

# I Got Rhythm, or Not----- Managing Atrial Fibrillation

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# Description

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- During this session you will learn about treatment options for patients with atrial fibrillation. Using a case-based approach you will learn about pharmacologic strategies for anticoagulation, rate and rhythm control as well as when to refer to cardiology for advanced interventions.

# Objectives

## Identify

Identify risk factors for the development of atrial fibrillation

## Describe

Describe the basic pathophysiology of atrial fibrillation.

## Recognize

Recognize symptoms and EKG findings of atrial fibrillation

## Discuss

Discuss evidence-based treatment options for managing atrial fibrillation

# Why is recognition significant?

## Epidemiology

## Worldwide epidemic

- >33 million people affected
- ~5 million new cases annually

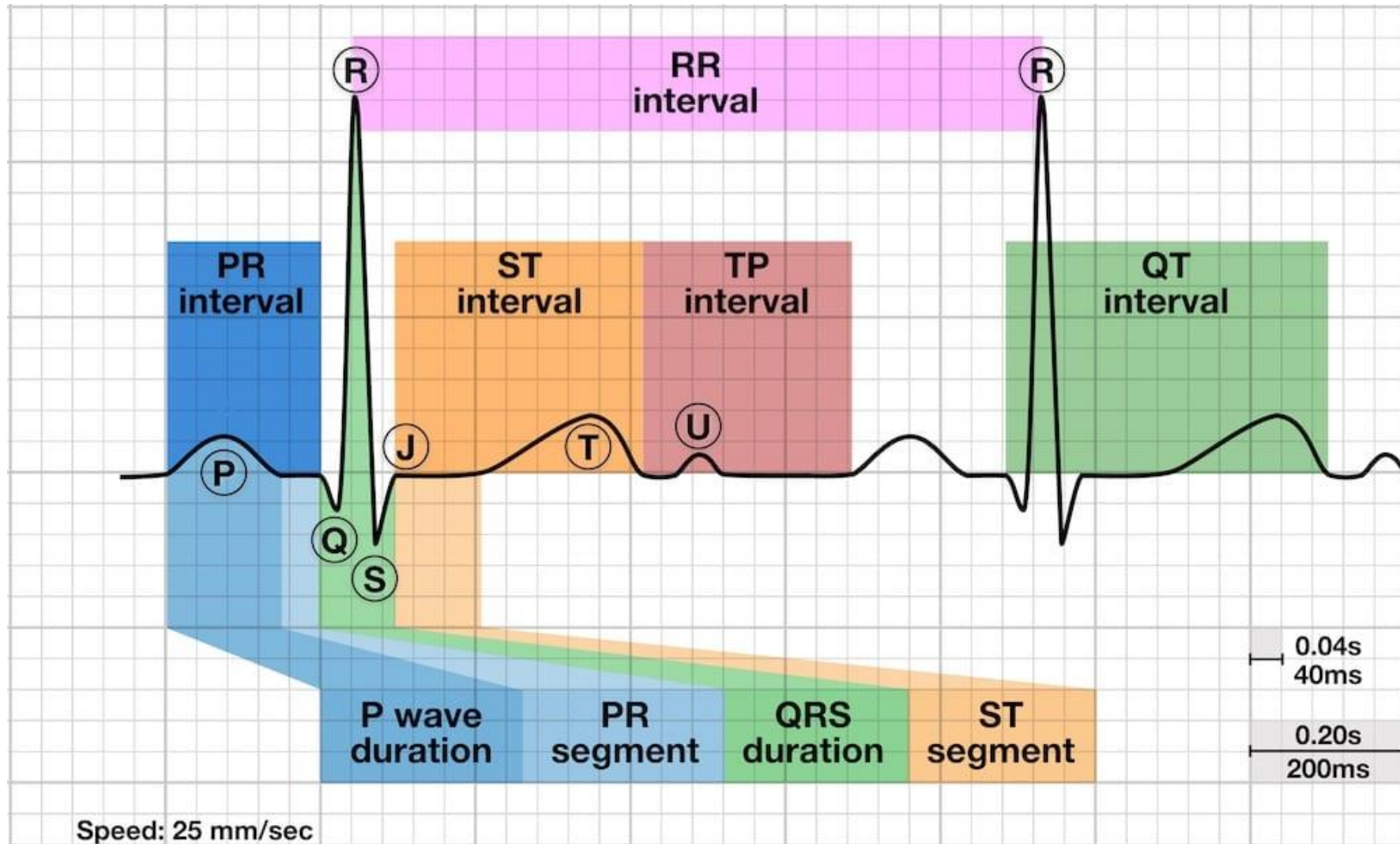
## USA

- ~2.7-6.1 Million: number of people affected
- ~12.1-15.9 Million: estimated number to be affected by 2050
- Lifetime risk in age >55 yr = 37%

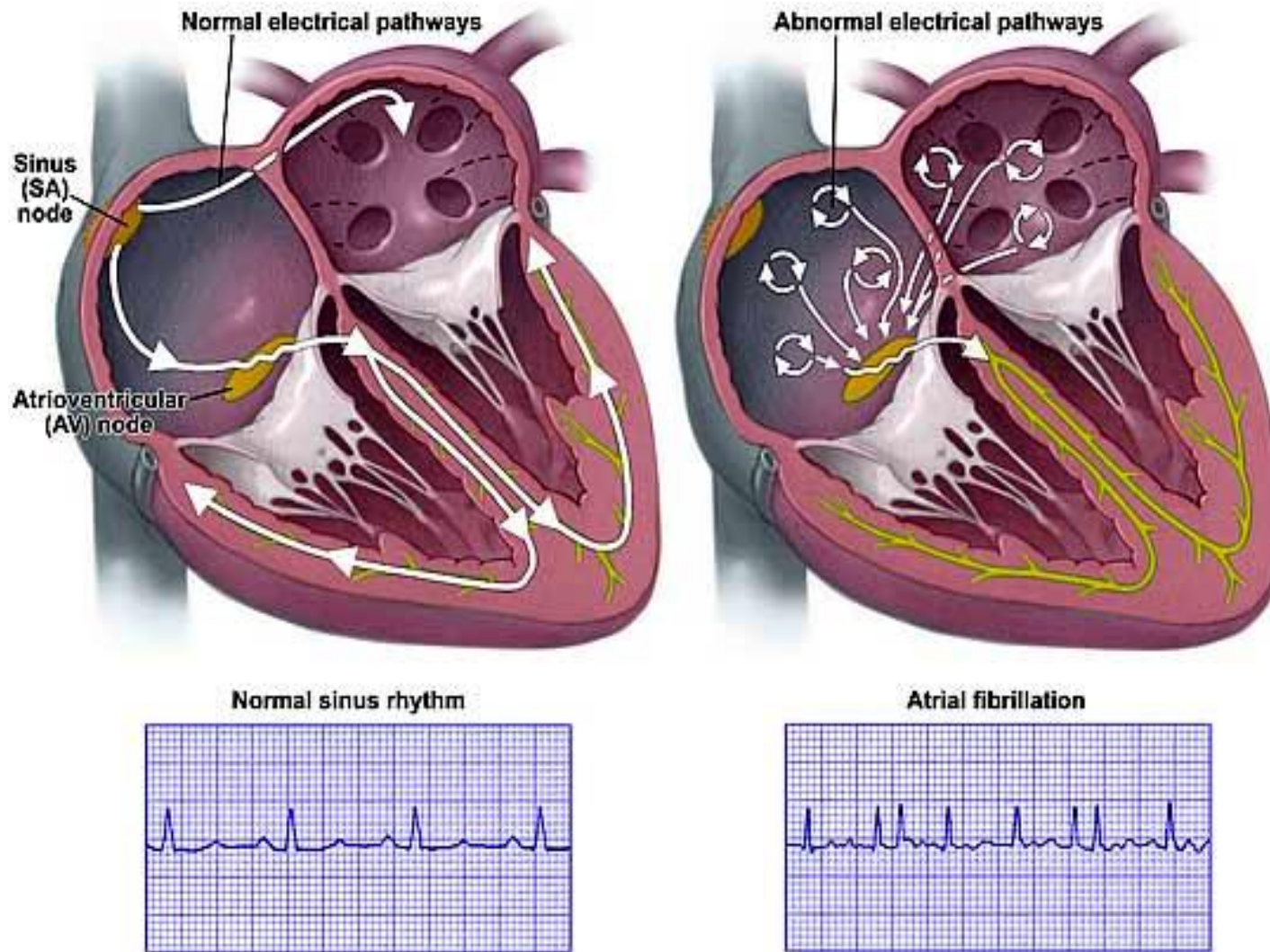
# Financial impact of atrial fibrillation

