHA₂DS₂-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

*25.8 What is the next best step

- IV furosemide, continue all of his remaining medications
- IV furosemide, continue all of his remaining medications except his calcium channel blocker
- Cardioversion

Case 5 continued

*25.8 What is the next best step

- IV furosemide, continue all of his remaining medications
- IV furosemide, continue all of his remaining medications except his calcium channel blocker**
- Cardioversion

Case 5 continued

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.

Case 5 continued

*25.9 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

*25.9 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

Take-Home Points

- Advanced age is not a contraindication to anticoagulation
- DOACs can be used safely in many patients with bioprosthetic valves
- Consider rhythm control strategy in patients with HFrEF on GDMT with high burden of Afib AND in new onset AFib
- 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