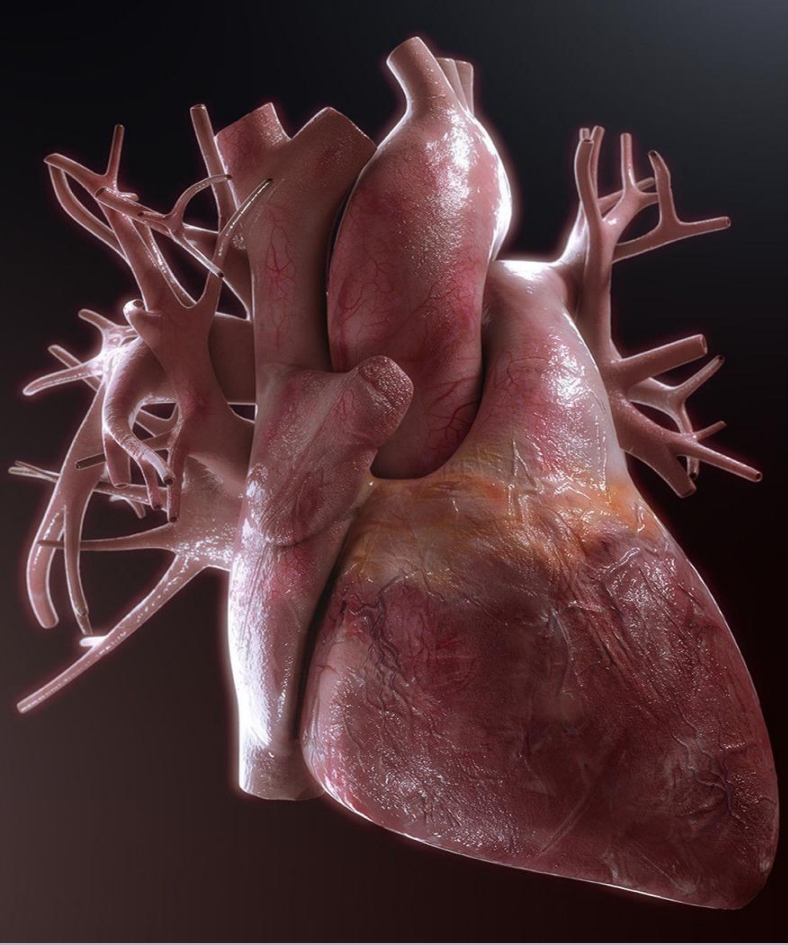


The Arrhythmias going to get you



Viet Le, DMSc MPAS PA-C FACC FAHA
Associate Professor of Research, Preventive Cardiology PA
Intermountain Heart & Vascular; Patients Health First, L.C.


Disclosures

- Relationship with Novartis Pharmaceuticals Corporation, Amgen, Amarin, Bayer, Pfizer, Lexicon Pharmaceuticals, and Idorsia that includes consulting or advising.
- Relationship with Janssen that includes research grant funding paid directly to the research department

Objectives

- Review the most common arrhythmia, Atrial Fibrillation.
- Discuss screening and diagnosis
- Review and discuss the acute/chronic management through lifestyle
- Discuss implications of pharmacologic treatment

Atrial Fibrillation

A photograph of two women dancing on a stage. The woman on the left is wearing a bright pink cardigan over a white shirt and light-colored pants. The woman on the right is wearing a green and black patterned shirt and dark pants. They are both in dynamic dance poses. A large, semi-circular screen is visible in the background.

The "Out Of Sync Electric Slide"



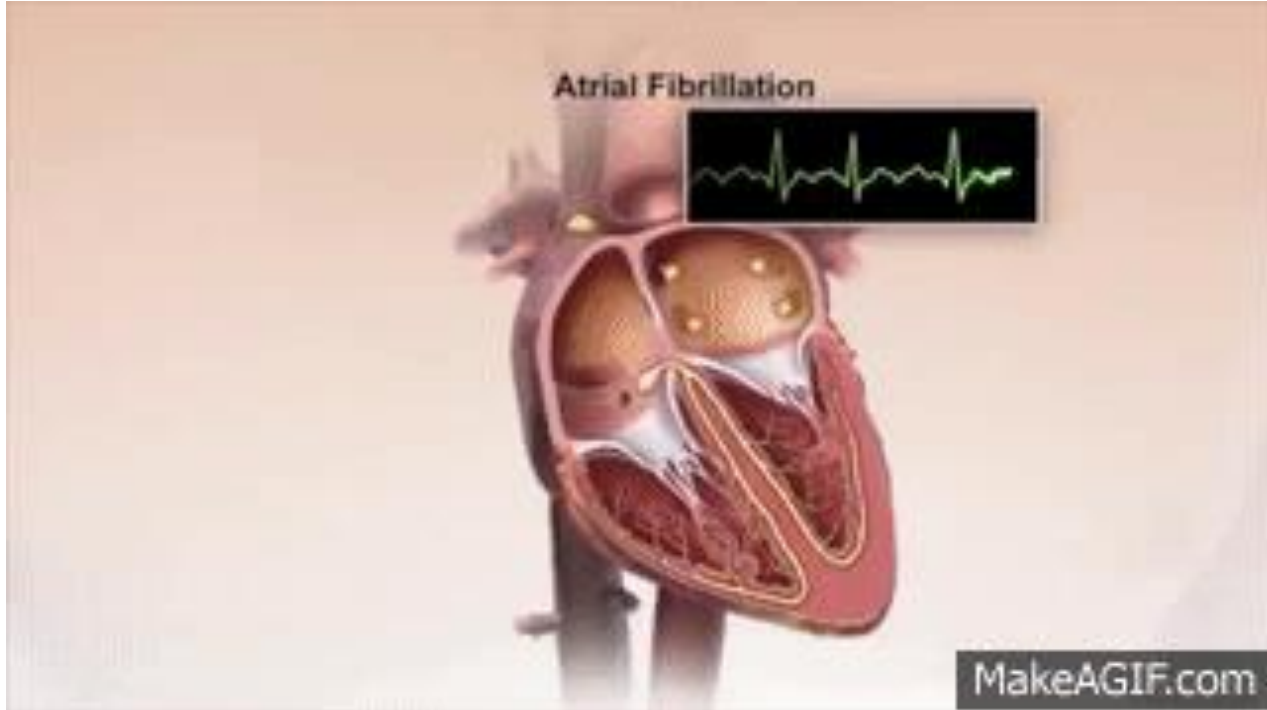
Case

- Sheryl, a 66-year-old woman, is a well-established patient who presents with a 3-month history of being **“tired a lot more.”** She has had moments where **“my heart beats fast,”** and this causes her to feel **“dizzy and lightheaded.”** She is on losartan-HCT 20-12.5 mg and amlodipine 5 mg, “I’ve had high blood pressure for years.” No fever, chills, or sweats. Does not report any abnormal bleeding.
- PastHx: Hypertension “for years.” Menopause at age 55.
- MEDS: As above.
- Vitals: BP 130/80, HR 103, SaO2 96%, T 98.9, Wt 165 Ht 5’6” BMI 26.6
- LABS: Serum Cr 1.1; AST 23; ALT 32; A1c 5.8%; TSH 2.23
- She has an irregularly irregular rhythm.



What is Atrial Fibrillation?

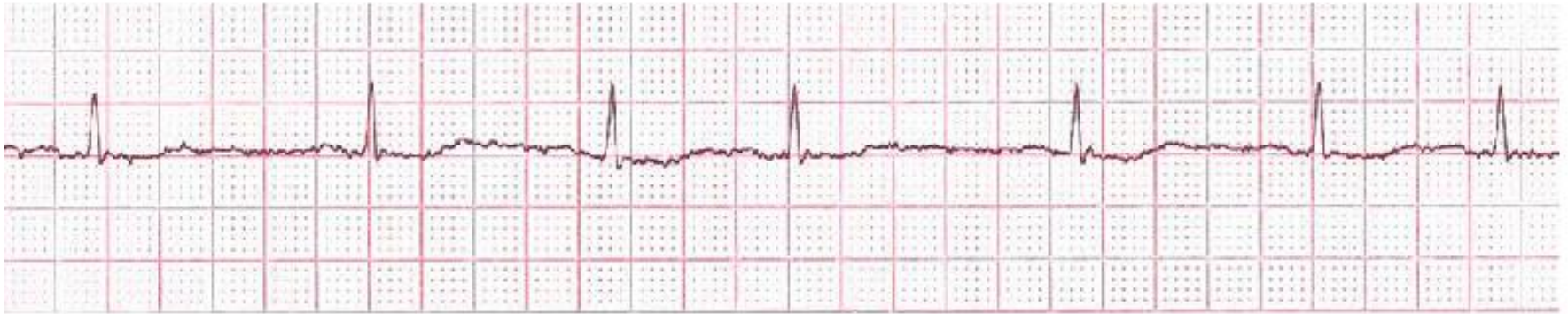
- Atrial Fibrillation is a common heart rhythm disorder characterized by irregular and often rapid heartbeats.



Atrial Fibrillation (AF)

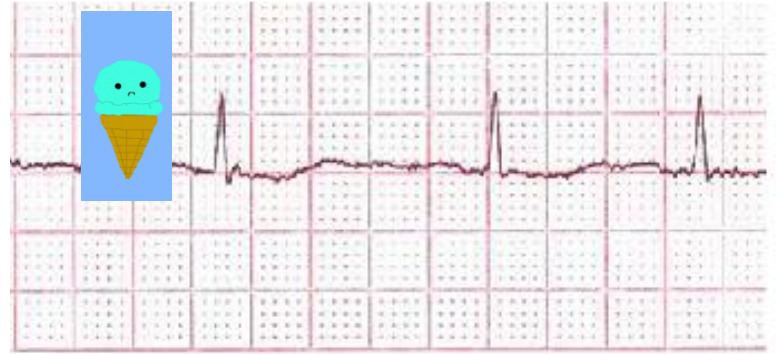
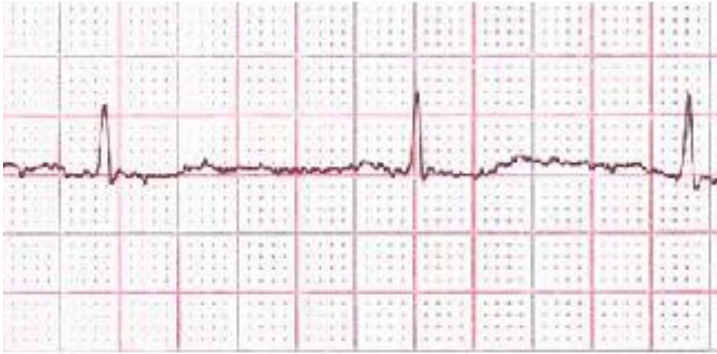
Initial gold-standard detection

- **Electrocardiogram (EKG)** relatively cheap, efficient, and ubiquitous.
 - Provides the diagnosis of AF
 - Findings:
 - Irregularly Irregular R-R Interval
 - No discernable P waves or related p-wave/QRS complexes



Atrial Fibrillation (AF)

Loaded diagnosis that brings fear. We need to be precise about AF
“BURDEN” – how often occurring, for how long, intermittent or
continuous, requiring interve



Basic Clinical Evaluation – Newly Diagnosed AF

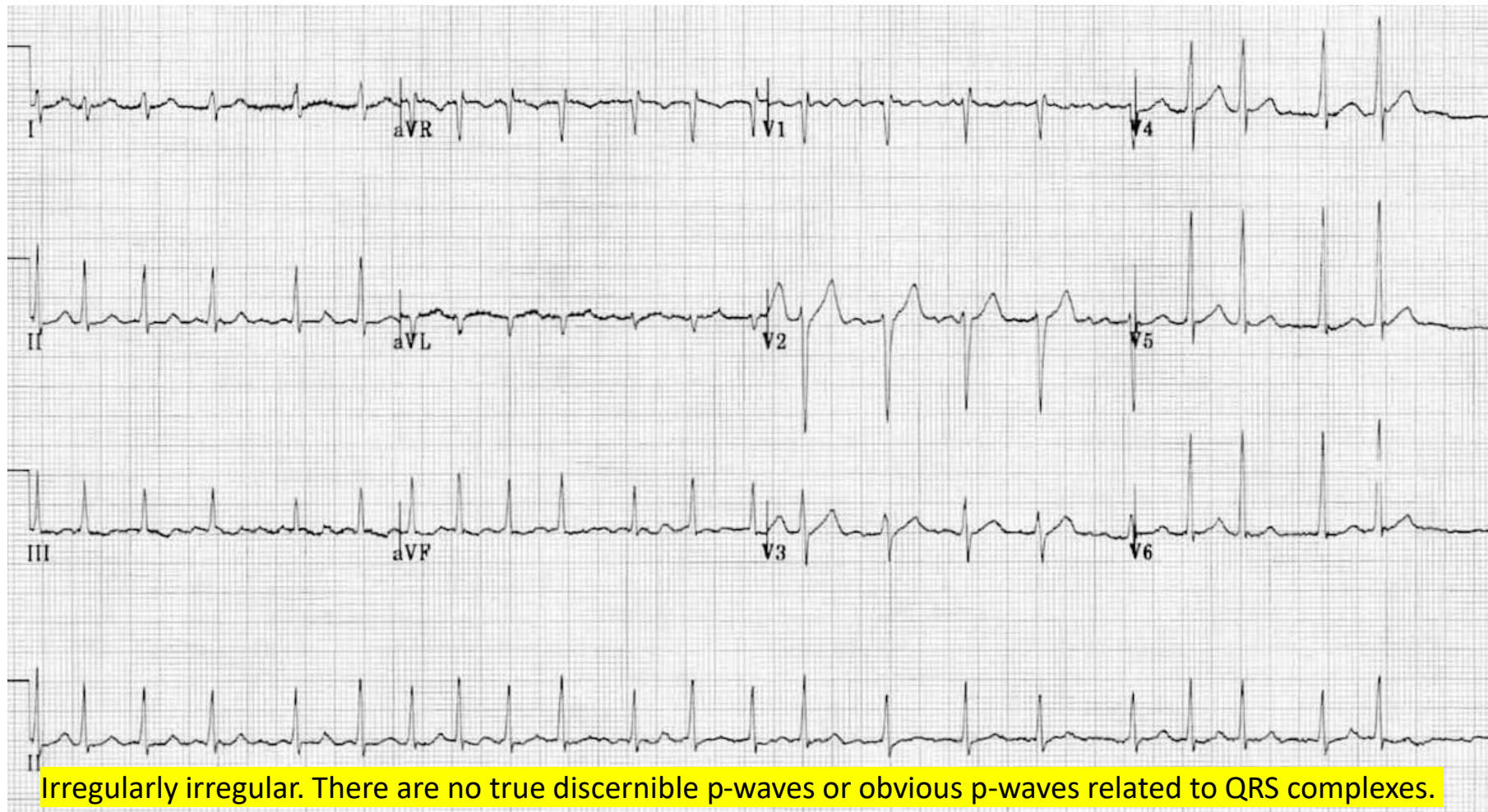
Do

- Transthoracic Echo
- CBC, BMP, TSH w/ Reflex T4
- Targeted testing to assess other medical conditions associate with AF to determine stroke and bleeding risk factors.

Don't

- Protocolized testing for ischemia, ACS and PE unless there are additional signs and symptoms to indicate those disorders.

Recommendations for Basic Clinical Evaluation Referenced studies that support the recommendations are summarized in the Online Data Supplement .		
COR	LOE	Recommendations
1	B-NR	1. In patients with newly diagnosed AF, a transthoracic echocardiogram ¹⁻⁴ to assess cardiac structure, laboratory testing to include a complete blood count, metabolic panel, and thyroid function, ⁵⁻⁷ and when clinical suspicion exists, targeted testing to assess for other medical conditions associated with AF are recommended to determine stroke and bleeding risk factors, as well as underlying conditions that will guide further management.
3: No benefit	B-NR	2. In patients with newly diagnosed AF, protocolized testing for ischemia, acute coronary syndrome (ACS), and pulmonary embolism (PE) should not routinely be performed to assess the etiology of AF unless there are additional signs or symptoms to indicate those disorders. ⁸⁻¹⁰



Pillars for AF Management

Access to All Aspects of Care for All

SOS

Stroke
Risk

Assess
and Treat

Optimize

All
Modifiable
Risk
Factors

Symptom
Management

AF Burden

Rhythm control
Rate control

1. What is the risk of stroke? i.e., do they need an anticoagulant
2. Reduce recurrence with risk factor modifications
3. Rate or Rhythm Control?