- Factors to consider:
  - Diagnostic workup
  - Medications
    - Anticoagulation monitoring if indicated
  - Impact on comorbidities
    - Heart failure
  - Lost productivity
- Projected annual cost to increase from \$6 Billion to \$26 Billion

# EKG Snapshot



# Atrial Fibrillation (AF)



## Shared Risk Factors

Age  
Hypertension  
Diabetes  
Obesity  
Metabolic Syndrome  
Sleep Apnea  
Smoking  
Alcohol  
Sedentary Life  
Genetics  
Coronary Disease  
Valvular Disease

## Shared Pathophysiology

### STRUCTURAL CHANGES

Ischemia  
Fibrosis  
Chamber dilation

### NEUROHORMONAL CHANGES

↑Renin/Aldosterone  
Angiotensin II  
Epinephrine  
Norepinephrine  
ANP  
BNP

### INFLAMMATORY MEDIATORS

IL-6  
IL-1  
CRP  
TNF- $\alpha$

### CELLULAR & MOLECULAR CHANGES

Oxidative stress  
Myocyte elongation  
Hypertrophy  
Apoptosis  
Mitochondrial dysfunction  
↓ $\beta$ -adrenergic receptors  
Abnormal Ca<sup>2+</sup> handling  
Electrical/mechanical uncoupling

### HEMODYNAMIC CHANGES

↑LV end-diastolic pressure  
↑ Systemic vascular resistance  
↓ Cardiac output  
↑ Wall stress  
↑ Valvular regurgitation



**Fig. 1.** AF and HF share common risk factors and pathophysiology that lead to the development of each other. CO, cardiac output; CRP, C reactive protein; IL, interleukin; LVEDP, left ventricular end diastolic volume; SVR, systemic vascular resistance; TNF, tumor necrosis factor.



# Non- Modifiable Risk Factors

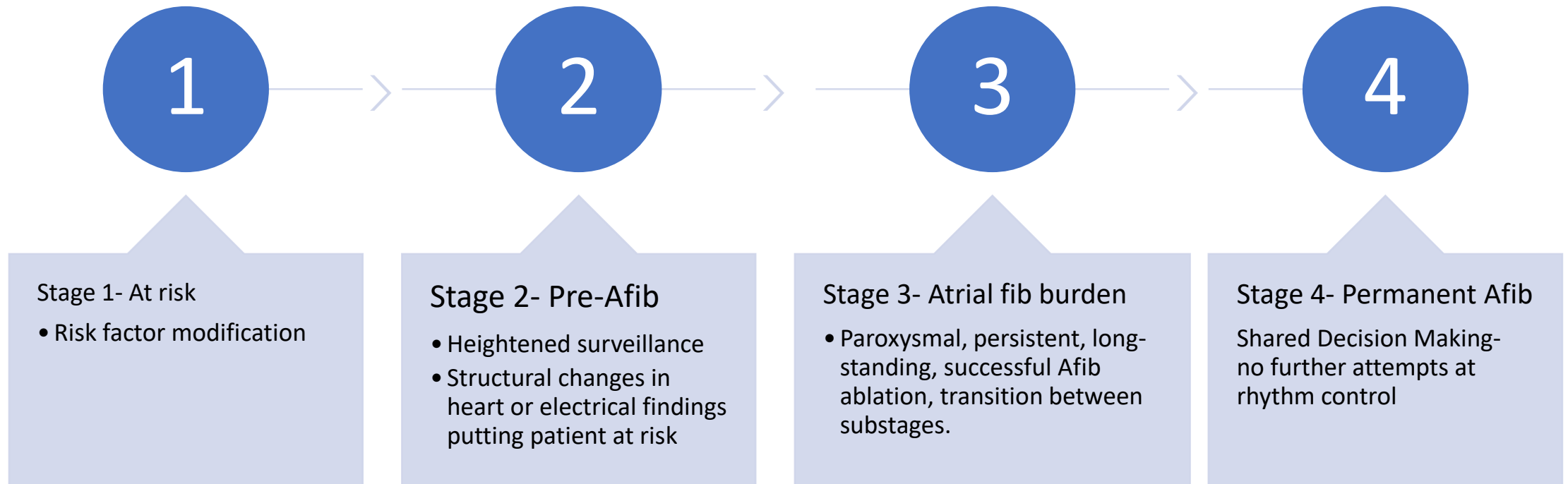
## Age

- Risk increases over age 65

## Genetics

- Smaller size atria in some populations

# Stages of Atrial fibrillation



# Definitions

## Paroxysmal

- Recurrent and terminates spontaneously within 7 days

## Persistent

- Sustained and lasts > 7 days or < 7 days but requires pharmacologic or electrical cardioversion.

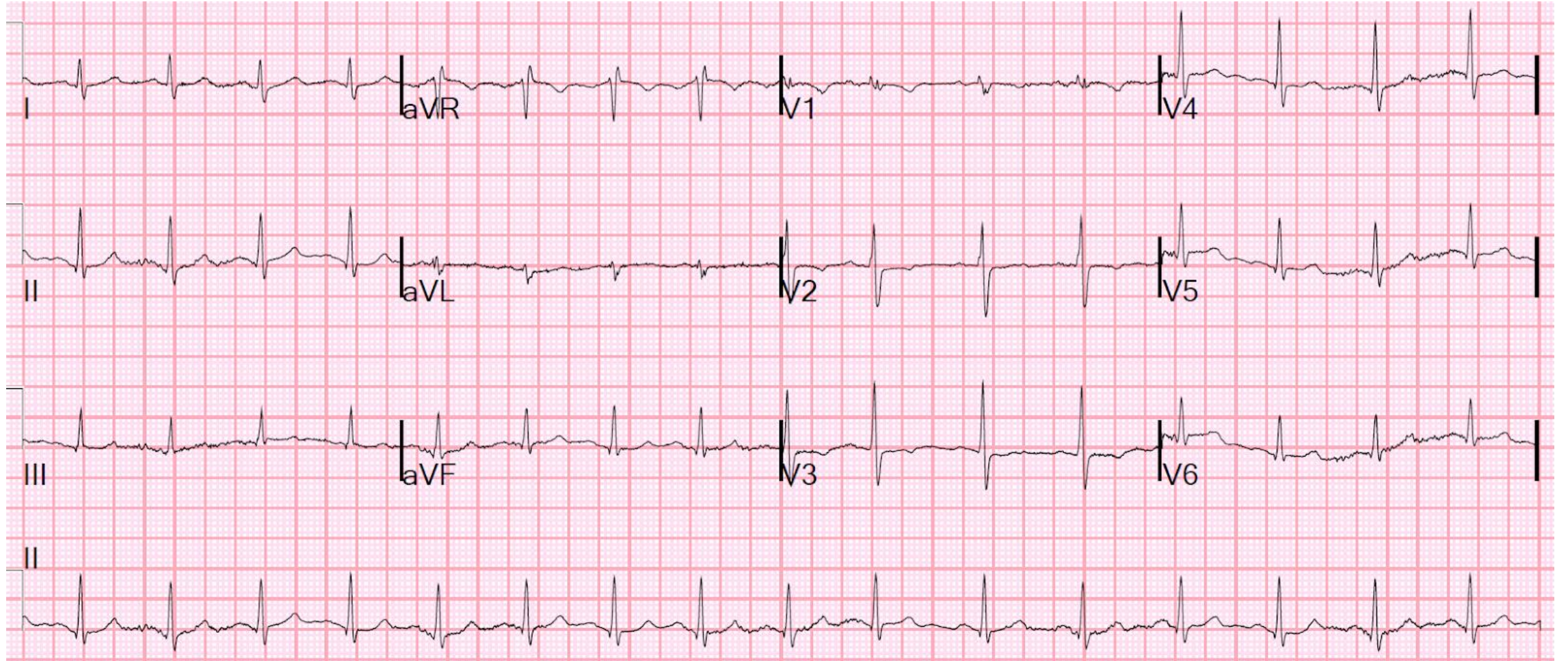
## Determine stroke risk and treatment

- Use risk tool to assess yearly thromboembolic event

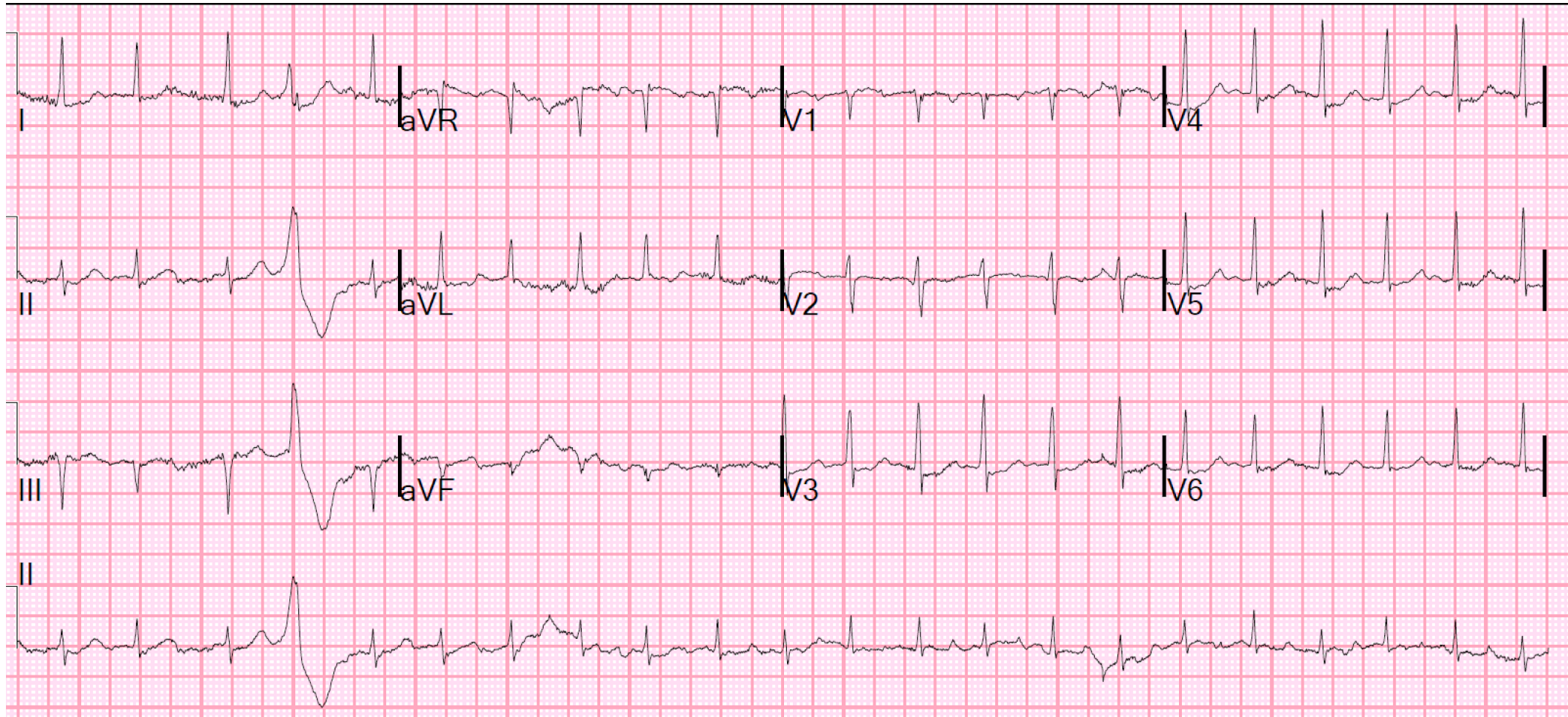
## Long-standing

- Lasting greater than 12 months.

# What is this rhythm?



# What is this rhythm?



# Modifiable Risk Factors



# Hypertension

Elevated BP leads to remodeling in both LA and LV

Remodeling stimulated by RAAS

Target RAAS blocker for possible prevention of Atrial fib

# Obesity

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Pericardial and epicardial fat are arrhythmogenic

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Strong association in pt with BMI  $\geq 30$  kg/m<sup>2</sup>

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Sustained weight loss  $\geq 10$  % associated with reduced risk of afib recurrence

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Bariatric surgery associated with reduced recurrence of afib after ablation and decreased risk of new afib



# Physical Inactivity

Independent risk factor for afib

Increased cardiorespiratory fitness associated with reduced risk of afib

Regular aerobic exercise improves symptoms and reduces afib burden

Extreme exercise may increase risk of afib

# Sleep Disordered Breathing

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Highly prevalent in patients with afib

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Screening for SDB should be part of treatment plan.

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Associated with autonomic, hemodynamic and inflammatory changes


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If severe SDB less likely to respond to antiarrhythmic meds

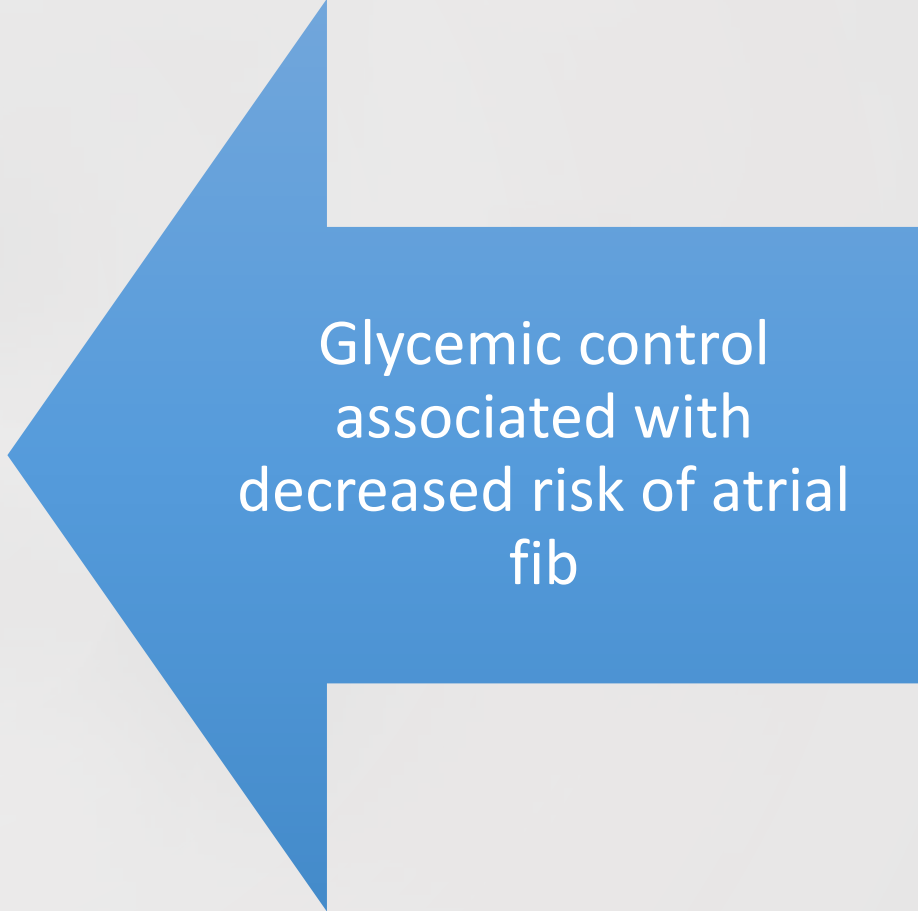
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Treatment with CPAP may reduce recurrence of afib


# Diabetes Mellitus



Insulin resistance and glucose intolerance provide substrates for development of atrial fib.



Glycemic control associated with decreased risk of atrial fib



# Tobacco Use Disorder

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Nicotine acts as a profibrotic and stimulates inflammation

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Nicotine is a stimulant that activates catecholamines to increase blood pressure, induce coronary vasospasm and myocardial ischemia.

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Vaping as a risk for atrial fib needs to be studied.