Shared Decision-Making

Treat Risk Factors and Enact Behavioral Changes

Heart failure

Exercise

Arterial hypertension

Diabetes

Tobacco

Obesity

Ethanol

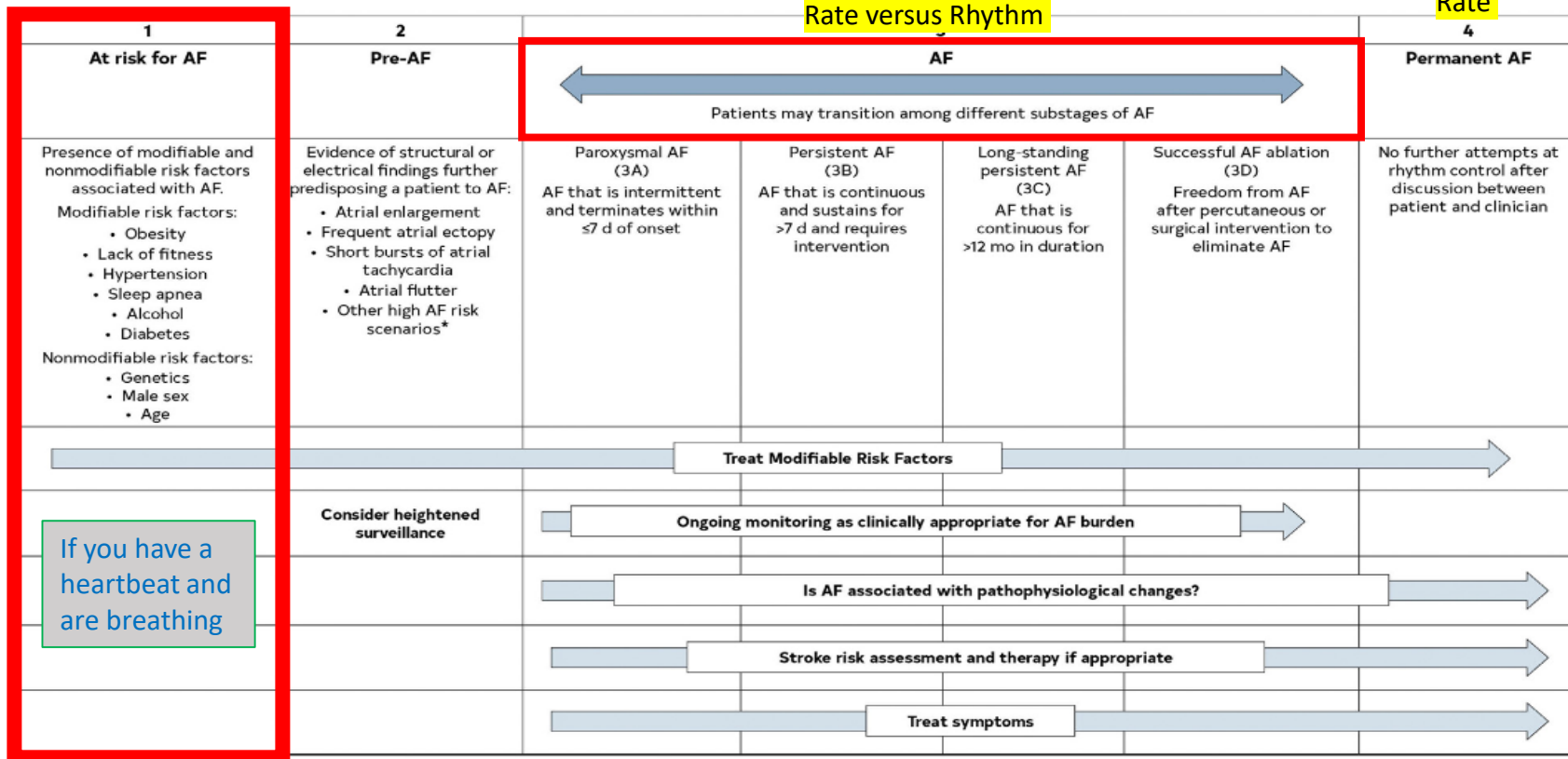
Sleep

FIGURE 4 AF Stages: Evolution of Atrial Arrhythmia Progression

Getting specific on "Atrial Fibrillation"

Rate versus Rhythm

Rate



If you have a heartbeat and are breathing

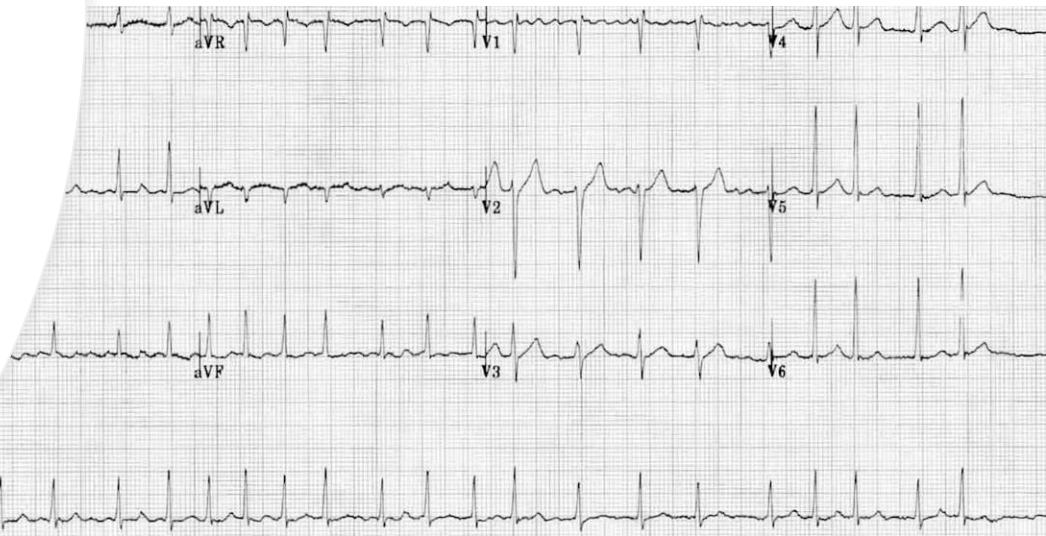
*Heart failure, valve disease, coronary artery disease, hypertrophic cardiomyopathy, neuromuscular disorders, thyroid disease. Original figure created by the 2023 Atrial Fibrillation Guideline Writing Committee. AF indicates atrial fibrillation.

Case

• Sheryl, a 66-year-old woman, is a well-established patient who presents with a 3-month history of being **“tired a lot more.”** She has had moments where **“my heart beats fast,”** and this causes her to feel **“dizzy and lightheaded.”** She is on losartan-HCT 20-12.5 mg and amlodipine 5 mg, “I’ve had high blood pressure for years.” No fever, chills, or sweats. Does not report any abnormal bleeding.

What AF stage is Sheryl in?

- Stage 1, “At risk for AF”
- Stage 2, “Pre-AF”
- Stage 3, “AF”
- Stage 4, “Permanent AF”



Atrial Fibrillation

- Etiology and Risk Factors (**the how will help with the why, e.g., valve dz->AF**)
 - More prevalent in men, but only a little.
 - **Hypertensive heart disease and Coronary Artery Disease** are the two most common conditions that increase risk in developed countries.
 - **Rheumatic Heart Disease** is a strong risk factor, although less common in developed nations now. Still a strong factor in developing nations.
 - Other cardiac conditions associated with A-Fib include Valvular Heart Disease (especially Mitral disease), Dilated Cardiomyopathy, Hypertrophic Cardiomyopathy, Heart

Atrial Fibrillation

- Etiology and Risk Factors (continued)-

- A-Fib can also occur in patients with otherwise healthy hearts with the following conditions or situations (**acute, self limited vs. more chronic impact**):

- **Acute alcohol excess** - Usually transient, self-limited
- **Holiday Heart** - Related to sudden withdrawal (“holiday”)
- Pericarditis
- Chest trauma or thoracic surgery
- Thyroid disorders (**thyrotoxicosis**)
- **Obstructive Sleep Apnea**
- Pulmonary Embolism
- **COPD**
- Obesity

- **A-Fib can rarely occur in patients with healthy hearts with no known cause**
- Some medications (theophylline, adenosine, digitalis, etc.)

Atrial Fibrillation

- Etiology and Risk Factors (continued)-

Highest attributable risk factors (ARIC Study) in order:

- Hypertension (22% of all AF cases, adjusted for age too)
- BMI (~28% risk w/ each increase of 5 kg/m², nonlinear though)
- Smoking (~32% for current, 9% former, 21% ever - dose/response too)
- Cardiac Disease (all those above lumped together)
- Diabetes (~28% DM, 20% pre-DM)

Atrial Fibrillation

- Pathophysiology-
 - Stretch Cardiomyocyte tissue = electrical issues
 - Will become atrial fibrillation if pulmonary



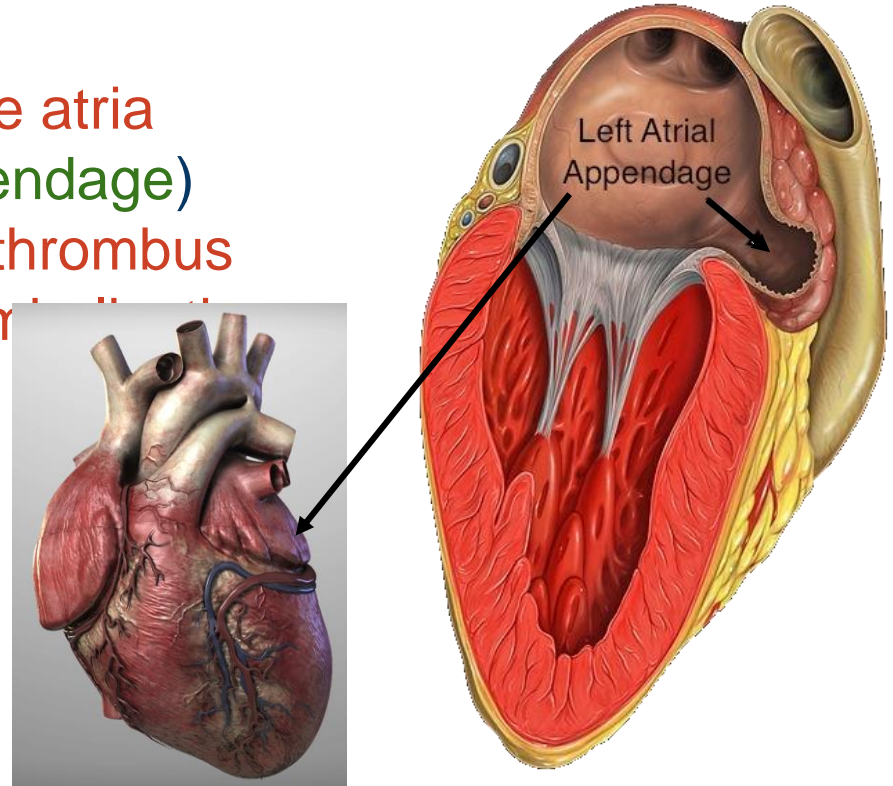
Atrial Fibrillation

- Pathophysiology-

- Regardless of the underlying risk factors, the underlying pathology is anatomic and electrophysiologic changes occurring in the atrial myocardium (hence, there is commonly an underlying heart disease).
- Most commonly, it has to do with atrial enlargement, increase in atrial pressure, or atrial inflammation/infiltration.
- These conditions cause increased atrial cell automaticity or increased trigger activity due to injury.
 - Several firing cells means there are several areas of the atria trying to act as the pacemaker, overriding the SA node

Atrial Fibrillation

- Pathophysiology (continued)-
 - During A-Fib, stasis within the atria (especially the left atrial appendage) increases the propensity for thrombus formation and subsequent embolization
 - This can result in cerebral infarction (stroke) or infarction of peripheral extremities



Atrial Fibrillation

- General Classification or types of A-Fib- (**Think, when do you encounter AF?**)
 - Any of the forms below can be “subclinical,” meaning asymptomatic
 - **Paroxysmal AF:** Terminates spontaneously or with intervention within **7 days** of onset (can recur).
 - **Persistent AF:** **Fails to self-terminate within 7 days.** Often requires pharmacologic or electrical cardioversion to restore NSR.
 - **Long-Standing Persistent AF:** Has lasted for **more than 12 months.**
 - **Successful AF ablation:** Successful termination of AF by catheter or surgical means
 - **Permanent AF:** Those individuals with persistent AF who, in a joint decision between provider and patient, are **no longer pursuing a rhythm control strategy.**

Atrial Fibrillation

- Signs and Symptoms-

- Many patients are **asymptomatic** – estimated to be over 50%
- If symptoms are present, they are variable and often vague.
- Presentation may involve:
 - **Palpitations**
 - **Tachycardia**
 - Hypotension
 - **Fatigue** (common) or weakness
 - Dizziness/lightheadedness
 - Dyspnea
 - Angina
 - **Presyncope** or (infrequently) syncope



Atrial Fibrillation

- Signs and Symptoms (continued)-

- A-Fib can present with slow, normal, or fast rates; **If the HR is greater than 100**, we would call it **A-Fib with Rapid Ventricular Response (RVR)**. If sufficiently rapid, can cause hypotension, MI, or tachy-induced myocardial dysfunction.
- Although the HR can range from slow to extremely rapid, it is **irregular (except in complete heart block or ventricular paper)**.
- Because of varying diastolic filling duration, **not all ventricular beats produce a palpable pulse (especially with fast HR)**.



Atrial Fibrillation

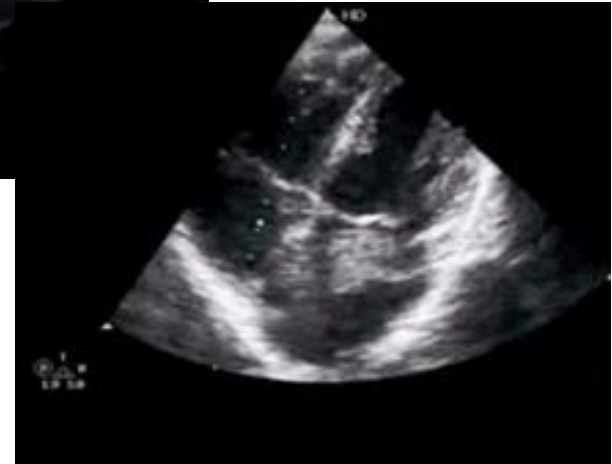
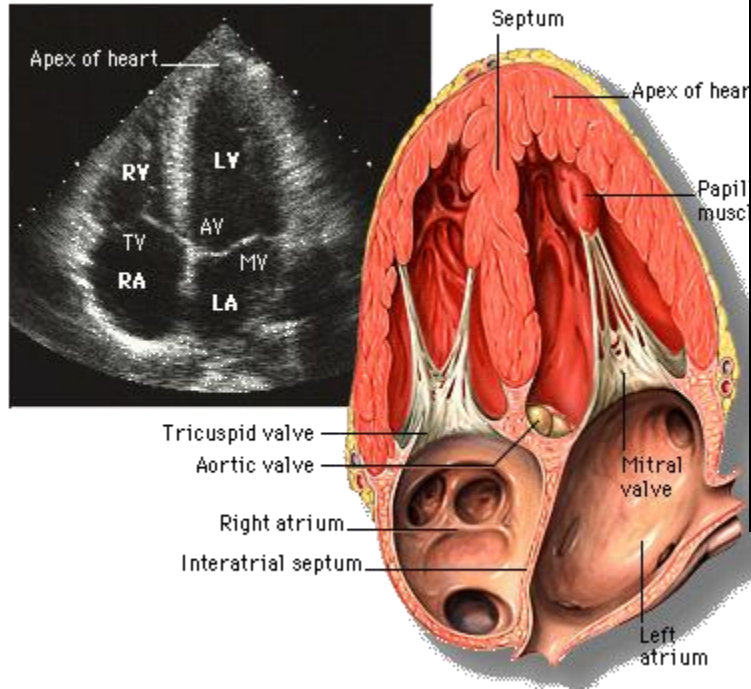
- Diagnostic Evaluation (continued)-
 - EKG also provides information about the **ventricular response**.
 - A-Fib often presents with Rapid Ventricular Response, with ventricular rate variable up to 180 bpm (normally around 120)
 - **Echocardiogram** provides valuable information (about the size and function) of the atria and ventricles. **Order for all cases of new A-Fib.**
 - It can also detect valvular disease, ventricular hypertrophy, and pericardial disease
 - Transthoracic Echo (TTE) is more commonly ordered.
 - Transesophageal Echo (TEE) is **more sensitive for detection of thrombi formation in the left atrium or left**

Atrial Fibrillation

- Diagnostic Evaluation (continued)-
 - **Ambulatory Cardiac Monitoring** with holter monitors or implantable loop monitors can be used to find intermittent A-Fib (if clinically suspected but not captured on a routine, in-office 12-lead)
 - **Baseline Laboratory Testing** is also important to rule out or evaluate for metabolic causes of /
 - TSH and fT4
 - CBC
 - CMP or BMP
 - HgbA1C



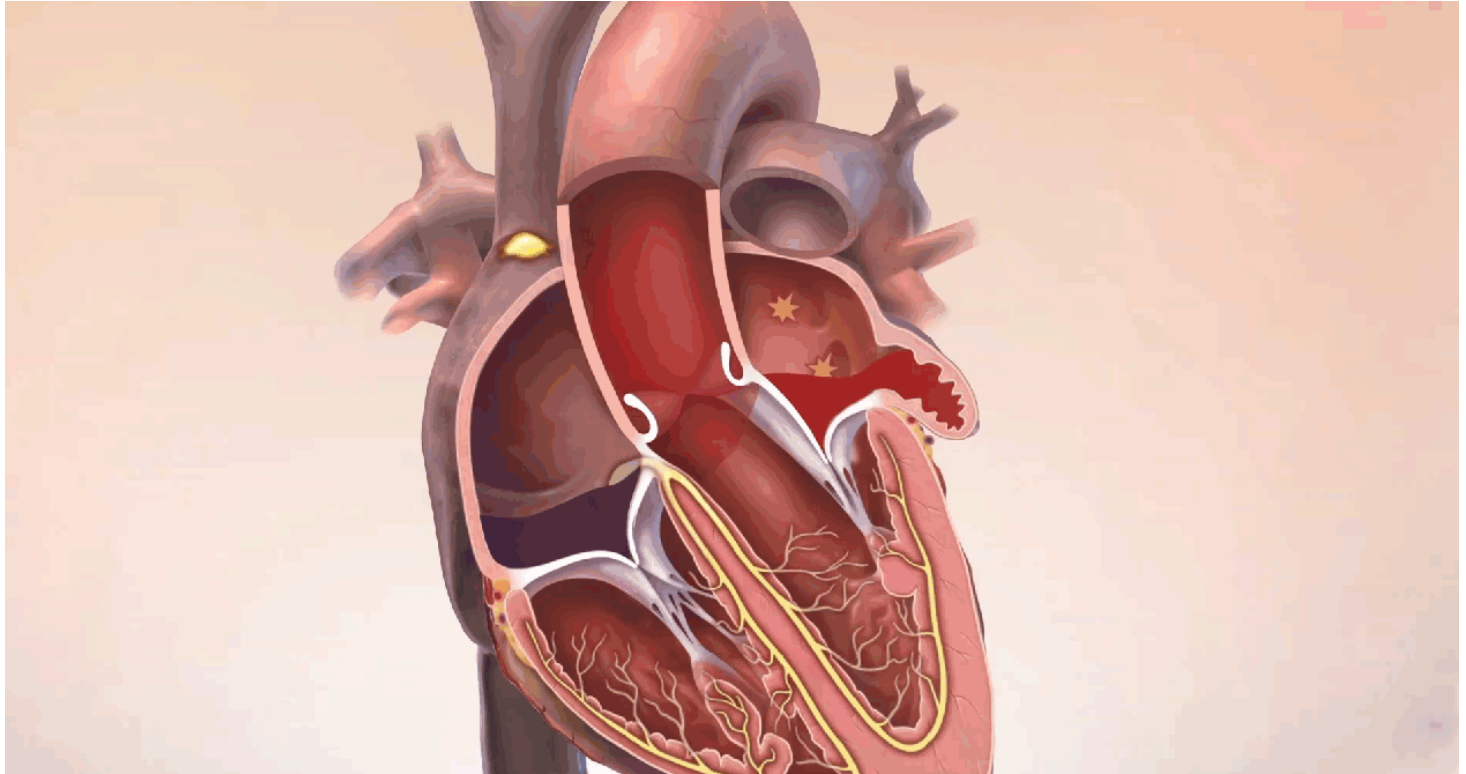
Echocardiogram



Atrial Fibrillation

- Treatment/Management-
 - Clinical management of A-Fib can be complicated and multifactorial.
 - ■ The plan is tailored to the patient in the context of stability.
■ For all those with A-Fib, the three principal goals of treatment are...
 - Control of symptoms
 - Prevention of thromboembolism
 - Reduce recurrence or progression via optimizing risk factors

Atrial Fibrillation and Stroke



Anti-coagulants – When to consider?

Paroxysmal, Persistent, Long-standing Persistent, and Permanent AF.

- Any patient with AF where the annual risk of stroke is **≥2%**
- If not started, reassess patient risk and desire (shared decision-making) to start
- Use risk calculators: Chads2, Atria, Chads2vasc, Garfield etc.

Recommendations for Risk-Based Selection of Oral Anticoagulation: Balancing Risks and Benefits
Referenced studies that support the recommendations are summarized in the [Online Data Supplement](#).

COR	LOE	RECOMMENDATIONS
1	B-R	1. In patients diagnosed with AF who have an estimated annual risk of stroke or thromboembolic events $\geq 2\%$, selection of therapy to reduce the risk of stroke should be based on the risk of thromboembolism, regardless of whether the AF pattern is paroxysmal, persistent, long-standing persistent, or permanent. ¹⁻³
1	B-NR	2. In patients with AF at risk for stroke, reevaluation of the need for and choice of stroke risk reduction therapy at periodic intervals is recommended to reassess stroke and bleeding risk, net clinical benefit, and proper dosing. ^{4,5}

Anti-coagulants – When to consider?

Paroxysmal, Persistent, Long-standing Persistent, and Permanent AF.

- Any patient with AF where the annual risk of stroke is $\geq 2\%$
- Annual stroke ≥ 1 and $< 2\%$ - may **consider** anticoagulation
- DOACs > VKA if there is NO moderate or severe rheum mitral stenosis or mechanical heart valves

Recommendations for Antithrombotic Therapy

Referenced studies that support the recommendations are summarized in the [Online Data Supplement](#).

COR	LOE	RECOMMENDATIONS
1	A	1. For patients with AF and an estimated annual thromboembolic risk of $\geq 2\%$ per year (eg, CHA ₂ DS ₂ -VASc score of ≥ 2 in men and ≥ 3 in women), anticoagulation is recommended to prevent stroke and systemic thromboembolism. ¹⁻⁷
1	A	2. In patients with AF who do not have a history of moderate to severe rheumatic mitral stenosis or a mechanical heart valve, and who are candidates for anticoagulation, DOACs are recommended over warfarin to reduce the risk of mortality, stroke, systemic embolism, and ICH. ¹⁻⁷
2a	A	3. For patients with AF and an estimated annual thromboembolic risk of $\geq 1\%$ but $< 2\%$ per year (equivalent to CHA ₂ DS ₂ -VASc score of 1 in men and 2 in women), anticoagulation is reasonable to prevent stroke and systemic thromboembolism. ^{1,3}
3: Harm	B-R	4. In patients with AF who are candidates for anticoagulation and without an indication for antiplatelet therapy, aspirin either alone or in combination with clopidogrel as an alternative to anticoagulation is not recommended to reduce stroke risk. ^{8,9}
3: No Benefit	B-NR	5. In patients with AF without risk factors for stroke, aspirin monotherapy for prevention of thromboembolic events is of no benefit. ^{10,11}

Anti-coagulants – When to consider?

Paroxysmal, Persistent, Long-standing Persistent, and Permanent AF.

- In AF, who are candidates for anticoagulation, without indication for antiplatelet (aspirin or p2y12i, e.g., clopidogrel) → It is NOT recommended to use **alone** or in **combination** to reduce stroke. **i.e., they are NOT alternatives to DOACs/VKA!**
- If there is no risk of stroke, ASA alone is of **NO BENEFIT**

3: Harm

B-R

4. In patients with AF who are candidates for anticoagulation and without an indication for antiplatelet therapy, aspirin either alone or in combination with clopidogrel as an alternative to anticoagulation is not recommended to reduce stroke risk.^{8,9}

3: No Benefit

B-NR

5. In patients with AF without risk factors for stroke, aspirin monotherapy for prevention of thromboembolic events is of no benefit.^{10,11}



Anti-coagulants – When to consider?

Paroxysmal, Persistent, Long-standing
Persistent, and Permanent AF.

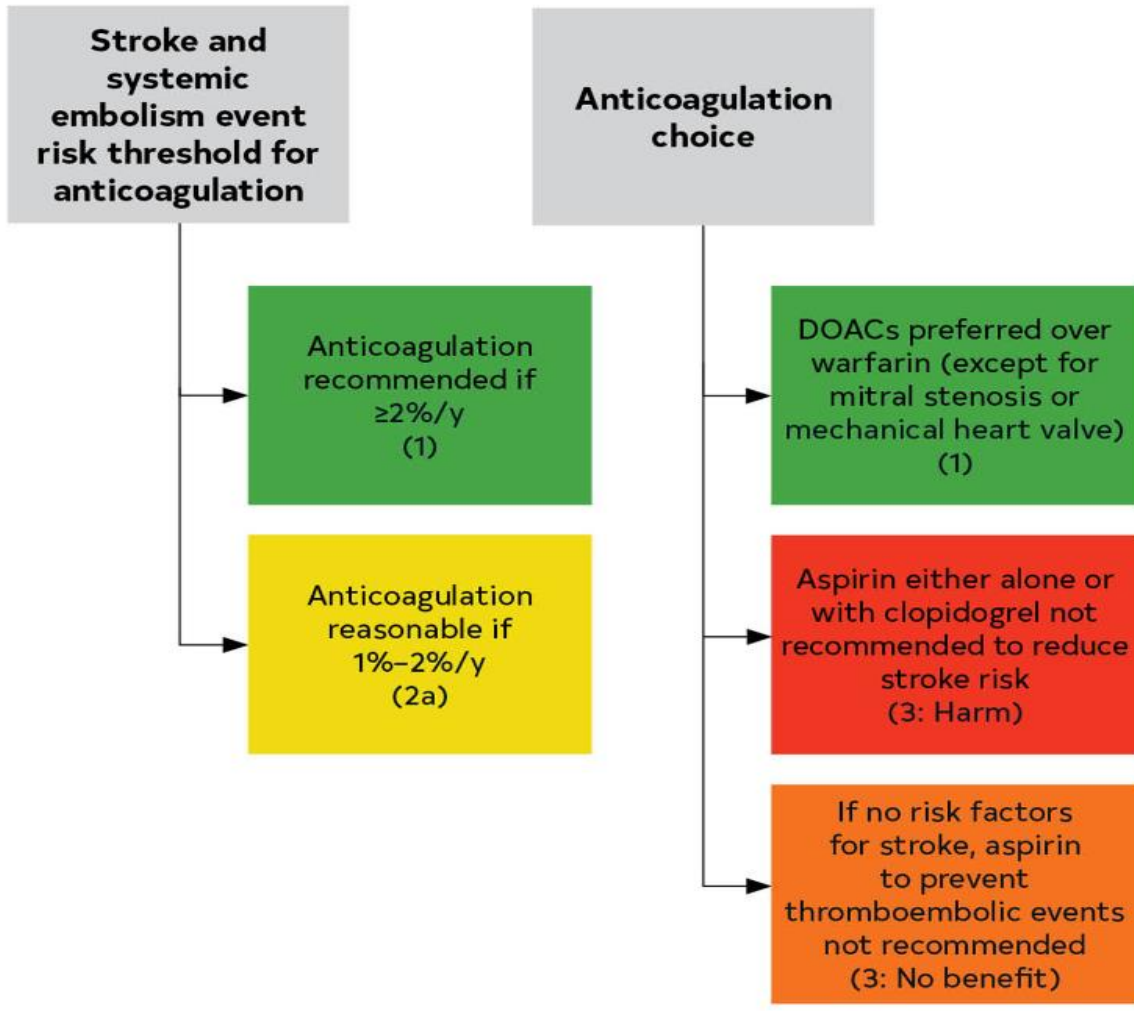
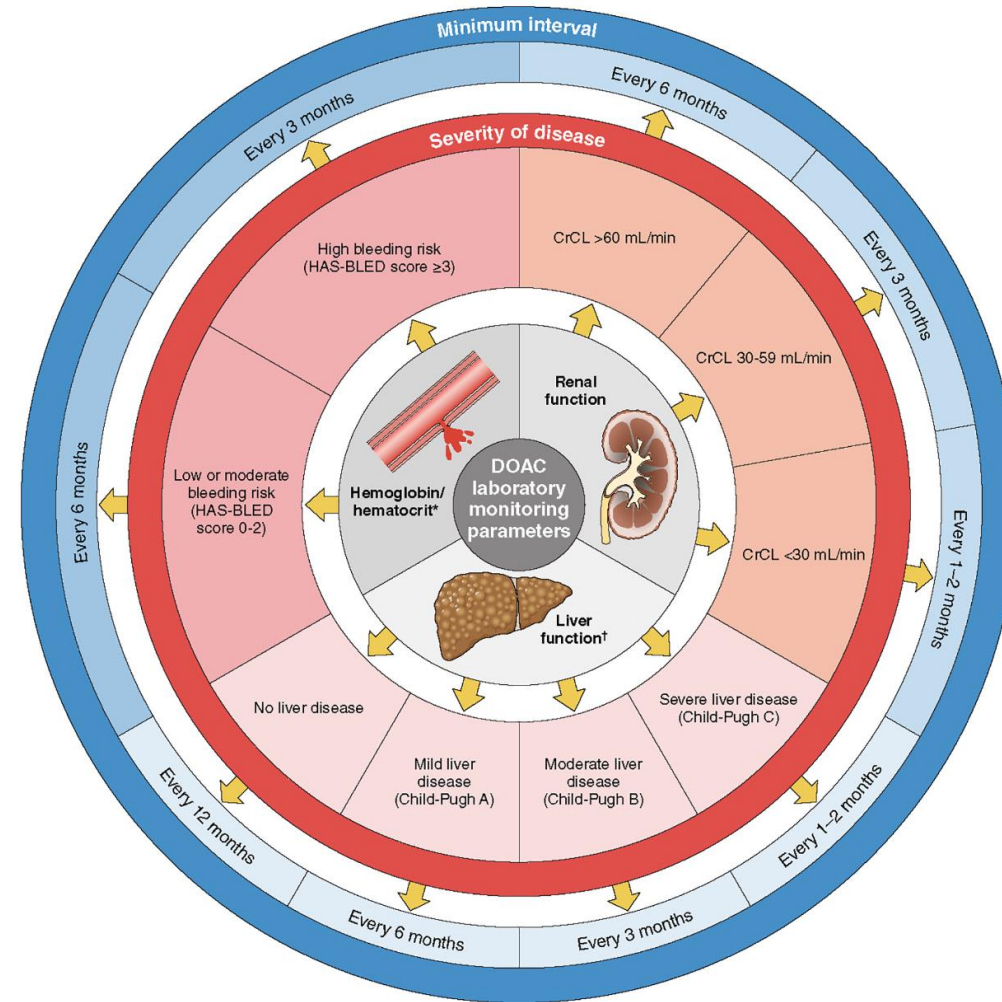


TABLE 13

OACs Pharmacokinetic Characteristics and Dosing

Class	VKA	Direct Thrombin Inhibitor		Factor Xa Inhibitor		
Name	Warfarin	Dabigatran		Rivaroxaban	Apixaban	Edoxaban
Metabolism	S-isomer: CYP2C9 R-isomer: CYP1A2, CYP2C19, CYP3A4	Minimal		CYP3A4/5	CYP3A4	Minimal CYP3A4
P-glycoprotein substrate	No	Yes		Yes	Yes	Yes
Excretion	0% renal; very little warfarin excreted unchanged in urine	80% renal		66% renal, 28% feces	27% renal, 73% biliary and intestinal	50% renal, 50% liver and biliary/intestinal
Half-life	20-60 h	12-17 h		5-9 h	12 h	10-14 h
Renal dosing adjustment based on actual body weight	N/A	CrCl >30 mL/min	150 mg twice daily	CrCl >50 mL/min	20 mg daily with the biggest meal*	5 mg twice daily
		CrCl 15-30 mL/min	75 mg twice daily	CrCl 15-50 mL/min	15 mg daily with the biggest meal*	If any 2 of the following: age ≥80y, body weight ≤60 kg, SCr ≥1.5 mg/dL
Drug interaction management based on concomitant therapy of CYP3A4 inhibitors/p-glycoprotein inhibitors	Adjust dose based on INR trends	CrCl 30-50 mL/min with concomitant use of dronedarone or systemic ketoconazole: 75 mg twice daily CrCl <30 mL/min: avoid dabigatran use concomitantly with dronedarone or systemic ketoconazole		Avoid rivaroxaban use with concomitant therapy of combined p-glycoprotein and strong CYP3A4 inhibitors (eg, systemic ketoconazole and ritonavir) No dose adjustment required with clarithromycin Avoid rivaroxaban use in patients with CrCl 15-<80 mL/min receiving combined p-glycoprotein and moderate CYP3A4 inhibitors (eg, erythromycin)	In patients receiving apixaban 5 mg twice daily, reduce dose to 2.5 mg twice daily when combined p-glycoprotein and strong CYP3A4 inhibitors (eg, itraconazole, systemic ketoconazole, ritonavir) are used concomitantly If patients already receiving apixaban 2.5 mg twice daily, avoid apixaban use if combined p-glycoprotein and strong CYP3A4 inhibitors are concomitantly used	No dose adjustment is required
Drug interaction management based on concomitant therapy of p-glycoprotein/CYP3A4 inducers (eg, carbamazepine, phenytoin, rifampin, St. John's wort)	Adjust dose based on INR trends	Avoid use		Avoid use	Avoid use	Avoid use with rifampin. No study evaluated the effect of other p-glycoprotein/CYP3A4 inducers on edoxaban drug levels
Appropriate use based on liver function (Child-Pugh score) [†] Child-Pugh A (mild) Child-Pugh B (moderate) Child-Pugh C (severe)	Not mentioned in the labeling	No dose adjustment needed		No dose adjustment needed	No dose adjustment needed	No dose adjustment needed
		Use with caution		Avoid use	Use with caution	Use with caution
		Avoid use		Avoid use	Avoid use	Avoid use

FIGURE 11 DOAC Laboratory Monitoring

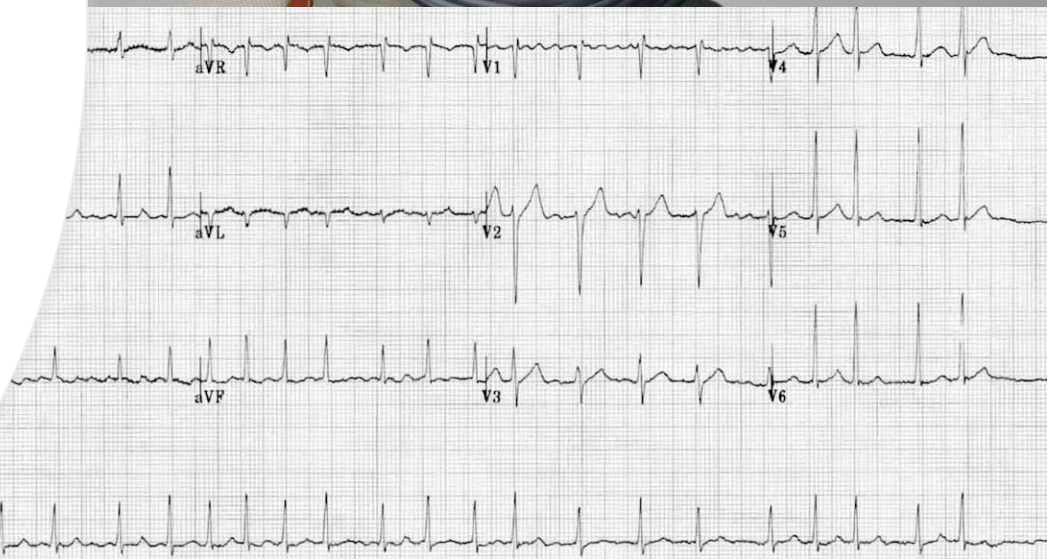


Case

- Sheryl, a 66-year-old woman, is a well-established patient who presents with a 3-month history of being **“tired a lot more.”** She has had moments where **“my heart beats fast,”** and this causes her to feel **“dizzy and lightheaded.”** She is on losartan-HCT 20-12.5 mg and amlodipine 5 mg, “I’ve had high blood pressure for years.” No fever, chills, or sweats. Does not report any abnormal bleeding.

LABS: Serum Cr 1.1; AST 23; ALT 32; A1c 5.8%; TSH 2.23

- What is Sheryl’s risk for stroke?



Sheryl, a 66-year-old woman, is a well-established patient who presents with a 3-month history of being **“tired a lot more.”** She has had moments where **“my heart beats fast,”** and this causes her to feel **“dizzy and lightheaded.”** She is on losartan-HCT 20-12.5 mg and amlodipine 5 mg, “I’ve had high blood pressure for years.” No fever, chills, or sweats. Does not report any abnormal bleeding.

What is Sheryl’s risk for stroke?

Age	<65 0	65-74 +1	≥75 +2
Sex	Female +1	Male 0	
CHF history	No 0	Yes +1	
Hypertension history	No 0	Yes +1	
Stroke/TIA/thromboembolism history	No 0	Yes +2	
Vascular disease history (prior MI, peripheral artery disease, or aortic plaque)	No 0	Yes +1	
Diabetes history	No 0	Yes +1	

3 points

Stroke risk was 3.2% per year in >90,000 patients (the Swedish Atrial Fibrillation Cohort Study) and 4.6% risk of stroke/TIA/systemic embolism.