# Alcohol

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Contributes to autonomic stimulation and atrial remodeling

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In moderate to high level consumers of alcohol, rhythm control may improve with reduction in alcohol consumption

# Beyond Risk Factors: Comorbidities & Afib

Hypertension

Coronary artery disease

Valvular heart disease

Heart failure

Cardiomyopathy

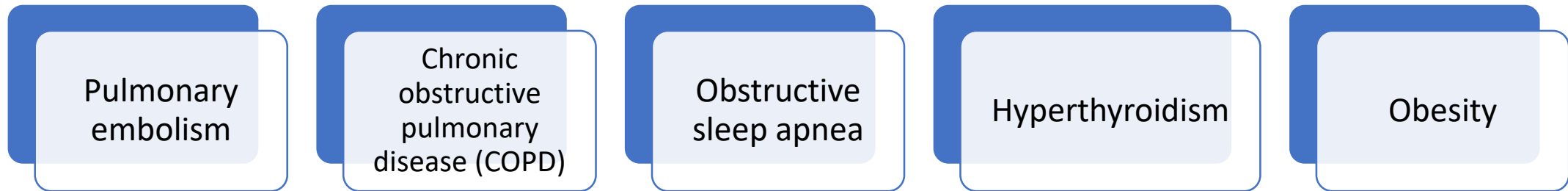
Pericarditis

Congenital heart disease

Cardiac surgery

Ananthapanyasut, W., Napan, S., Rudolph, S., Harindhanavudhi, H., Guglielmi, K., Lerma, E. (2010). Prevalence of Atrial Fibrillation and Its Predictors in Nondialysis Patients with Chronic Kidney Disease. *Clin J Am Soc Nephrol.* 5(2): 173–181.  
doi: [10.2215/CJN.03170509](https://doi.org/10.2215/CJN.03170509)

# Noncardiac Comorbidities Associated With Afib



Ananthapanyasut, W., Napan, S., Rudolph, S., Harindhanavudhi, H., Guglielmi, K., Lerma, E. (2010). Prevalence of Atrial Fibrillation and Its Predictors in Nondialysis Patients with Chronic Kidney Disease. *Clin J Am Soc Nephrol.* 5(2): 173–181.

doi: [10.2215/CJN.03170509](https://doi.org/10.2215/CJN.03170509)

# 3 pillars of afib management SOS



Stroke- Assess and treat



Optimize- All modifiable risk factors



Symptom Management- rate vs rhythm control, atrial fib burden



# Respond- Treatment Options

## Anticoagulation

- Stroke risk vs. Bleeding risk

## Rate control

- Medications

## \*\* Early Rhythm control

- Cardioversion

Ablation- Class I indication as first line

# Goals of Acute and Chronic Therapy

- Prevent stroke
- Slow ventricular response
- Restore and maintain normal sinus rhythm
- Improve symptoms
- Improve quality of life
- Reduce cost
- Prolong survival

# Approach to anticoagulation

Anticoagulant should be patient specific and involve shared decision-making

For patients with AF (except with moderate-to-severe mitral stenosis or a mechanical heart valve) who are unable to maintain a therapeutic INR level with warfarin, use of a NOAC is recommended.

# CHA<sub>2</sub>DS<sub>2</sub> VASc

## Scoring Differences Between CHADS<sub>2</sub> and CHA<sub>2</sub>DS<sub>2</sub>-VASc

Risk Factor	CHADS <sub>2</sub>	CHA <sub>2</sub> DS <sub>2</sub> -VASc
	(Maximum score, 6)	(Maximum score, 9)
	Points	Points
<b>Congestive heart failure</b>	1	1
<b>Hypertension</b>	1	1
<b>Diabetes</b>	1	1
<b>Vascular disease</b>	N/A	1
<b>Age 65-74</b>	N/A	1
<b>Age ≥75</b>	1	2
<b>Female sex</b>	N/A	1
<b>Previous stroke/TIA</b>	2	2

*N/A – not applicable*



# Garfield AF Risk Calculator

- If intermediate risk and unsure about anticoagulation
  - Use shared-decision making
- Includes a variety of other variables including:
  - Weight, HR, diastolic BP, ejection fraction, CKD and dementia
- Provides 6month, 1 yr and 2 yr risk

<https://reference.medscape.com/calculator/685/garfield-af-risk-calculator>

# HAS-BLED

Letter	Clinical Characteristic	Points
H	Hypertension	1
A	Abnormal Liver or Renal Function	1 or 2
S	Stroke	1
B	Bleeding	1
L	Labile INR	1
E	Elderly (age > 65)	1
D	Drugs or Alcohol	1 or 2
<b>Maximum Score</b>		<b>9</b>

Ruff, C. Which Risk Score Best Predicts Bleeding With Warfarin in Atrial Fibrillation? 2011. <https://www.acc.org/latest-in-cardiology/articles/2014/07/18/11/38/which-risk-score-best-predicts-bleeding-with-warfarin-in-atrial-fibrillation>

# Warfarin in atrial fibrillation

MOA- Vitamin K antagonist

Dosing- variable based on INR which should be monitored weekly until target achieved, then monthly.

- Target INR is 2.0-3.0.

Onset- 3-5 days after starting to reach its full blood thinning effect.

Half-Life- up to 40 hrs

Reversibility- Vitamin K

# Direct Oral Anticoagulants for atrial fibrillation

Medication	MOA	Dosing	Onset	Half-Life	Reversibility
Apixaban	Direct factor Xa inhibitor	Oral Twice a day	3 hr	8-15 hr	Andexanet Alfa Subcutaneous
Dabigatran	Direct thrombin inhibitor	Oral Twice a day	2 hr	12-17 hrs	Idarucizumab IV
Edoxaban	Direct factor Xa inhibitor	Oral Once a day	1-2 hrs	10-14 hrs	Andexanet Alfa Subcutaneous
Rivaroxaban	Direct factor Xa inhibitor	Oral Once a day	2-4 hrs	5-9 hrs	Andexanet Alfa Subcutaneous



# Strategies to Enhance Anticoagulation Management

## Patient

- Education
  - Diet, drugs, diseases, etc.
- Engagement
  - Consider home monitoring or anticoagulant that does not require monitoring
- Ongoing patient education to reinforce long-term adherence with therapy

## Provider

- Online warfarin dosing calculators to assist with warfarin initiation.
- Partnering with patient, family and nursing to increase time in TTR.
- Increase familiarity with newer anticoagulants.

# Home Monitoring

The Home INR Study (THINRS) to compare methods among 2,922 warfarin-treated patients at VA centers

Weekly finger-stick INR associated with nonsignificant decrease in bleeding, stroke, or death compared with clinic monitoring ( $P=0.10$ )

Source: Jacobson AK, et al "A Prospective Randomized Controlled Trial of the Impact of Home INR Testing on Clinical Outcomes: The Home INR Study (THINRS)" *AHA* 2008; Abstract 5217.

# Home INR Monitoring

Home monitoring reduced time outside of therapeutic range by 7%.

Results supported home testing as alternative to high-quality clinic care.

Preferable if patients have difficulty getting to the clinic because of disability or distance.

2016 analysis of data deemed it cost effective compared to clinic anticoagulation management and preferred by pt in the study.

## Selecting an Anticoagulant

For patients with AF and an elevated CHA<sub>2</sub>DS<sub>2</sub>-VASc score of 2 or greater in men or 3 or greater in women, oral anticoagulants are recommended.

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Warfarin  
(LOE: A)

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Dabigatran  
(LOE: B)

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Rivaroxaban  
(LOE: B)

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Apixaban  
(LOE: B)

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Edoxaban  
(LOE: B-R)

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# Initiation of DOAC

- In eligible patients with afib DOACs are recommended over warfarin

**Exception- Mechanical heart valve or moderate to severe mitral stenosis**

- Baseline evaluation of renal and hepatic function then on annual basis.
- Engage in shared decision making with the patient and/or caregiver regarding treatment options.

# Using CHA<sub>2</sub>DS<sub>2</sub>-VASc for treatment decision

CHA <sub>2</sub> DS <sub>2</sub> -VASc Score	Gender	Anticoagulate
0	Men	Can Omit
1	Women	Can Omit
1	Men	Consider anticoagulant
2	Women	Consider anticoagulant
2 or greater with CKD or dialysis	Men	Warfarin or apixaban
3 or greater with CKD or dialysis	Women	Warfarin or apixaban
4, 5, 6		Anticoagulate

## Special Considerations

Consider reduced doses of medications in patients with moderate to severe CKD

- Serum creatinine  $\geq 1.5$  mg/dL  
Apixaban
- CrCl 15 to 30 mL/min  
Dabigatran
- CrCl  $\leq 50$  mL/min  
Rivaroxaban
- CrCl 15 to 50 mL/min  
Edoxaban

# Bridging and Interrupting Anticoagulation

## Mechanical valve

- Balance risk of stroke and bleeding
- Bridge with low molecular weight heparin or unfractionated heparin

## No mechanical valve

- Balance risk of stroke and bleeding and the duration of time a patient will not be anticoagulated.
- Bridge with low molecular weight heparin or unfractionated heparin



# Electrical Cardioversion

When Afib duration of 48 hrs or longer or duration unknown:

- Anticoagulation with warfarin, a factor Xa inhibitor, or direct thrombin inhibitor for at least **3 weeks before** and at least **4 weeks after** cardioversion, regardless of the CHA<sub>2</sub>DS<sub>2</sub>-VASc score or the method (electrical or pharmacological) used to restore sinus rhythm.
- When immediate cardioversion is required for hemodynamic instability, anticoagulation should be **initiated as soon as possible** and continued for at least **4 weeks after** cardioversion unless contraindicated

## Anticoagulation and Cardioversion

For patients with AFib of less than 48 hours' duration and CHA<sub>2</sub>DS<sub>2</sub>-VASc score of 2 or greater in men and 3 or greater in women:

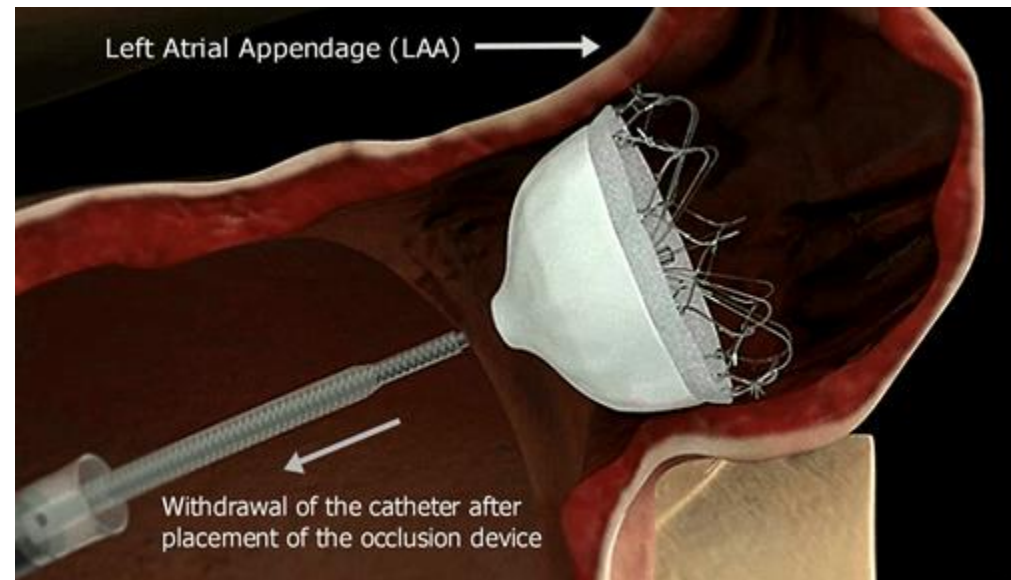
Heparin, a factor Xa inhibitor, or a direct thrombin inhibitor is reasonable as soon as possible before cardioversion and subsequent long-term anticoagulation therapy.

After cardioversion for AFib of any duration base anticoagulation therapy on thromboembolic risk profile and bleeding risk profile.

# Left Atrial Appendage Occluder- 2a recommendation

Percutaneous LAA occlusion may be considered in patients with AF at increased risk of stroke who have contraindications to long-term anticoagulation.

- Lariat™
- Watchman™
- Amplatzer cardiac plug™



# Effectiveness in Stroke reduction

PROTECT AF (5 yr analysis) and PREVAIL trial data used for a pooled analysis.

PREVAIL showed an increase in ischemic stroke.

Compared LAA closure device to warfarin or DOAC.

Cost effective and cost saving in reducing stroke in patients with nonvalvular atrial fib

For pts requiring lifelong anticoagulation LAA device is an option

# Consideration for Left Atrial Appendage Occluder

People that have had some major bleeding issues on coumadin or other NOACs

- GI bleeds
- Hemorrhagic strokes

Patients who are non-compliant on anticoagulant therapy or those with issues regulating their INR.

People with active lifestyles.

Elderly or those who are prone to falls.

A large orange circle on the left side of the slide, partially cut off by the edge.

## Contraindications for Left Atrial Appendage Occluder

Mechanical heart valve

Current thrombus in the left atrial  
appendage

Left atrial appendage opening  
larger than current device available

# Medications beyond anticoagulation

## Rate control

- Beta blocker
- Calcium channel blocker (Diltiazem and Verapamil)
- Digoxin

## Rhythm control (most common)

- Calcium channel blocker (Diltiazem and Verapamil)
- Amiodarone
- Sotalol
- Dofetilide

## Anticoagulation and cardioversion

Perform transesophageal echocardiography (TEE) for patients with AFib of 48 hours' duration or longer or of unknown duration who have not been anticoagulated for the preceding 3 weeks.

If no left atrial thrombus is identified, perform cardioversion, provided that anticoagulation is achieved before transesophageal echocardiography and maintained after cardioversion for at least 4 weeks.



## Anticoagulation and cardioversion

For patients with AF or atrial flutter of less than 48 hours' duration with a CHA<sub>2</sub>DS<sub>2</sub>-VASc score of 0 in men or 1 in women

Administration of heparin, a factor Xa inhibitor, or a direct thrombin inhibitor, OR no anticoagulant therapy, may be considered before cardioversion.

Post cardioversion oral anticoagulation may not be needed long term

# Catheter ablation



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A procedure which focuses on disrupting electrical signals in the heart by destroying or scarring tissue in the atria.

In patient with symptomatic atrial fib and heart failure with reduced EF (HFrEF) catheter ablation may reduce hospitalizations and lower mortality.

# Catheter Ablation

- **Class I Indication**
  - Symptomatic patients with paroxysmal atrial fib not intolerant to antiarrhythmic meds or medications are ineffective.
  - Patients with HFrEF
  
- **Additional indications for which catheter ablation can be considered**
  - Asymptomatic patients
  - Patients with AF and psychological distress

Parameswaran R, et al. Catheter ablation for atrial fibrillation: current indications and evolving technologies. *Nat Rev Cardiol.* 2021 Mar;18(3):210-225. doi: 10.1038/s41569-020-00451-x. Epub 2020 Oct 13. PMID: 33051613.

# Catheter Ablation

## Class IIa indications

- Symptomatic persistent Afib and paroxysmal AF as first-line therapy
- HFrEF
- Tachycardia–bradycardia syndrome
- Selected elderly patients
- Athletes

Parameswaran R, et al. Catheter ablation for atrial fibrillation: current indications and evolving technologies. *Nat Rev Cardiol.* 2021 Mar;18(3):210-225. doi: 10.1038/s41569-020-00451-x. Epub 2020 Oct 13. PMID: 33051613.

# What about post op atrial fib?

- If precipitant in surgery or an acute medical illness then evaluate the risk of recurrence of atrial fib.

# Case 1

HPI- 60 yo male with 3 days of increased fatigue and dyspnea at rest and with exertion. Denies palpitations, chest discomfort or dizziness.

PMH- Htn, OA, CAD, DM

## Meds:

HCTZ 25mg daily

Losartan 50mg daily,

Atorvastatin 40 mg daily

ASA 81 mg daily

Naprosyn 500mg bid

Glimepiride 2mg daily

**Refuses to take “rat poison”**

Recent EKG- atrial fib with rapid ventricular response at 110

# Case 1

PE: 124/56 HR 102 RR 18 O2 sat 98%

General : well appearing White male in NAD

HEENT: head normocephalic. Conjunctiva pink, sclera anicteric. Mucous membranes moist. Neck veins flat, 2+carotids without bruits.