FACTS & FIGURES

Interpretation:

CHA ₂ DS ₂ -VASc Score	Risk of ischemic stroke	Risk of stroke/TIA/systemic embolism
0	0.2%	0.3%
1	0.6%	0.9%
2	2.2%	2.9%
3	3.2%	4.6%
4	4.8%	6.7%
5	7.2%	10.0%
6	9.7%	13.6%
7	11.2%	15.7%
8	10.8%	15.2%
9	12.2%	17.4%

**≥2% annual risk
= Anticoagulation**

Age 66; HTN; Serum Cr 1.1; AST 23; ALT 32; A1c 5.8%; TSH 2.23

HAS-BLED SCORING	USING THE SCORE
<p>Each checkmark = 1 point:</p> <ul style="list-style-type: none"> Hypertension (SBP >160 mm Hg)<ul style="list-style-type: none">Abnormal: <input type="checkbox"/> Kidney function: serum creatinine >2.26<input type="checkbox"/> Liver function: Bili > 2X ULN <u>and</u> LFTs > 3X LN<input type="checkbox"/> Stroke history<input type="checkbox"/> Bleeding history or predisposition<input type="checkbox"/> Labile INRs: TTR 60% Elderly: > 65 years<ul style="list-style-type: none">Drugs: <input type="checkbox"/> ETOH abuse<input type="checkbox"/> ASA or NSAID use	<p>Score = 0–1: Low risk</p> <p>Score = 2: Moderate risk</p> <p>Score = 3: High risk</p> <p>For patients at high bleeding risk, consider:</p> <ul style="list-style-type: none"><input type="checkbox"/> Optimizing blood pressure control<input type="checkbox"/> More frequent INRs in first 3 months of warfarin<input type="checkbox"/> Anticoagulation clinic management<input type="checkbox"/> Fall prevention interventions, if needed<input type="checkbox"/> Use of NOAC

	Dabigatran	Rivaroxaban	Apixaban	Edoxaban
Class	Antithrombin	Factor Xa inhibitor	Factor Xa inhibitor	Factor Xa inhibitor
Bleeding risk compared to warfarin	Less intracranial bleeding Higher incidence of gastrointestinal bleeding	Less intracranial bleeding Higher incidence of gastrointestinal bleeding	Substantially lower risk of major bleeding Less intracranial bleeding	Lower risk of major bleeding Less intracranial bleeding
Dosage	110 mg twice daily 150 mg twice daily	20 mg once daily (give with food)	5 mg twice daily	60 mg once daily
Dosage adjustments	75 mg twice daily for creatinine clearance ¹ 15–30 mL/min (approved in the United States but not tested in clinical trials)	15 mg once daily for creatinine clearance ¹ < 50 mL/min	2.5 mg twice daily for patients with at least two of three risk factors: 1. Age ≥ 80 years 2. Body weight ≤ 60 kg 3. Serum creatinine ≥ 1.5 mg/dL	30 mg once daily for creatinine clearance ¹ ≤ 50 mL/min FDA recommends not to use if creatinine clearance ¹ > 95 mL/min

Case

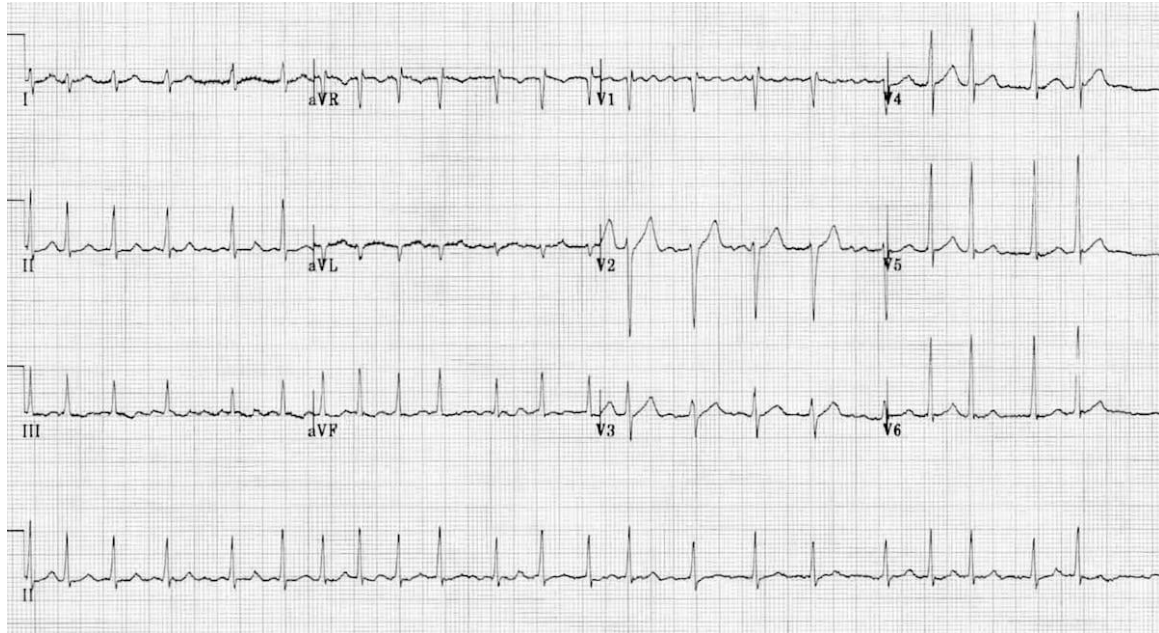


Sheryl, a 66-year-old woman, is a well-established patient who presents with a 3-month history of being **“tired a lot more.”** She has had moments where **“my heart beats fast,”** and this causes her to feel **“dizzy and lightheaded.”** She is on losartan-HCT 20-12.5 mg and amlodipine 5 mg, “I’ve had high blood pressure for years.” No fever, chills, or sweats. Does not report any abnormal bleeding.

She is Stage 3 – AF.

Not sure yet whether it is Paroxysmal, Persistent, or Long-standing Persistent.

She meets guideline criteria at CHADS2Vasc 3, for stroke prophylaxis (anticoagulant).



Caveats for anti-coagulation

Remember, “Atrial Fibrillation” needs to have patient context, duration/burden, and symptom context

ARTESIA

Sub-clinical AF – “Atrial High Rate Episodes” by implanted devices (e.g., pacemaker, defibrillator, loop recorder) ≥ 6 to ≤ 24 minutes

EXCLUDED: Afib by EKG, telemetry or Holter > 6 min regardless of symptoms.



HEALEY, J.S., ET AL. **APIXABAN FOR STROKE PREVENTION IN SUBCLINICAL ATRIAL FIBRILLATION.** N ENGL J MED. 2024;390:170-1. DOI: 10.1056/NEJMOA2310234

QUESTION

In patients with subclinical atrial fibrillation, will treatment with oral anticoagulation decrease risk of stroke or systemic embolism?

INCLUSION CRITERIA

1. Patients with subclinical atrial fibrillation detected by pacemaker, defibrillator, or cardiac monitor with at least one episode lasting 6 min but no longer than 24 hours.
2. CHADSCVASC of 3 or higher
3. Age ≥ 55 years

EXCLUSION CRITERIA

1. History of major bleeding within the last 6 months
2. Creatinine clearance < 25 mL/min
3. Treatment w/ other DOAC

ARTESIA

RANDOMIZATION

Double Blind Randomization

Mean follow up: 3.5 \pm 1.8 years

N = 4012



Apixaban
5mg or 2.5mg BID

N = 2015

*Anticoagulation was permanently discontinued if there was development of atrial fibrillation lasting > 24 hrs

Aspirin
81mg qD

N = 1997

PRIMARY OUTCOME

STROKE OR SYSTEMIC EMBOLISM

Apixaban

55 patients
0.78% per patient-year



HR 0.63
95% CI 0.45 to 0.88
p=0.007

Aspirin

86 patients
1.24% per patient-year

SAFETY OUTCOME

MAJOR BLEEDING

Apixaban

1.71% per patient-year



HR 1.80
95% CI 1.26 to 2.57
p=0.001

Aspirin

0.94% per patient year

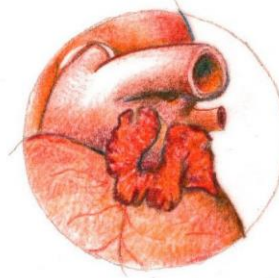
CONCLUSION

In patients with subclinical atrial fibrillation, patients randomized to apixaban had a lower risk of stroke or systemic embolism than aspirin but a higher risk of major bleeding.

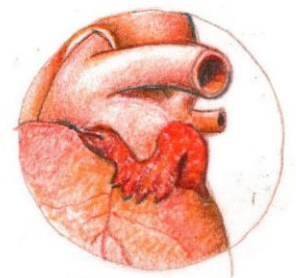
Atrial Fibrillatio

What about devices to reduce stroke
in AF?

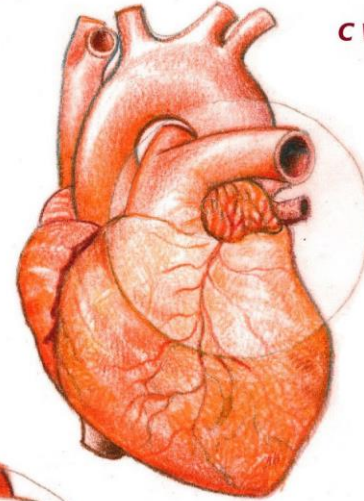
The left atrial appendage



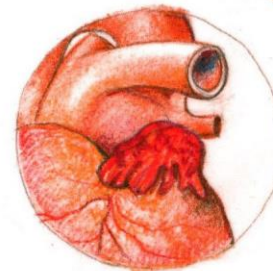
A *Chicken wing*



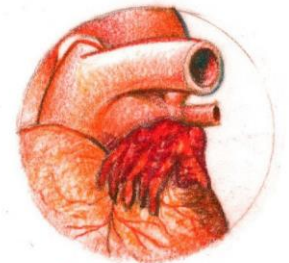
C *Windssock*



E *Left atrial
appendage*



B *Cactus*

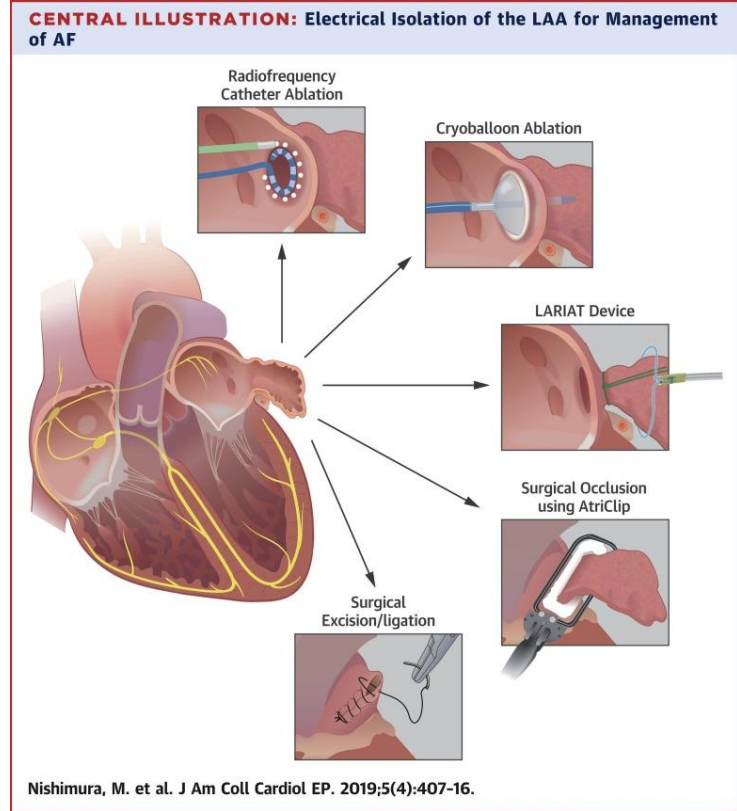
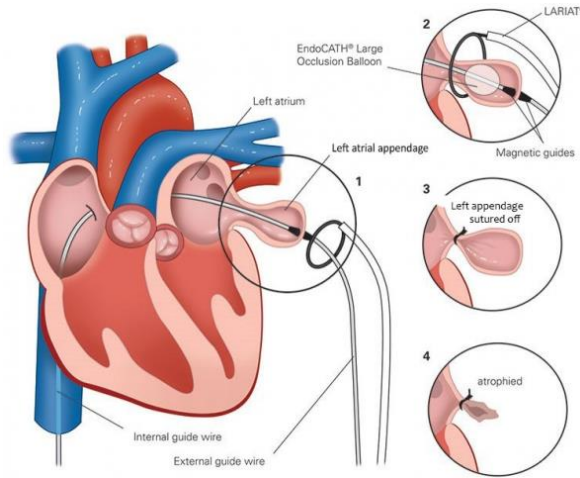
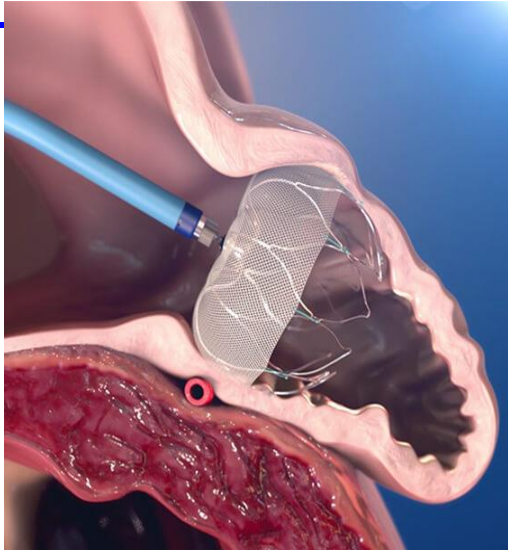


D *Cauliflower*

Atrial Fibrillation

What about devices to reduce stroke in AF?

- Lariat



RATE VS RHYTHM –

No clear choice, but some variables to help decide

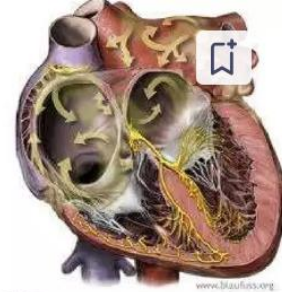


Major Trials Involving Rhythm and Rate Control in Atrial Fibrillation

Randomized Control Trial	Population	Treatments	Outcomes
AFFIRM (2002)	Patients with AF and additional stroke risk factors <ul style="list-style-type: none"> n = 4060 	Rate: BB, CCB, digoxin Rhythm: amiodarone, sotalol, propafenone, procainamide, quinidine, flecainide, disopyramide, moricizine	No difference in survival <ul style="list-style-type: none"> Lower risk of adverse drug effects with rate control
RACE (2002)	Persistent AF after previous electrical cardioversion <ul style="list-style-type: none"> n = 522 	Rate: digoxin, BB, CCB, or combination Rhythm: cardioversion, sotalol, flecainide, amiodarone	Rate control non-inferior to rhythm control

AFFIRM, PMID 12466506; **RACE**, PMID 12466507

Abbreviations: AF = atrial fibrillation; BB = beta blocker; CCB = calcium channel blocker

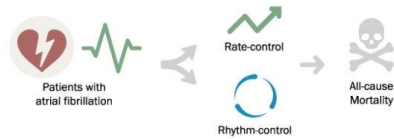


Cumulative Mortality from Any Cause in the Rhythm-Control Group and the Rate-Control Group.

AFFIRM Trial: A Comparison of Rate Control and Rhythm Control in Patients with Atrial Fibrillation

Multicenter, parallel-group, randomized, controlled trial

Objective: Among patients with atrial fibrillation and a high risk of stroke or death, what are the effects of rate control versus rhythm control on mortality?



4,060 patients with nonvalvular atrial fibrillation

Rate-control strategy
(n=2,027)

Follow-up:
5 years

Rhythm-control strategy
(n=2,033)

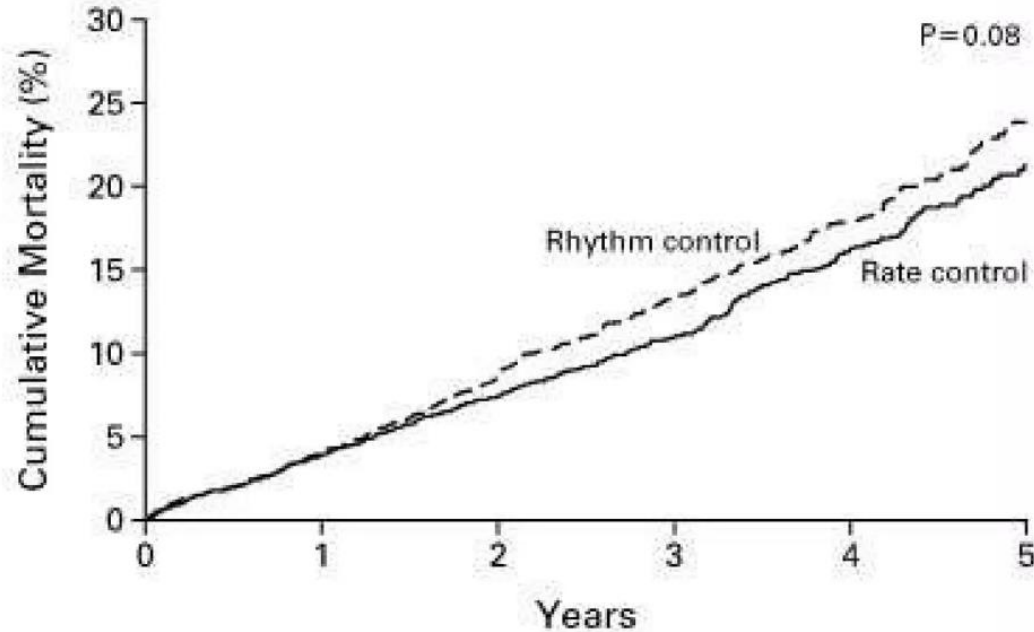
25.9% **Primary End Point** 5-year mortality (P=0.08)

26.7%

32.7% **Secondary Outcomes** Composite of death, stroke, major bleeding, or cardiac arrest

32.0%

In patients with nonvalvular AF, there is no survival benefit between rate and rhythm control, but rhythm trends toward increased mortality.



NO. OF DEATHS

number (percent)

Rhythm control

0

80 (4)

175 (9)

257 (13)

314 (18)

352 (24)

Rate control

0

78 (4)

148 (7)

210 (11)

275 (16)

306 (21)

TABLE 2. DRUGS USED IN THE RATE-CONTROL GROUP AND THE RHYTHM-CONTROL GROUP.*

DRUG	RATE-CONTROL GROUP		RHYTHM-CONTROL GROUP	
	USED DRUG FOR INITIAL THERAPY	USED DRUG AT ANY TIME	USED DRUG FOR INITIAL THERAPY	USED DRUG AT ANY TIME
	no. of patients (%)			
Rate control				
Data available	1957	2027	1266	2033
Digoxin	949 (48.5)	1432 (70.6)	417 (32.9)	1106 (54.4)
Beta-blocker	913 (46.8)	1380 (68.1)	276 (21.8)	1008 (49.6)
Diltiazem	583 (29.8)	935 (46.1)	198 (15.6)	610 (30.0)
Verapamil	187 (9.6)	340 (16.8)	56 (4.4)	204 (10.0)
Rhythm control				
Data available	1265	2027	1960	2033
Amiodarone	2 (0.2)†	207 (10.2)	735 (37.5)	1277 (62.8)
Sotalol	1 (0.1)†	84 (4.1)	612 (31.2)	841 (41.4)
Propafenone	2 (0.2)†	45 (2.2)	183 (9.3)	294 (14.5)
Procainamide	0	30 (1.5)	103 (5.3)	173 (8.5)
Quinidine	2 (0.2)†	14 (0.7)	92 (4.7)	151 (7.4)
Flecainide	0	29 (1.4)	88 (4.5)	169 (8.3)
Disopyramide	0	7 (0.3)	42 (2.1)	87 (4.3)
Moricizine	0	2 (0.1)	14 (0.7)	35 (1.7)
Dofetilide	0	5 (0.2)	0	13 (0.6)

At least 10%, up to 20% use of rhythm control agent at any time in the 5 years, no idea for how long or if in the same patient

RATE VS RHYTHM –
I may sneak off with rhythm control first though... ;)



EAST-AFNET 4 TRIAL

Kirchhof P. et al. Early Rhythm-Control Therapy in Patients With Atrial Fibrillation. N Engl J Med 2020;383:1305-16..



OBJECTIVE

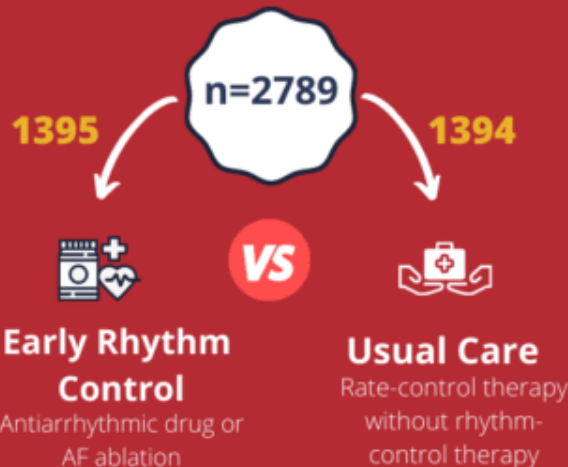
Is Early Rhythm-Control Therapy associated with lower risk of CV Outcomes in patients with early AFIB?

Rhythm control strategies: antiarrhythmic drugs or ablation and/or cardioversion of persistent AF

Both groups were in their first year of AFib diagnosis with at least two CV conditions

METHODS

Parallel-group, open, blinded-outcome trial



RESULTS

Early Rhythm Control

Usual Care

3.9



CV death



Stroke



Hospitalization with worsening HF/ACS

Incidence/100 person-yrs. P<0.005

5.8

5.0



of nights in hospital/year

Incidence/100 person-yrs. P=0.23

5.1



Safety outcome: Serious adverse events related to rhythm-control therapy occurred in 4.9% vs 1.4% of the patients assigned to usual care

Conclusion: Early rhythm control was associated with a lower risk of CV outcomes than usual care among patients with early AF and CV conditions

3.9



CV death



Stroke



Hospitalization with
worsening HF/ACS

Incidence/100 person-yrs; $P=0.005$

5.8

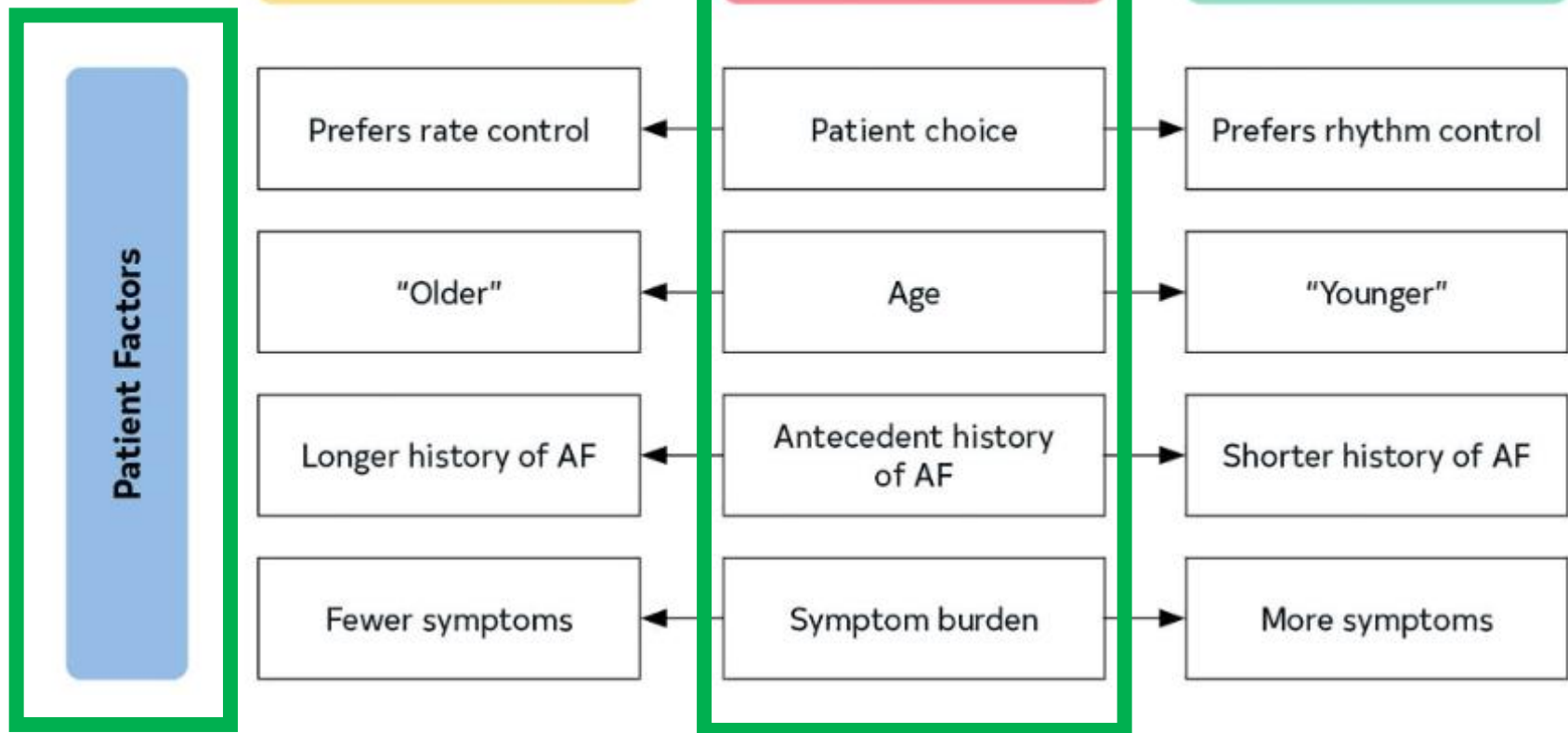
5.0



of nights in hospital/year

Incidence/100 person-yrs; $P=.23$

5.1



**Physical Examination
Anatomy**

Favors Rate Control

Easily controlled heart rate

Larger LA

Less LV dysfunction

Less AV regurgitation

Variable

Rate control in AF

LA size

LV function in AF

AV regurgitation in AF

Favors Rhythm Control

Difficult to control heart rate

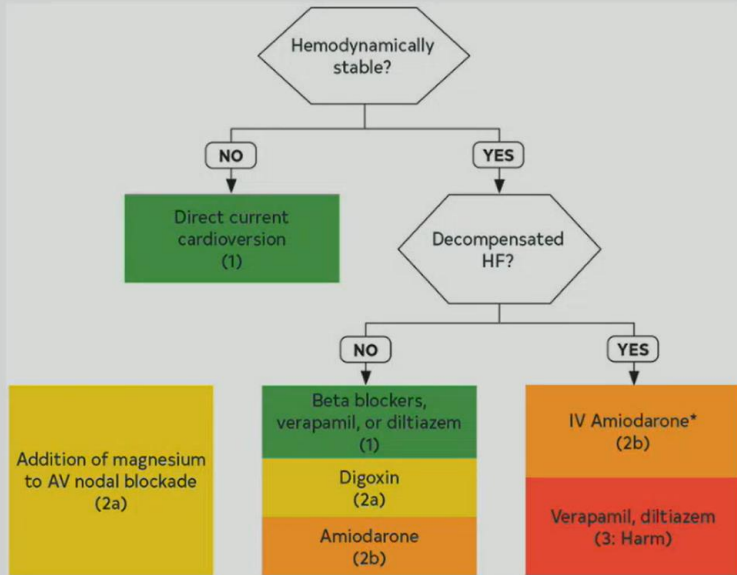
Smaller LA

More LV dysfunction

More AV regurgitation

Atrial Fibrillation Management – Rate Control

Acute Rate Control



Atrial Fibrillation

Newly diagnosed A-Fib: initial management depends on whether they are **hemodynamically unstable or stable**.

- **Hemodynamically Unstable Patient-**

- Hospitalization and immediate treatment of A-Fib are required.
- Instability is generally a result of **rapid ventricular rate** or associated cardiac or noncardiac conditions.
- In the acute setting, **IV beta blockers** (ie. Metoprolol) or **IV calcium channel blockers** (ie. Diltiazem) are usually effective at rate control.
- What about **urgent electrical cardioversion**?
 - indicated in patients with shock/severe hypotension, pulmonary edema, or ongoing MI/ischemia.

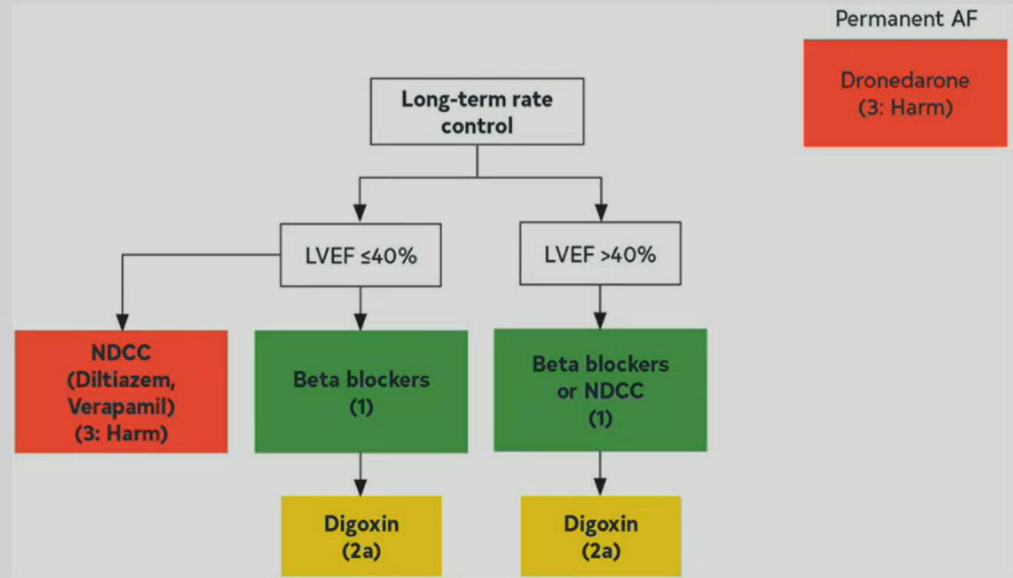
Atrial Fibrillation

Newly diagnosed A-Fib: initial management depends on whether they are **hemodynamically unstable or stable.**

- **Hemodynamically Stable Patient-**
 - If the newly diagnosed patient is clinically stable and at least relatively asymptomatic, **hospitalization is generally not necessary.**
 - A strategic approach to **rate control and anticoagulation is appropriate.**
 - This is true whether the condition that precipitated the A-Fib is likely to persist or might resolve spontaneously over hours to days
 - **Up to 66% of these IV or PO antiarrhythmics (36 hrs) of A-Fib annel blockers are considered NSR in the agents for conversion. If A-Fib has been present for more than a week, spontaneous conversion is unlikely.**

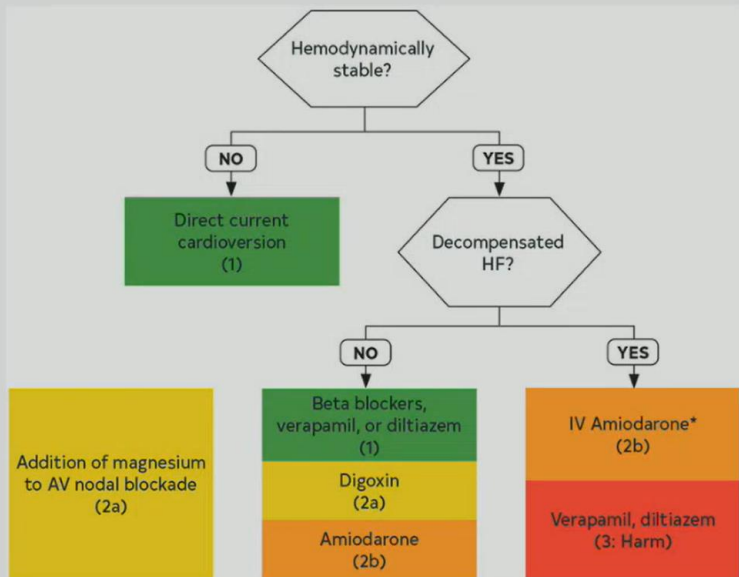
Atrial Fibrillation Management – Rate Control

Chronic Rate Control

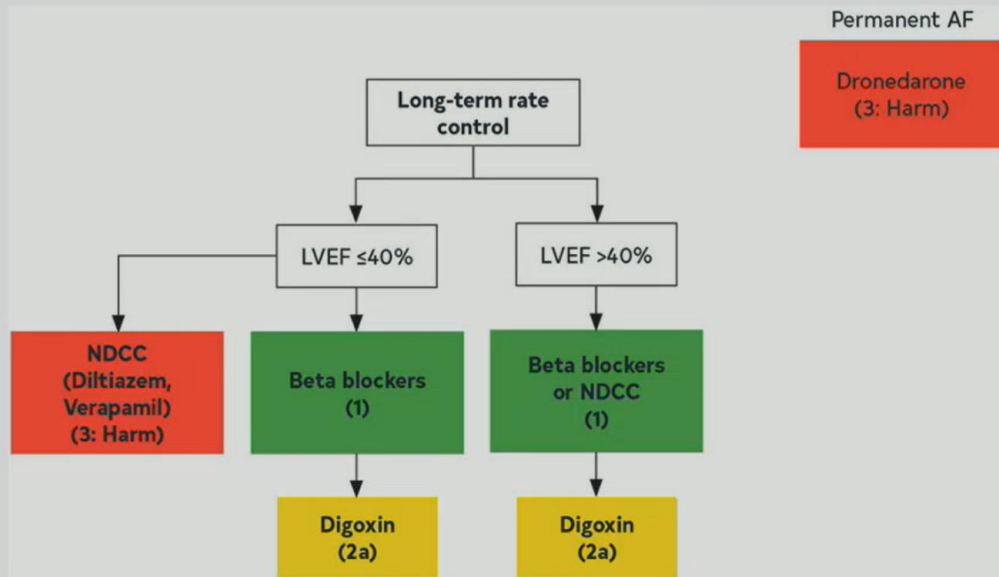


Atrial Fibrillation Management – Rate Control

Acute Rate Control

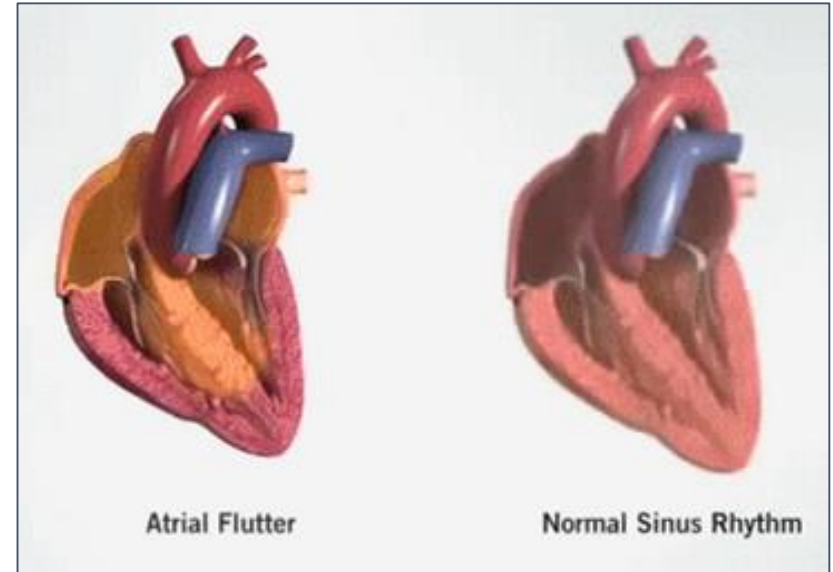


Chronic Rate Control



Atrial Flutter

- A-Flutter is another atrial arrhythmia, similar to Atrial Fibrillation.
 - Like A-Fib, it's commonly tachycardic. Unlike A-Fib, it's characteristically regular on EKG.
- Much less common than A-Fib, Atrial Flutter has an estimated incidence of ~~like with A-Fib~~ 200,000 new cases per year in the US.
- Especially with left atrial enlargement or left ventricular



Rate Control – What heart rate parameters?