Chest: Lungs with bibasilar crackles

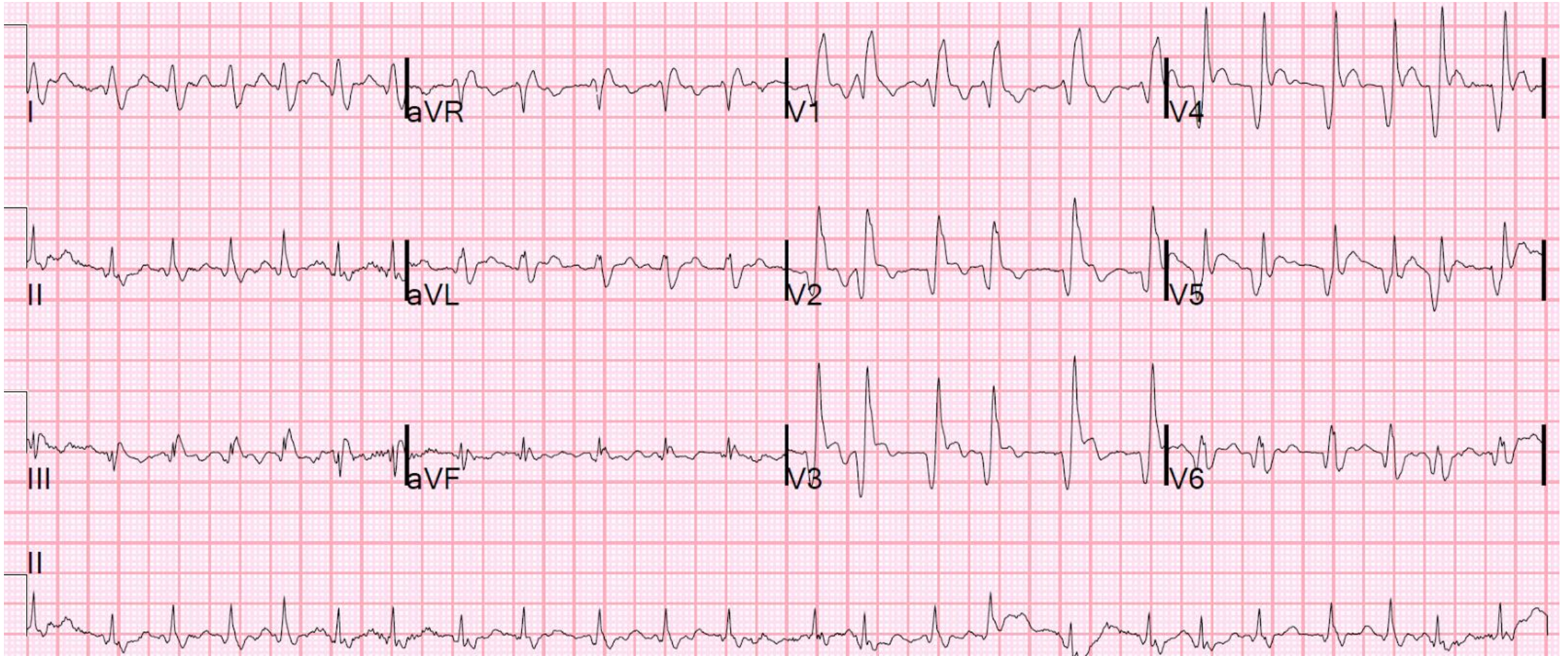
Cardiac: Rapid irregular rate and rhythm. Normal S1 S2 no murmurs

Abdomen: soft, NT, + bowel sounds, without hepatomegaly

Ext: 2+ distal pulses without edema

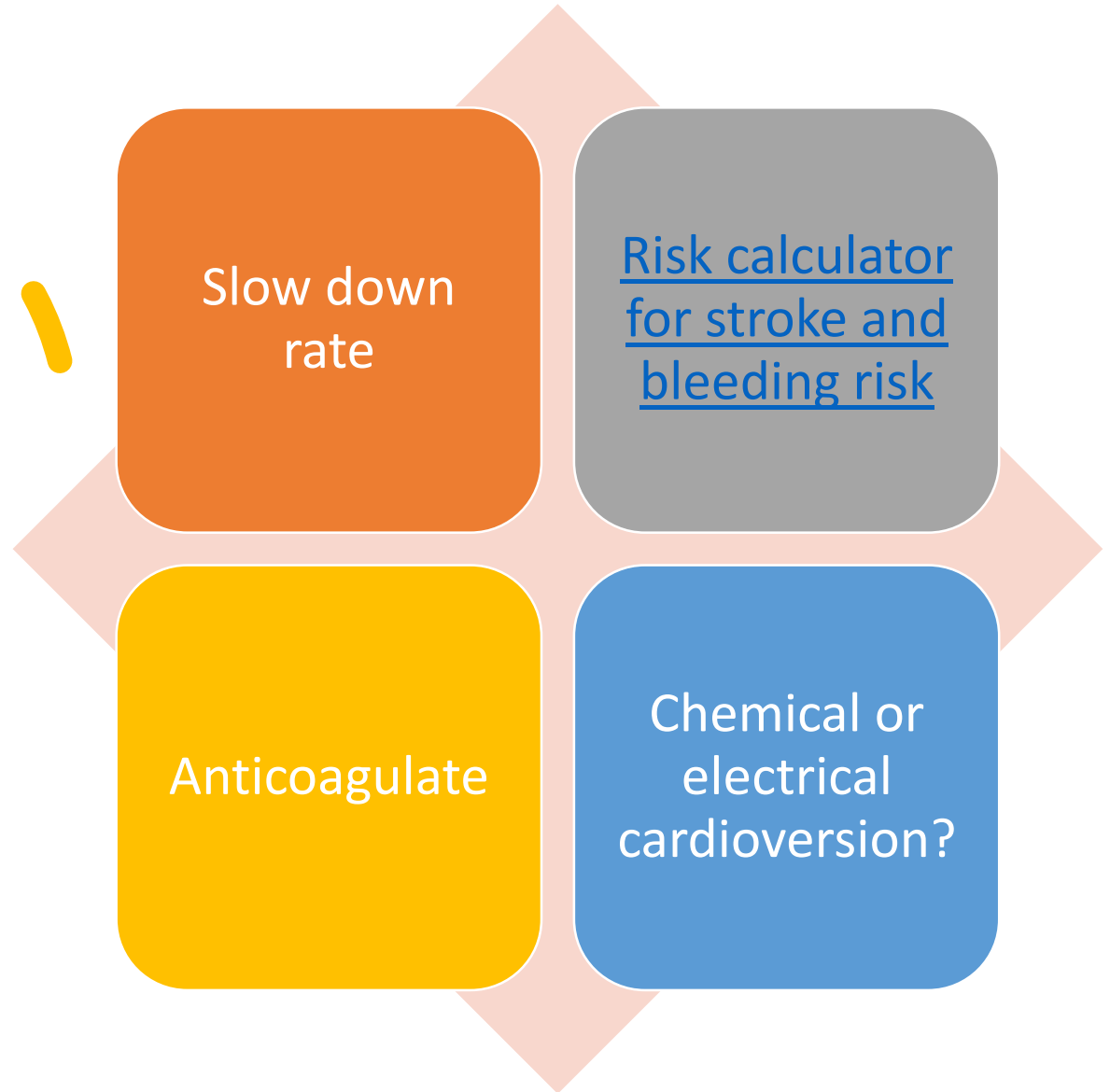
Skin: warm and dry, no cyanosis , rashes or lesions.

# Case 1





# Approach to treatment



Should I recommend ablation?

# Focus of Treatment

- Early rhythm control
- Maintain sinus rhythm
- Minimizing burden of atrial fib

## Case 2

HPI: 71 yo female discharged to long term care after recent hospitalization. She has a h/o Parkinsonism, OSA, Htn and heart failure with EF 30% and new onset paroxysmal atrial fibrillation. S/P recent hospitalization fluid overload in the setting of paroxysmal atrial fib. She spontaneously converted to sinus rhythm 48 hrs prior to discharge.