Paroxysmal, Persistent, Long-standing Persistent, and Permanent AF.

- A decision to remain in AF also means reasonable heart rate parameters to avoid tachycardic cardiomyopathy or avoidable symptoms from tachycardia.
- Absent a co-morbid diagnosis of Heart Failure, resting heart rates of **<100 to 110 is reasonable**

Recommendations for Broad Considerations for Rate Control
Referenced studies that support the recommendations are summarized in the [Online Data Supplement](#).

COR	LOE	RECOMMENDATIONS
1	B-NR	1. In patients with AF, SDM with the patient is recommended to discuss rhythm- versus rate-control strategies (taking into consideration clinical presentation, comorbidity burden, medication profile, and patient preferences), discuss therapeutic options, and for assessing long-term benefits. ¹⁻³
2a	B-R	2. In patients with AF without HF who are candidates for select rate-control strategies, heart rate target should be guided by underlying patient symptoms, in general aiming at a resting heart rate of <100 to 110 bpm. ^{2,4-6}

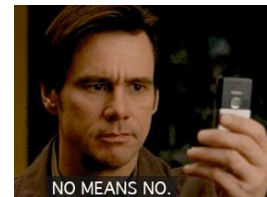
Rate Control – What heart rate parameters?

Paroxysmal, Persistent, Long-standing Persistent, and Permanent AF.

Recommendations for Long-Term Rate Control

Referenced studies that support the recommendations are summarized in the [Online Data Supplement](#).

COR	LOE	RECOMMENDATIONS
1	B-NR	1. In patients with AF, beta blockers or nondihydropyridine calcium channel blockers (diltiazem, verapamil) are recommended for long-term rate control with the choice of agent according to underlying substrate and comorbid conditions. ^{1,2}
2a	B-NR	2. For patients with AF in whom measuring serum digoxin levels is indicated, it is reasonable to target levels <1.2 ng/mL. ³⁻⁶
2a	B-R	3. In patients with AF and HF symptoms, digoxin is reasonable for long-term rate control in combination with other rate-controlling agents, or as monotherapy if other agents are not preferred, not tolerated, or contraindicated. ⁷⁻⁹
3: Harm	C-LD	4. In patients with AF and LVEF <40%, nondihydropyridine calcium channel-blocking drugs should not be administered given their potential to exacerbate HF. ^{10,11}
3: Harm	B-R	5. In patients with permanent AF who have risk factors for cardiovascular events, dronedarone should not be used for long-term rate control. ¹²



Atrial Fibrillation Management – AV Node Ablation

7.3. Atrioventricular Nodal Ablation (AVNA)

Recommendations for AVNA Referenced studies that support the recommendations are summarized in the Online Data Supplement .		
COR	LOE	Recommendations
1	C-LD	1. In patients with AF and a persistently rapid ventricular response who undergo AVNA, initial pacemaker lower rate programming should be 80 to 90 bpm to reduce the risk of sudden death. ^{1,2}
2a	B-R	2. In patients with AF and uncontrolled rapid ventricular response refractory to rate-control medications (who are not candidates for or in whom rhythm control has been unsuccessful), AVNA can be useful to improve symptoms and QOL. ³⁻⁶
1	B-NR	3. In patients with AF who are planned to undergo AVNA, implantation of a pacemaker before the ablation (ie, before or same day of ablation) is recommended to ensure adequacy of the pacing leads before performing ablation. ⁷⁻⁹
2b	C-LD	4. In patients with AF with normal EF undergoing AVNA, conduction system pacing of the His bundle ¹⁰⁻¹³ or left bundle area ^{12,13} may be reasonable.

- AV node ablation can be useful to improve symptoms and quality of life in patients with AF and uncontrolled rapid ventricular response refractory to medical management (Level 2a)
- Patients with AF and plan for AV node ablation, implantation of a pacemaker before the ablation is recommended to ensure adequacy of pacing leads prior to ablation. (Level 1)
- Initial pacemaker lower rate programming should be 80 to 90 bpm to reduce the risk of sudden death. (Level 1)
- Conduction system pacing may be reasonable in AF patients with normal LVEF undergoing AV node ablation.

Rate Control – What heart rate parameters?

Paroxysmal, Persistent, Long-standing Persistent, and Permanent AF.

- Tachy-Brady Syndrome – Be careful of the iatrogenic variety of bradycardia
- Too slow (rate control dose too high), <60 + symptomatic; or too fast (not enough dosing), >110 sustained



Rhythm Control

Paroxysmal, Persistent, Long-standing Persistent, and Permanent AF.

Recommendations for Goals of Therapy With Rhythm Control

Referenced studies that support the recommendations are summarized in the [Online Data Supplement](#).

COR	LOE	RECOMMENDATIONS
1	B-R	1. In patients with reduced LV function and persistent (or high burden) AF, a trial of rhythm control should be recommended to evaluate whether AF is contributing to the reduced LV function. ¹⁻⁶
2a	B-R	2. In patients with symptomatic AF, rhythm control can be useful to improve symptoms. ⁷⁻¹¹
2a	B-R	3. In patients with a recent diagnosis of AF (<1 year), rhythm control can be useful to reduce hospitalizations, stroke, and mortality. ¹²⁻¹⁴
2a	B-R	4. In patients with AF and HF, rhythm control can be useful for improving symptoms and improving outcomes, such as mortality and hospitalizations for HF and ischemia. ¹⁵⁻¹⁹
2a	B-NR	5. In patients with AF, rhythm-control strategies can be useful to reduce the likelihood of AF progression. ²⁰⁻²⁷
2b	C-LD	6. In patients with AF where symptoms associated with AF are uncertain, a trial of rhythm control (eg, cardioversion or pharmacological therapy) may be useful to determine what if any symptoms are attributable to AF. ²⁸⁻³²
2b	B-NR	7. In patients with AF, rhythm-control strategies may be useful to reduce the likelihood of development of dementia or worsening cardiac structural abnormalities. ³³⁻⁴⁵

All very reasonable, laudable even, goals. Clinical trials have not addressed these directly to date

Rhythm Control

Paroxysmal, Persistent, Long-standing Persistent, and Permanent AF.

For rhythm control

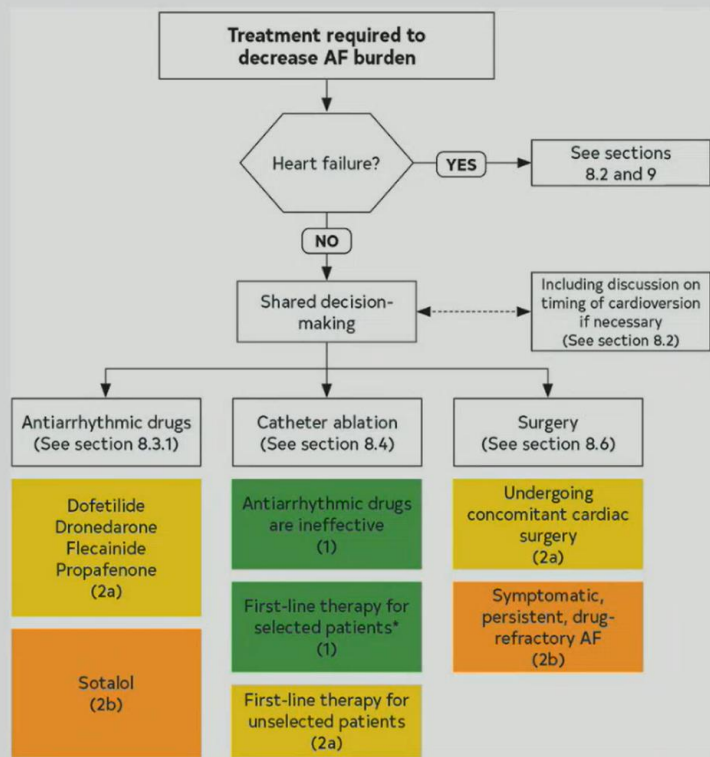
- 1) If HFrEF $\leq 40\%$ = amiodarone or dronedarone
- 2) Uncomplicated AF = flecainide or propafenone
- 3) Uncomplicated AF = if failed flecainide or propafenone, consider dofetilide, amiodarone, or sotalol



Recommendations for Specific Drug Therapy for Long-Term Maintenance of Sinus Rhythm Referenced studies that support the recommendations are summarized in the [Online Data Supplement](#).

COR	LOE	RECOMMENDATIONS
2a	A* B-NR†	1. For patients with AF and HFrEF ($\leq 40\%$), therapy with dofetilide* ¹ or amiodarone† ² is reasonable for long-term maintenance of sinus rhythm.
2a	A	2. For patients with AF and no previous MI, or known or suspected significant structural heart disease, or ventricular scar or fibrosis, use of flecainide ³⁻⁵ or propafenone ⁵⁻¹² is reasonable for long-term maintenance of sinus rhythm.
2a	A	3. For patients with AF without recent decompensated HF or severe LV dysfunction, use of dronedarone ^{5,13-15} is reasonable for long-term maintenance of sinus rhythm.
2a	A	4. For patients with AF without significant baseline QT interval prolongation or uncorrected hypokalemia or hypomagnesemia, use of dofetilide ^{1,5,16 5-7,10,17,18} is reasonable for long-term maintenance of sinus rhythm, with proper dose selection based on kidney function and close monitoring of the QT interval, serum potassium and magnesium concentrations, and kidney function.
2a	A	5. For patients with AF and normal LV function, use of low-dose amiodarone (100-200 mg/d) is reasonable for long-term maintenance of sinus rhythm ^{2,5,17-22} but, in view of its adverse effect profile, ^{5,23,24} should be reserved for patients in whom other rhythm control strategies are ineffective, not preferred, or contraindicated.
2b	A	6. For patients with AF without significant baseline QT interval prolongation, hypokalemia, hypomagnesemia, or bradycardia, use of sotalol ^{5-7,10,17,18} may be considered for long-term maintenance of sinus rhythm, with proper dose selection based on kidney function and close monitoring of the QT interval, heart rate, serum potassium and magnesium concentrations, and kidney function.
3: Harm	B-R	7. In patients with previous MI and/or significant structural heart disease, including HFrEF (LVEF $\leq 40\%$), flecainide and propafenone ²⁵ should not be administered due to the risk of worsening HF, potential proarrhythmia, and increased mortality. ^{26,27}
3: Harm	B-R	8. For patients with AF, dronedarone should not be administered for maintenance of sinus rhythm to those with NYHA class III and IV HF or patients who have had an episode of decompensated HF in the past 4 weeks due to the risk of increased early mortality associated with worsening HF. ²⁸

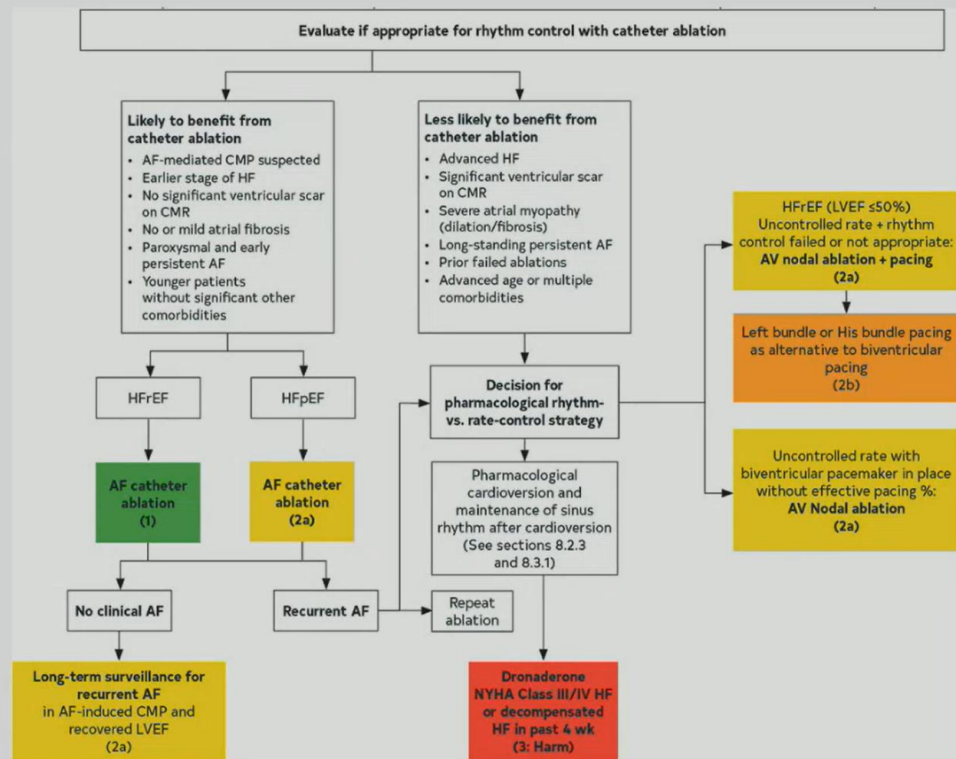
Atrial Fibrillation Management – Rhythm Control



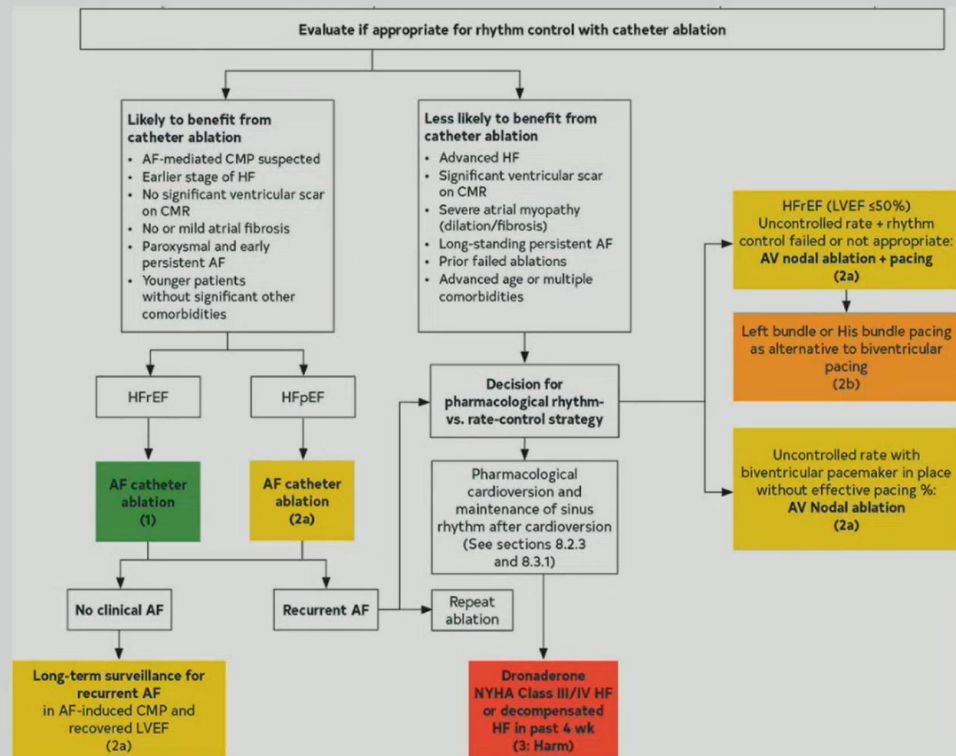
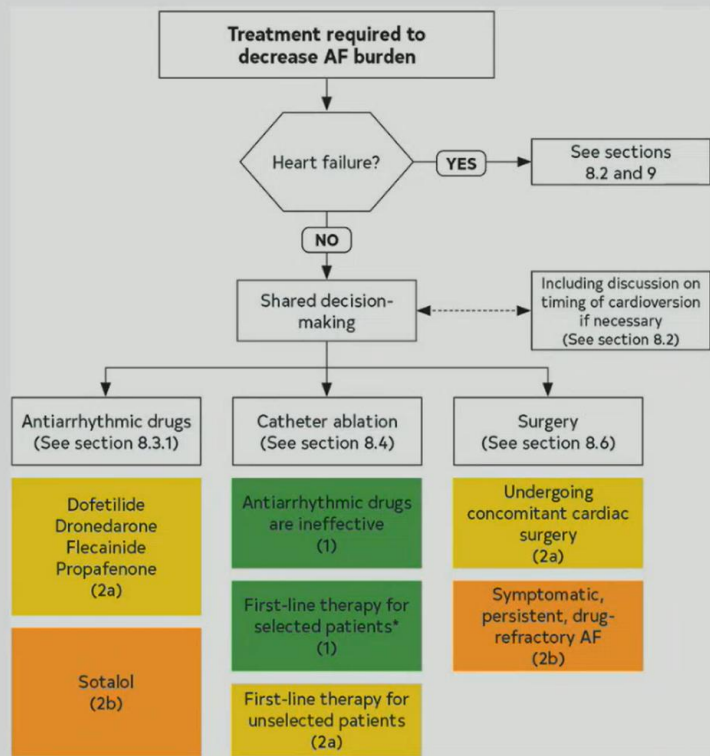
Rate vs Rhythm Control

- Basic principles of the Rhythm Control strategy:
 - **Initial conversion to normal sinus** may involve antiarrhythmic medications or external electrical therapy.
 - AKA pharmacological or electrical cardioversion
 - **STOP. THINK. -> What is the most pressing issue/complication of atrial fibrillation if you are going to “cardiovert” a patient?**
 - **If unknown onset of AF, initiate anticoagulation before cardioversion. In the least, perform immediate TEE prior to attempted chemical or electrical cardioversion. See anticoagulation guidelines.**

Atrial Fibrillation Management – Rhythm Control



Atrial Fibrillation Management – Rhythm Control



EARLY-AF

Andrade JG, Wells GA, Deyell MW, et al. Cryoablation or drug therapy for initial treatment of atrial fibrillation.
New England Journal of Medicine. 2021;384(4):305-315.