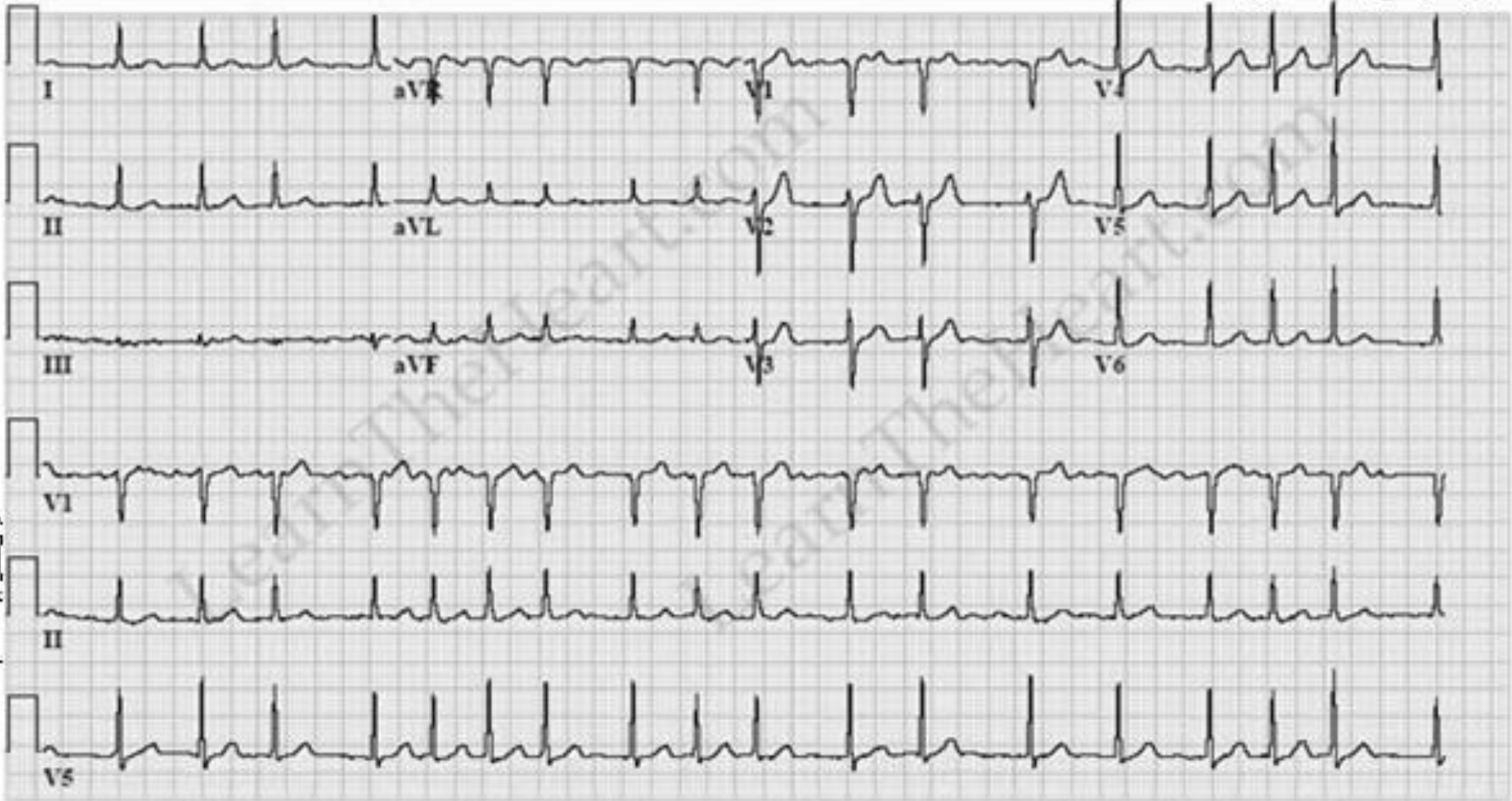
### Meds:

- Metoprolol Succinate, Furosemide, Sinemet, Lisinopril, Warfarin, Spironolactone, Peri-colace

# Case 2

- PE: 104/86 HR 96 RR 14 O2 sat 99%
- General : frail appearing older African American female in NAD.
- HEENT: head normocephalic. Conjunctiva pink, sclera anicteric. Mucous membranes moist. Neck veins slightly elevated 2cm above the clavicle. 2+carotids without bruits.
- Chest: Lungs without crackles or wheezes.
- Cardiac: Rapid irregular rate and rhythm. Normal S1 S2, 3/6 holosystolic murmur.
- Abdomen: soft, NT, + bowel sounds, without hepatomegaly
- Ext: 2+ distal pulses with trace pitting edema
- Skin: warm and dry, no cyanosis , rashes or lesions.

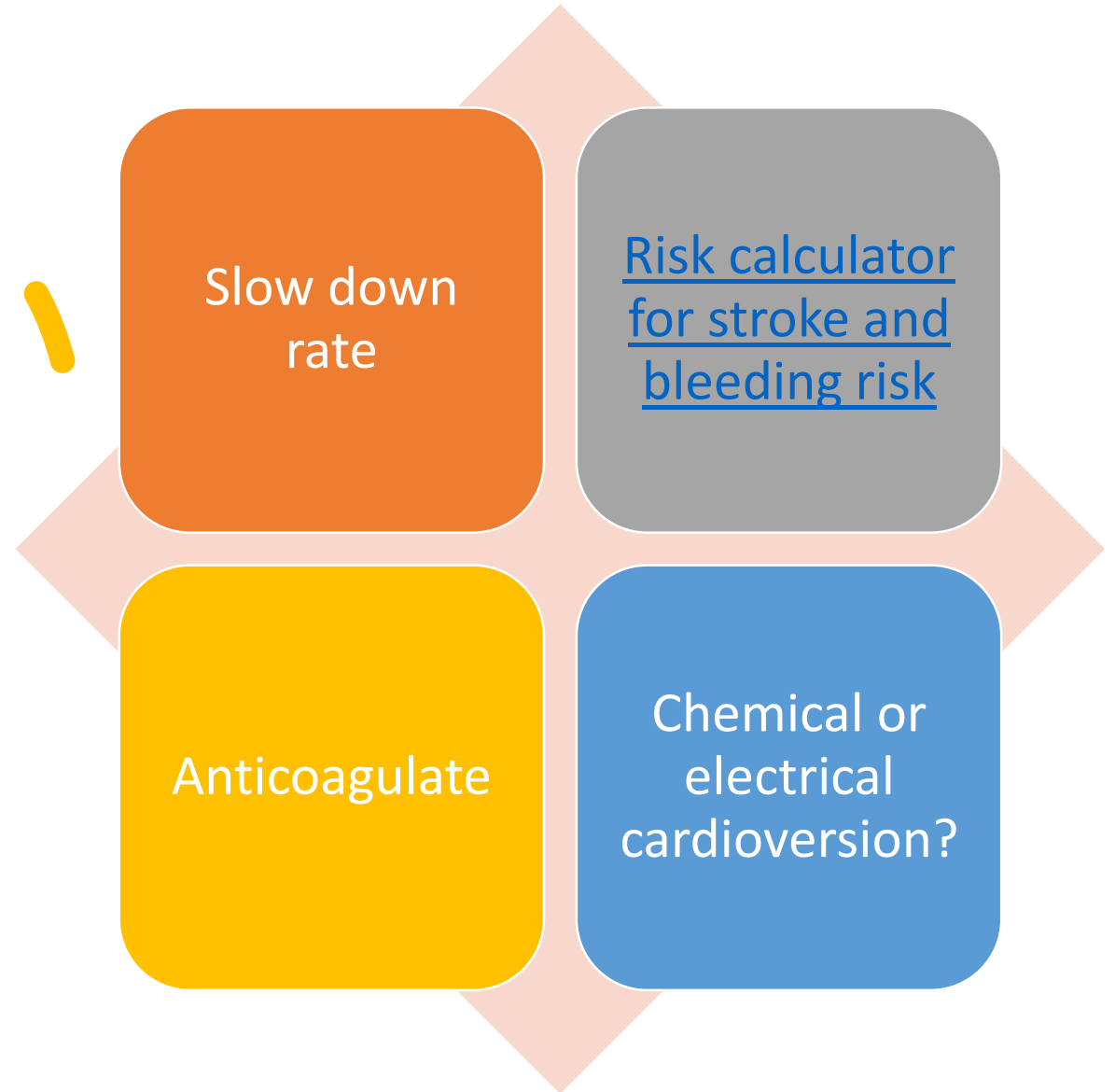
# EKG



25mm/s 10mm/mV 40Hz 005C 12SL 250 CID-2

EID-607 EDT-13:33 34-OCT-2003 ORDER-

Respond  
(treatment)



# Mobile Health



**Wearable sensors**



**Applications**



**Useful for**

Early detection

Paroxysmal episodes



**Challenges**

Overdiagnosis

Overtreatment

# Mobile Health devices

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Mobile phones are ubiquitous

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Consider as a cost-effective method  
of screening high risk individuals

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User experience is straightforward

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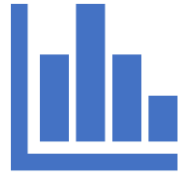
Accuracy compared to gold standard  
12 lead EKG is still being studied



# Mobile health



## Event monitor



## Holter monitor



## Mobile devices

12 lead ECG

Single lead ECG

Direct or indirect heart rate  
monitor

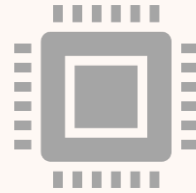
Patch

# Detection using a wearable



## Sensor in back of watch and in digital crown

Monitors heart rate  
Allows user activation



## AliveCor

Two fingers on the electrodes fixed to a small plastic plate transmit to phone or computer  
High sensitivity and specificity  
Less accurate in children, elite athletes and hospitalized older adults