Objective

Is first-line ablation more effective than antiarrhythmic drugs in preventing recurrence of atrial tachyarrhythmia?

Inclusion criteria:

>18 years of age
At least one episode of AF on ECG in the past 24 months

Primary endpoint:

AF recurrence (after 91-365 days)

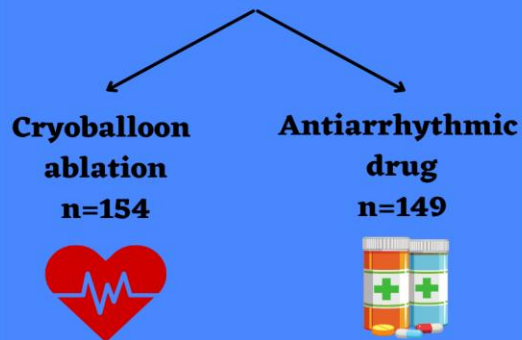
Secondary endpoints:

Free of symptomatic arrhythmias
AF burden
Quality of life
Health care utilization

Methods

Prospective, multicenter, open-label, randomized trial

303 patients



Monitored via
Implantable cardiac
monitor

Results

Follow up: 1 year

Recurrence of AF

Ablation:	Antiarrhythmic
66/154 (42.9%)	101/149 (67.8%)
HR 0.48 (0.35-0.66)	

Symptomatic arrhythmia	Safety endpoint
Ablation: 17/154 (11%)	Ablation: 5/154 (3.2%)
Antiarrhythmic: 39/149 (26%)	Antiarrhythmic: 6/149 (4%)
HR 0.39 (0.22-0.68)	HR 0.81 (0.25-2.59)

Conclusion:

Catheter cryoballoon ablation was associated with a significantly lower rate of AF recurrence when used as initial treatment for symptomatic paroxysmal AF compared to antiarrhythmic therapy.

Recurrence of AF

Ablation:

66/154 (42.9%)

Antiarrhythmic

101/149 (67.8%)

HR 0.48 (0.35-0.66)

P<0.001

Symptomatic arrhythmia

Safety endpoint

Ablation: 17/154 (11%)

Ablation: 5/154 (3.2%)

Antiarrhythmic: 39/149 (26%)

Antiarrhythmic: 6/149 (4%)

HR 0.39 (0.22-0.68)

HR 0.81 (0.25-2.59)

STOP AF

Wazni OM, Dandamudi G, Sood N, et al. Cryoballoon ablation as initial therapy for atrial fibrillation.
New England Journal of Medicine. 2021;384(4):316-324.



Objective

Is first-line cryoballoon ablation more effective than antiarrhythmic drugs in restoring sinus rhythm in patients with symptomatic paroxysmal AF?

Inclusion criteria:

18-80 years of age
Recurrent symptomatic paroxysmal AF

Primary endpoint:

Treatment success*

Secondary endpoints:

Quality of life
Safety endpoints
(specific procedural complications)

*freedom from initial failure of the procedure or atrial arrhythmia recurrence after a 90-day blanking period to allow recovery from the procedure or drug dose adjustment, evaluated in a Kaplan-Meier analysis

Methods

Parallel, multicenter, open-label, randomized trial

203 patients

Cryoballoon
ablation
n=104



Antiarrhythmic
drug
n=99



Monitored via
12-lead EKG at 1, 3, 6, 12 mo.
24-hr holter at 6 & 12 mo

Results

Follow up: 1 year

Treatment success

Ablation: 78/104 (74.6%)	Antiarrhythmic 48/99 (45%)
------------------------------------	--------------------------------------

P<0.001

Arrhythmia
Reoccurrence

Ablation: 21/104 (20%)

Antiarrhythmic: 35/99 (35%)

Serious
Adverse event

Ablation: 15/104 (14%)

Antiarrhythmic: 14/99 (14%)

Conclusion:

Cryoballoon ablation as initial therapy was superior to drug therapy for the prevention of atrial arrhythmia recurrence in patients with symptomatic paroxysmal AF

Treatment success

Ablation:
78/104 (74.6%)

Antiarrhythmic
48/99 (45%)

P<0.001

**Arrhythmia
Reoccurrence**

Ablation: 21/104 (20%)

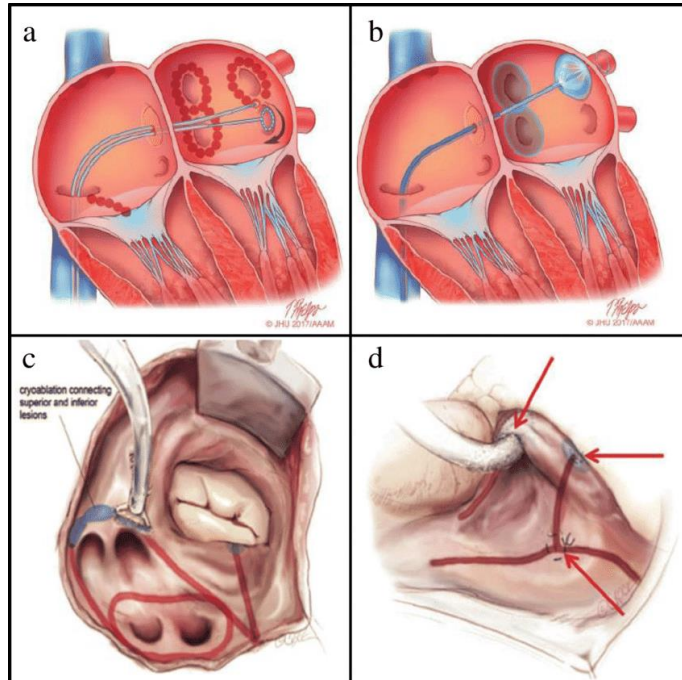
Antiarrhythmic: 35/99 (35%)

**Serious
Adverse event**

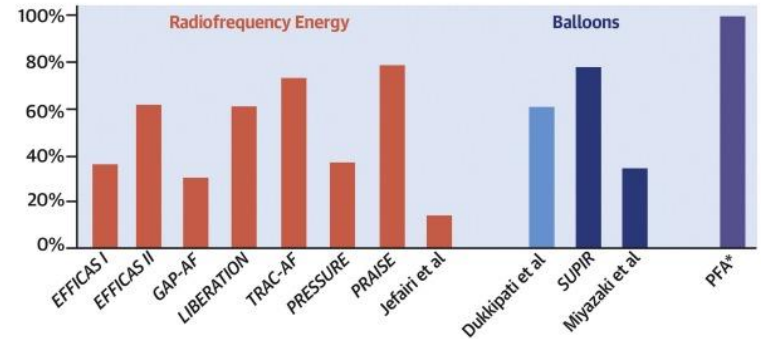
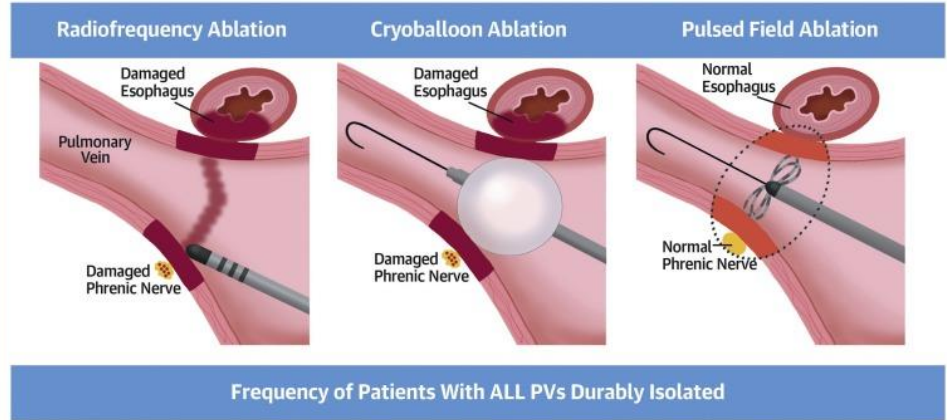
Ablation: 15/104 (14%)

Antiarrhythmic: 14/99 (14%)

Radiofrequency and cryoablation (Pulmonary Vein Isolation)

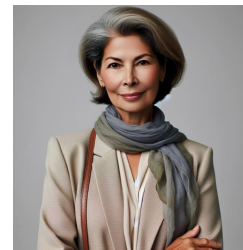


CENTRAL ILLUSTRATION: Pulmonary Vein Isolation for Atrial Fibrillation by Pulsed Field Ablation



Reddy, V.Y. et al. J Am Coll Cardiol. 2019;74(3):315-26.

Case



Sheryl, a 66-year-old woman, is a well-established patient who presents with a 3-month history of being **“tired a lot more.”** She has had moments where **“my heart beats fast,”** and this causes her to feel **“dizzy and lightheaded.”** She is on losartan-HCT 20-12.5 mg and amlodipine 5 mg, “I’ve had high blood pressure for years.” No fever, chills, or sweats. Does not report any abnormal bleeding.

Rate or Rhythm control for Sheryl?

- A. Rate
- B. Rhythm
- C. No idea yet – need to assess her goals/preferences and the context of her AF (symptoms, length of time, etc.) and anatomical features (large atrium, LV function, etc.).

Case



Sheryl, a 66-year-old woman, is a well-established patient who presents with a 3-month history of being **“tired a lot more.”** She has had moments where **“my heart beats fast,”** and this causes her to feel **“dizzy and lightheaded.”** She is on losartan-HCT 20-12.5 mg and amlodipine 5 mg, “I’ve had high blood pressure for years.” No fever, chills, or sweats. Does not report any abnormal bleeding.

After discussion, she chooses to start rivaroxaban 20 mg daily.

At her echocardiogram, her atria sizes are normal and she has mild concentric LVH (long-standing hypertension), and EF 55% (“normal” 50-75%) and is in NSR, ventricular rate 65.

She is now anticoagulated (stroke prophylaxis). Appear to have Paroxysmal AF (comes and goes).

Rate versus Rhythm control? Perhaps we need more data – expensive single assessment Holter, Ambulatory Telemetry Monitoring (ATM)...

OR Patient owned continuous and ongoing FDA cleared wearables?

CENTRAL ILLUSTRATION: Common Health Metrics Provided by Consumer Wearable Devices

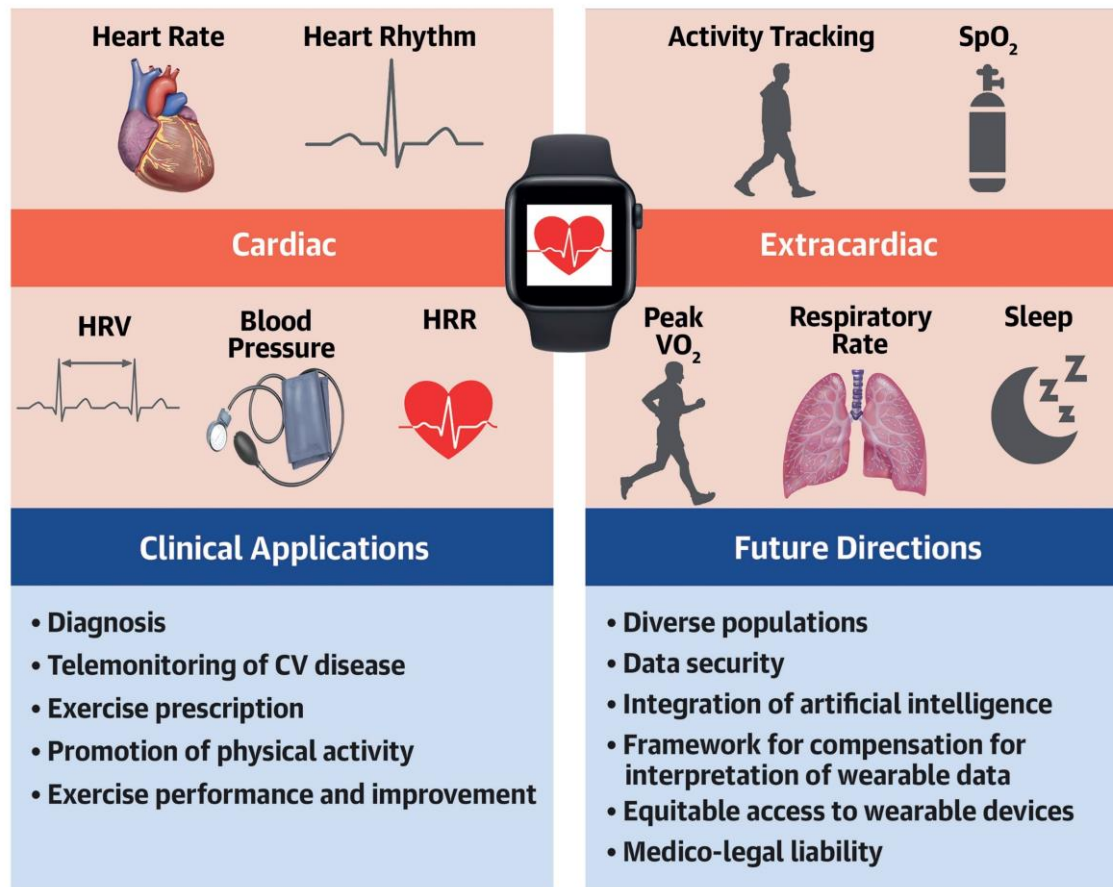
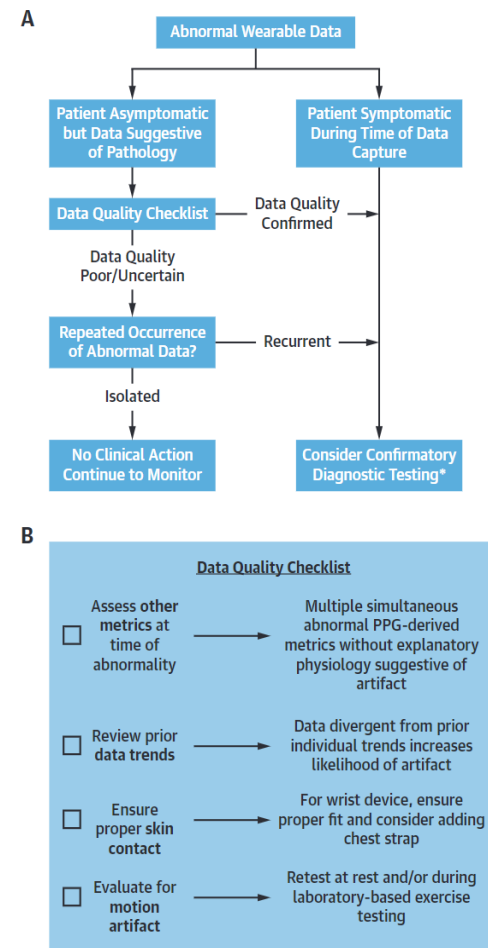
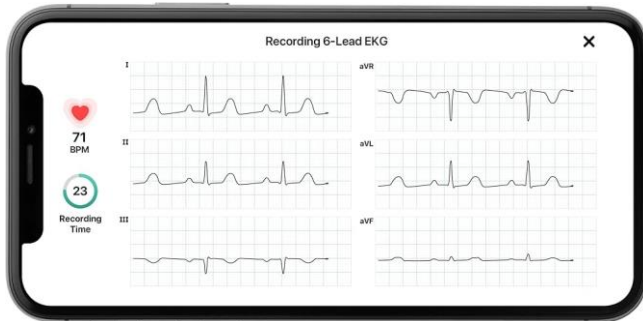
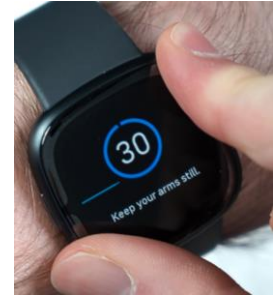
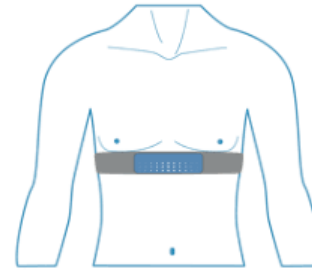
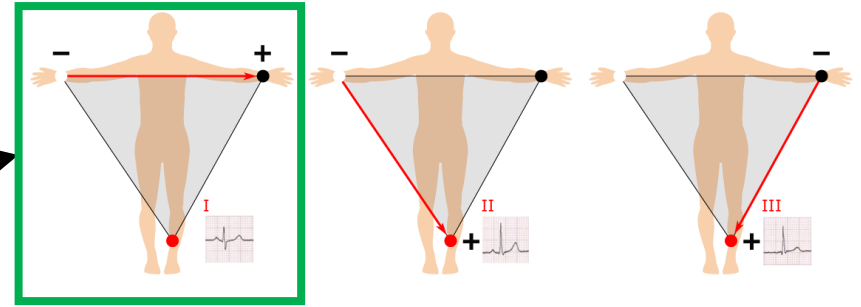