## KardiaBand

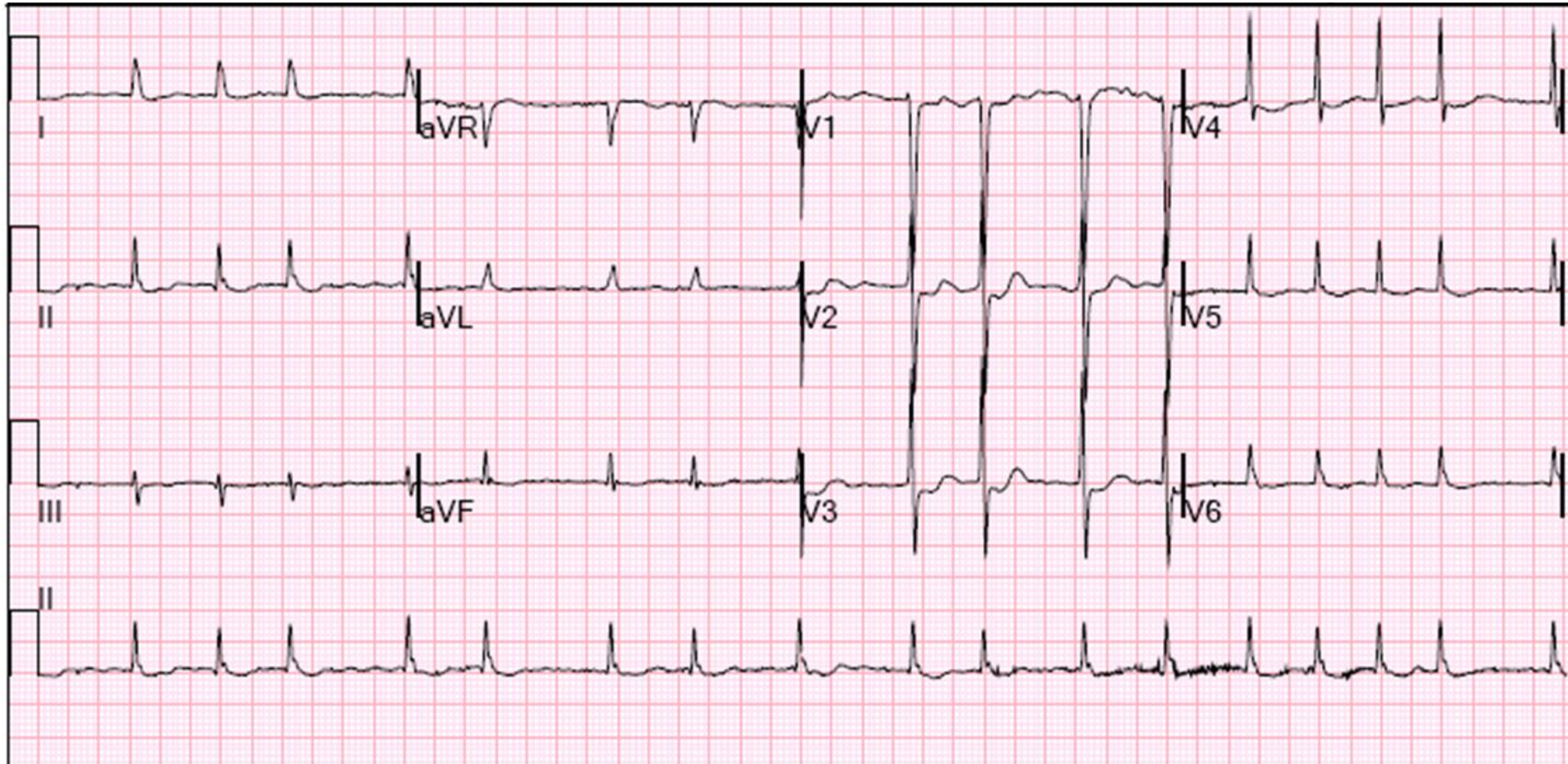
Worn on wrist in combination with Apple Watch

# Case 3

## Patient advice message:

- 54 yo male with a h/o:
  - Sleep disordered breathing and BMI>40
  - + Family history of atrial fibrillation
- Has had a “few” episodes of palpitations recently
- Purchased a mobile device with an option to transmit 12 lead EKG

# Case 3



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Next steps for  
this patient

Office visit vs. phone followup

Diagnostics

- EKG
- Event monitor

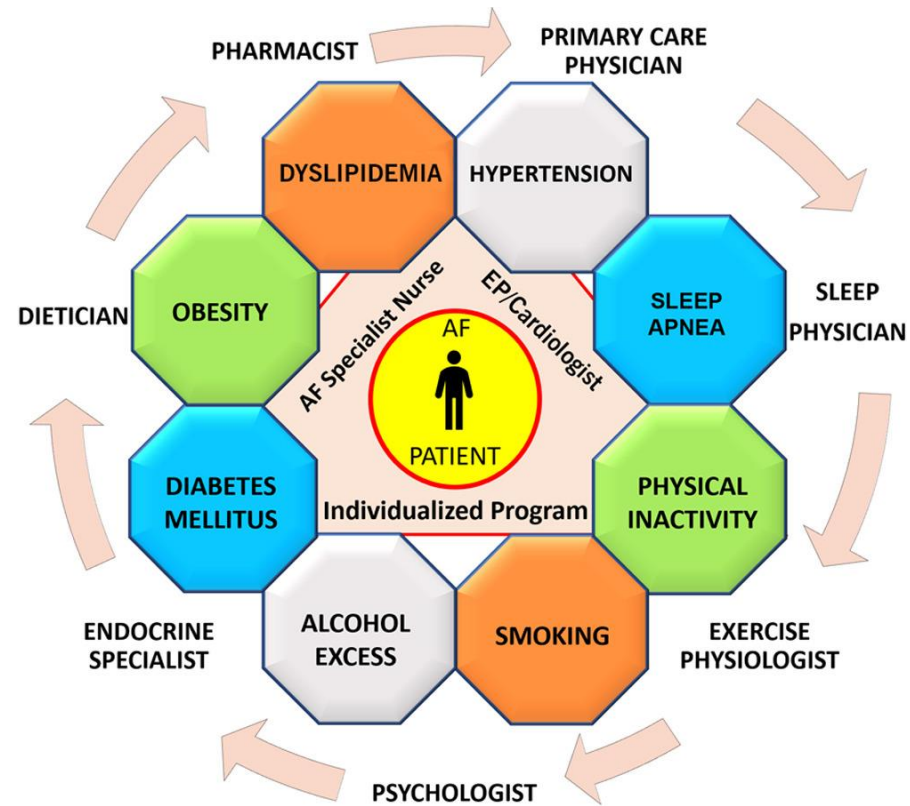
Anticoagulate or not?

# Shared decision- making

- Discussion between patient and clinician to address goals of treatment
- Relevant to anticoagulation discussion
- Clinical trials with heterogenous results on adherence and outcomes
- Shared Decision-Making for Atrial Fibrillation (SDM4AFib) trial
  - No significant effect on clinical safety outcomes or treatment decisions.

# Shared decision- making

- [Stroke and bleeding risk calculator](#)
- Factors included:
  - Age, gender
  - H/o Heart failure, HTN, DM
  - H/o Stroke, TIA, MI or plaque
- If Yes, prompted to answer additional questions
  - Dialysis or abnormal kidney function
  - Abnormal liver function or liver disease
  - Elevated INR
  - Major bleeding requiring blood transfusion or hospital
  - Taking NSAID or antiplatelet medications
  - Alcohol use > 8 glasses/week



Mina K. Chung. *Circulation*. Lifestyle and Risk Factor Modification for Reduction of Atrial Fibrillation: A Scientific Statement From the American Heart Association, Volume: 141, Issue: 16, Pages: e750-e772, DOI: (10.1161/CIR.0000000000000748)



# Summary

Atrial fibrillation is highly prevalent in the global population

Risk factor modification should focus on prevention of afib

Effective management of comorbidities is essential

Use scoring tools to stratify risks vs benefits of anticoagulation

Consider treatment options for both rate and rhythm control

Use shared decision-making approach

# Key References

- Fox KAA, Lucas JE, Pieper KS, Bassand J-P, Camm AJ, Fitzmaurice DA, Goldhaber SZ, Goto S, Haas S, Hacke W, Kayani G, Oto A, Mantovani LG, Misselwitz F, Piccini JP, Turpie AGG, Verheugt FWA, Kakkar AK. [Improved risk stratification of patients with atrial fibrillation: an integrated GARFIELD-AF tool for the prediction of mortality, stroke and bleed in patients with and without anticoagulation.](#) BMJ Open 2017;7.
- Joglar, J. et al. 2023 ACC/AHA/ACCP/HRS Guideline for the Diagnosis and Management of Atrial Fibrillation: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Circulation. 2024; 149e-e156.  
<https://doi.org/10.1161/CIR.0000000000001193>

Questions-[Margaret.bowers@duke.edu](mailto:Margaret.bowers@duke.edu)



Personal Photo M.  
Bowers