FIGURE 4 Algorithm for Interpretation of Abnormal Testing from CWDs



Patient owned devices –

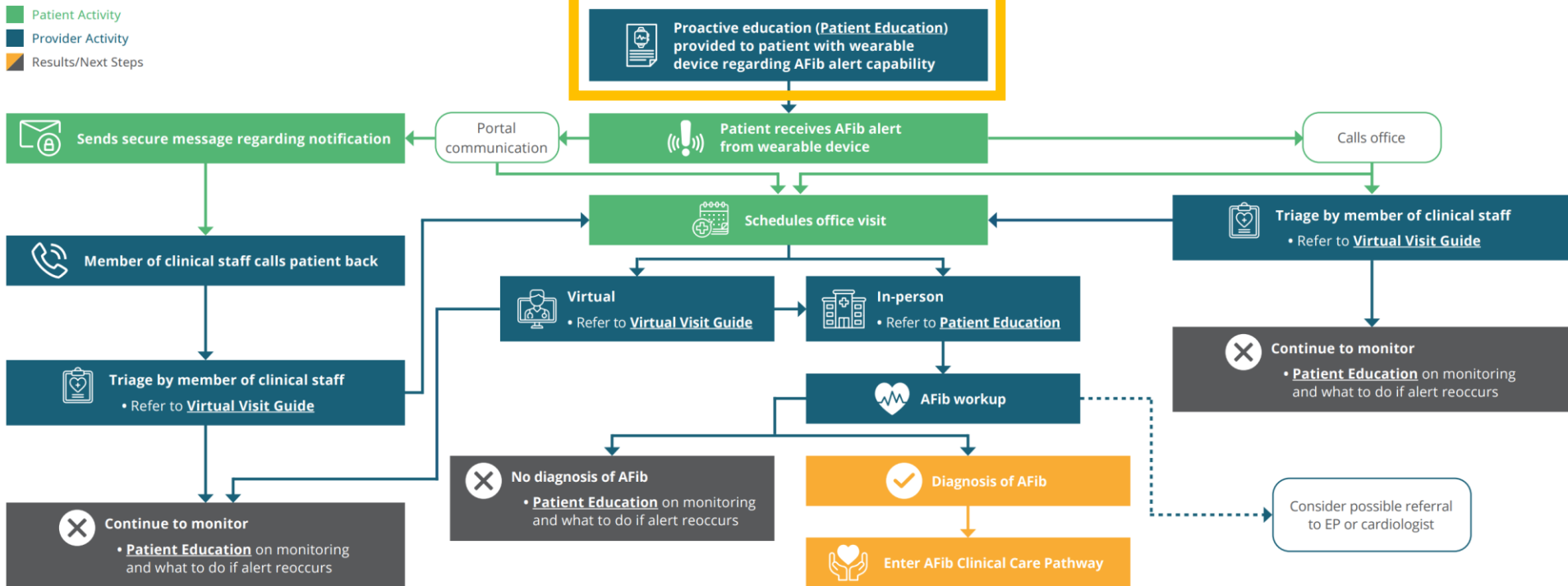
- Almost all are predicated on obtaining **Lead I**
- You can see how you might obtain Leads II or III...
- Then, there is six lead... three points of contact (right and left-hand + left knee or ankle = Leads I, II, III -> aVF, aVL, aVR)



ESTABLISH RULES of ENGAGEMENT

Example Workflow Mapping for Integrating Consumer Wearables for Potential Detection of AFib

This is a sample high-level overview of potential pathways that patients and providers might encounter when a patient receives an AFib alert on a CWD. **Guidance on the management of AFib depends on each health system's processes.**



ESTABLISH RULES of ENGAGEMENT

Absent infrastructure at the system level

1. Invite patients with a wearable device to become familiar with obtaining a single lead EKG.
2. Normal is generally normal (high sensitivity/specificity). “AF detected” is >90% sensitive for true AF. “Abnormal” is anyone’s guess unless and until confirmed with medical grade 12-Lead, Holter, ATM, etc.
3. DON’T text when normal.
4. Have a plan for confirmed AF. If known and just monitoring, fine. If symptomatic, responses are symptom severity dependent including “Go to the ED”.
5. **Wearables provide patients opportunities to engage in their care, better understand any associations between symptoms and arrhythmias, know what the burden (amount) of arrhythmias they are having, and manage any “pill-in-the-pocket” strategies for rhythm or rate control**

ESTABLISH RULES of ENGAGEMENT

What Should I Do if My Wearable Device Alerts Me to an Irregular Heartbeat?

If you get an alert on your device, it means it may have detected an irregular heartbeat. You can share an ECG reading on your device with your doctor or care team.



If you have not already set up a plan with your doctor or care team, then you should¹¹:



Contact your doctor or care team member.

Let them know your device has notified you of a possible irregular heartbeat that may be AFib.



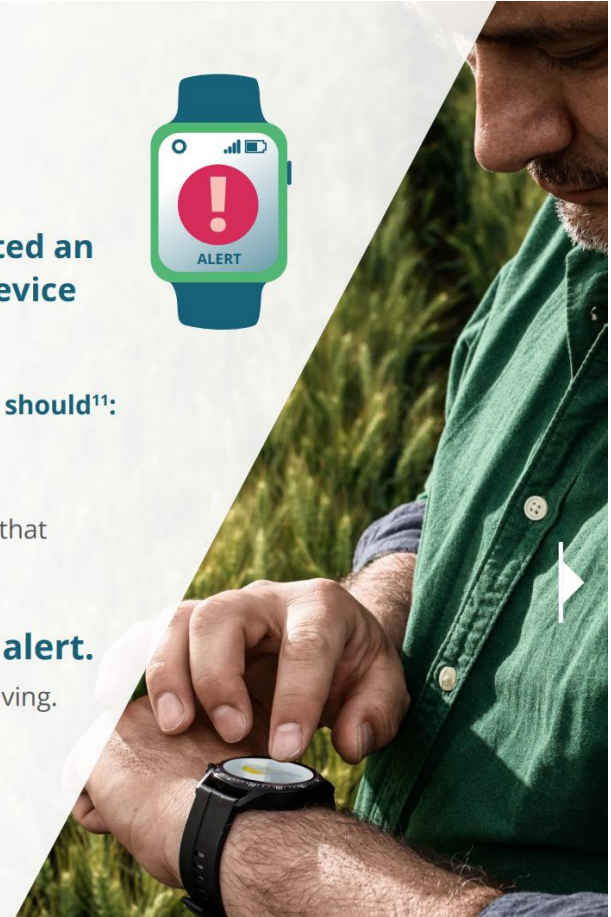
Have information ready about when you received the alert.

Share what you were doing at the time, and any symptoms you had or are having.



Follow your doctor's instructions.

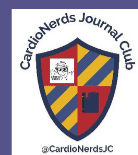
You may be asked to share data from your device, make an appointment for a follow-up, or seek medical help.





VITAL-AF

Screening for Atrial Fibrillation in Older Adults at Primary Care Visits: VITAL-AF Lubitz et al., *Circulation*. 2022



QUESTION

- Is routine screening of older adults using single-lead ECGs more effective for diagnosing AF than usual care in a contemporary primary care practice setting?

BACKGROUND

- AF is a leading cause of stroke; however, AF may be asymptomatic and first diagnosed at the time of stroke.
- Screening may enable earlier diagnosis of AF and implementation of oral anticoagulation to prevent strokes.

METHODS

Open-label Randomized
Control Trial

n = 35308



15,393 screening arm
15,322 control arm

Inclusion Criteria:

- Age >65

Primary Outcome:

- Incidence of newly diagnosed AF during the 12-month screening period

Secondary Outcomes:

- Incident AF associated with a primary care encounter
- New oral anticoagulation prescription
- Continued prescription of anticoagulation at 12 months among those started on anticoagulation
- New ischemic stroke within 24-months of study start
- Major hemorrhage within 24-months of study start

RESULTS

PRIMARY ENDPOINT

Incidence of newly
diagnosed AF during the
12-month screening period

1.72% individuals in the screening arm
versus 1.59% in the control arm at 1 year
(RD, 0.13% [95% CI, -0.16 to 0.42]; P=0.38)

Among individuals aged at least 85 years,
new AF was diagnosed in 65 individuals
(5.56%) in the screening arm versus 47
individuals (3.76%) in the control arm (RD,
1.80% [95% CI, 0.18 to 3.30]).

CONCLUSION

Screening for AF using a single-lead ECG at primary care visits did not affect new AF diagnoses among all individuals aged 65 years or older compared with usual care.

Case



Sheryl, a 66-year-old woman, is a well-established patient with a 3-month history of being “**tired a lot more.**” She has had moments where “**my heart beats fast,**” and this causes her to feel “**dizzy and lightheaded.**” She is on losartan-HCT 20-12.5 mg and amlodipine 5 mg, “I’ve had high blood pressure for years.” No fever, chills, or sweats. Does not report any abnormal bleeding.

She has AF stage 3, paroxysmal. She is now on rivaroxaban 20 mg daily. She has metoprolol tartrate 50 mg ½ to 1 tab PRN for heart rates >110. Her heart anatomy suggests that the rhythm control strategy is reasonable.

In the absence of LV dysfunction and symptomatic coronary disease, she elects flecainide 50 mg po BID. She likes the idea of using a wearable to identify whether symptomatic palpitations are AF.

Case



Sheryl, a 66-year-old woman. She has stage 3 AF, paroxysmal AF. She is now on rivaroxaban 20 mg daily. She has metoprolol tartrate 50 mg $\frac{1}{2}$ to 1 tab PRN for heart rates >110 . Her heart anatomy suggests rhythm control strategy is reasonable.

In the absence of LV dysfunction and symptomatic coronary disease, she elects flecainide 50 mg po BID (100 mg daily) and likes the idea of using a wearable to identify whether symptomatic palpitations are AF.

Potential INSTRUCTIONS:

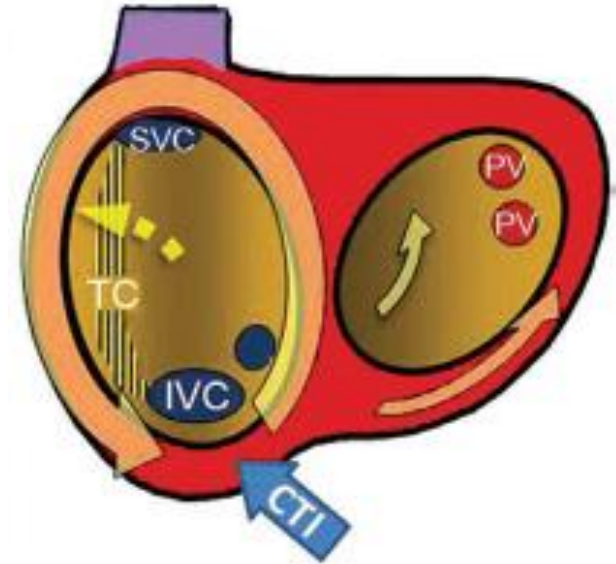
1. For AF recurrences, if HR >110 , may use a $\frac{1}{2}$ tab Metoprolol tartrate 50 mg.
2. May use an extra tab of flecainide 50 mg (up to 300 mg daily maximum) to “chemically cardiovert”
3. Sheryl is provided contact numbers of the clinic and specific RN/Mas supporting me and has my direct cell for texts/calls for clarification.
4. Always, she is directed that ED is reasonable when symptoms are severe.

Summary

1. Identify and reduce elevated stroke risk with anti-coagulation. Use risk calculators WITH your patient.
2. Patient-owned devices can help assess the burden of AF and help inform the choice for rate or rhythm control strategies.
3. Additionally, A rate or rhythm control strategy can leverage patient-owned devices to improve therapeutics' choice and “success” to achieve mutually agreed-upon goals.
4. Patient-owned devices may help guide patients on PRN delivery of therapeutics on top of chronic daily medications.
5. Patient-owned devices may help patients become more engaged and improve patient understanding of their disease and the therapies they are using.

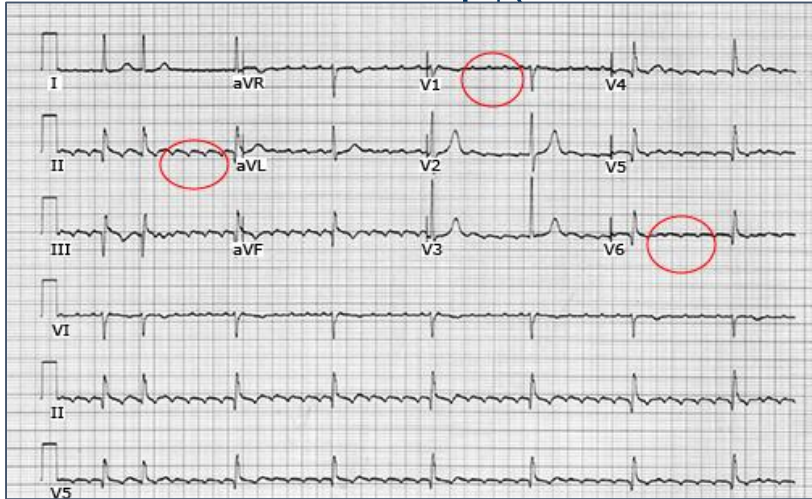
Atrial Flutter

- Pathophysiology and EKG-
 - There are **two main types** of A-Flutter: Typical and Atypical.
 - **Typical Atrial Flutter-**
 - The **more common** of the two types, this is a **Macroreentrant Circuit within the right atrium** includes the **Cavotricuspid Isthmus (CTI)**.
 - CTI = The portion of the RA wall that spans the gap between the IVC and tricuspid valve
 - AKA CTI-dependent Atrial Flutter
 - The LA is then passively depolarized.



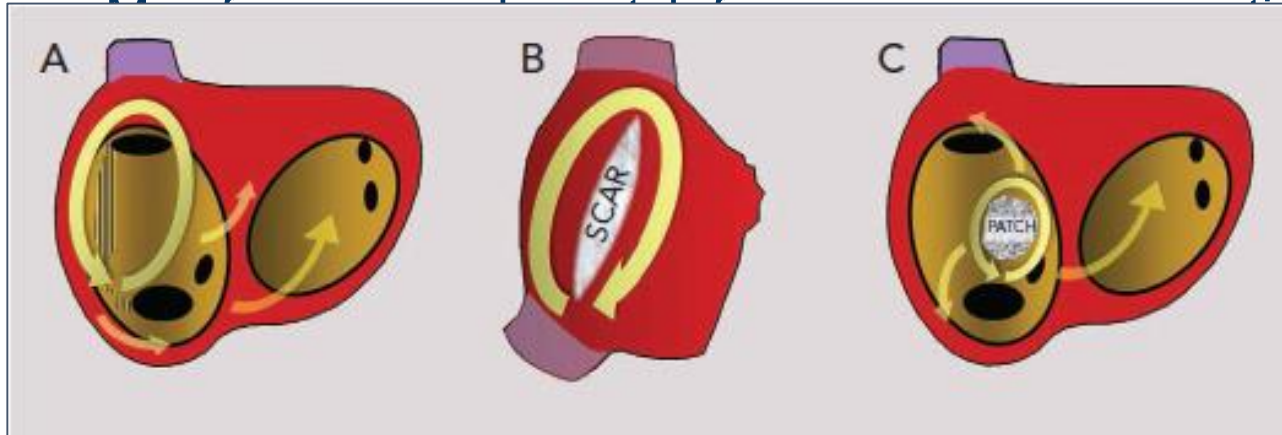
Atrial Flutter

- Pathophysiology and EKG (continued)-
 - Typical Atrial Flutter (continued)-
 - The circuit is generally counterclockwise and creates a **classic sawtooth appearance best seen in the inferior leads** (but can be



Atrial Flutter

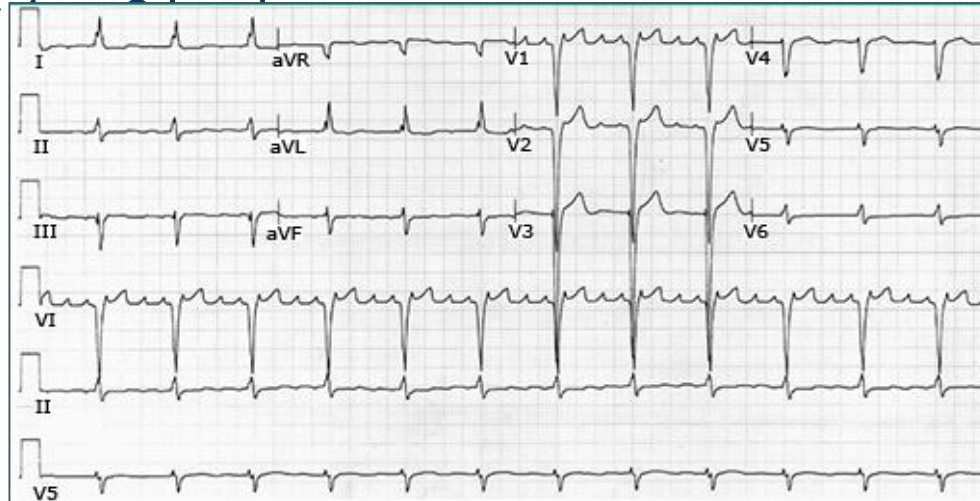
- Pathophysiology and EKG (continued)-
 - **Atypical Atrial Flutter-**
 - The less common of the two types.
 - While it is also a macroreentrant circuit, it **does not involve the CTI**.



ssue

Atrial Flutter

- Pathophysiology and EKG (continued)-
 - Atypical Atrial Flutter (continued)-
 - The appearance on EKG may not be quite as obviously A-Flutter as we see with Typical type. May see sawtooth waves in only

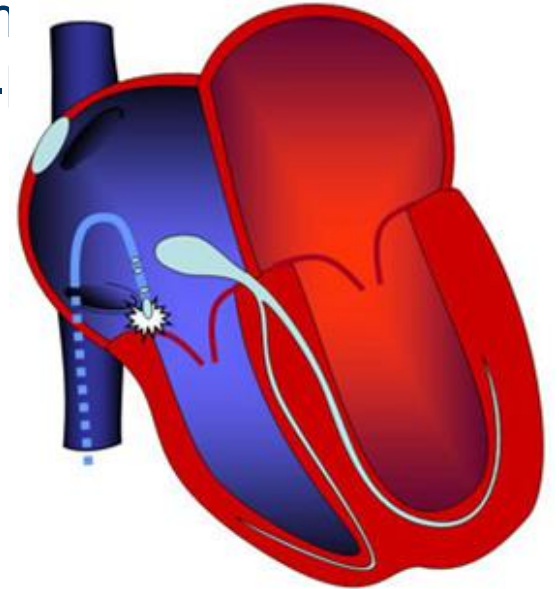


Atrial Flutter

- Treatment/Management-
 - Because ventricular rates can be sustained at around 150 bpm, **rate control** is an important component of treatment.
 - Accomplished using the same agents used in A-Fib (BBs & CCBs)
 - ■ **Pharmacologic cardioversion** to NSR is also difficult to achieve with most antiarrhythmics.
 - Highest success rate with IV **ibutilide** (50-70% success)
 - **Electrical cardioversion** is a very effective treatment for about 90% of patients with A-Flutter, converting with shocks as low as 25-50 J.

Atrial Flutter

- Treatment/Management (continued)-
 - The **risk of thromboembolism** should be considered equal to A-Fib because the two can co-exist to some degree.
 - Same **anticoagulation** thoughts as A-Fib.
 - **Catheter Ablation** of the CTI is a highly successful treatment for Typical A-Flutter, and is considered the preferred approach for recurrent arrhythmia.
 - Same thoughts on referral and admission as we discussed with A-Fib.



QUESTIONS?